Reengineering the Corporation, A Study
At a Semiconductor Company

by

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Submitted to the Department of Electrical Engineering and Computer Science in Partial
Fulfillment of the Requirements for the Degrees of

Bachelor of Science and Master of Science

at the

Massachusetts Institute of Technology

May 1994

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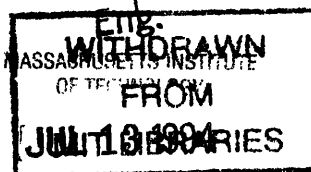
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ABSTRACT

This thesis begins with a study on the introduction of imaging and document management system and workflow technology into an organization. The results suggest that in order for information technology to deliver bottom-line benefit for an organization, it needs to follow the integration of business and information technology (IT) strategies and to be accompanied by changes in roles, organizational structure, incentive system, and business processes. Many practitioners today dub the change in or the redesign of business processes as reengineering. Reengineering or the redesign of business processes has been the least understood science and art, and will be the focal issue discussed here. Specifically, research has shown that business and technology people need to work together in synergy to make reengineering a success. However, there is a conceptual and communication gap between the two groups of people. This second part of the thesis is to cover management and technology issues related to reengineering in an attempt to narrow this gap: It gives business people an overview of the underlying technology and engineering techniques, concepts, and tools; at the same times, it gives technology people an understanding of the management disciplines. The key is to learn how to introduce new information technology systems that will ultimately increase productivity and competitive advantage for the organization without upsetting the daily routine so work continues to be done. It is my hope that this thesis will contribute knowledge and understanding to anyone who wants to take on the challenge of reengineering.

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Thesis Supervisor: Mr. Jim Wilson, Desktop Automation Department Manager, Giant Corporation.

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Overview

The history of reengineering is less than four years. Because of its infancy, the *what*, *why*, *how*, and *when* of reengineering have not been well understood by most practitioners and researchers. They learn through the experiences of those organizations that take on the challenge of reengineering. Early results of reengineering efforts at many different major organizations have been disappointing; most have had limited success with reengineering. Their limited productivity gain is very much a reflection of their lack of understanding in the reengineering discipline. Reengineering is a powerful tool, and it can deliver improvement in quality, cost, service, and speed. Hence, the objective or goal of this thesis is to contribute knowledge and understanding to anyone who wants to take on the challenge of reengineering. In order to achieve this objective, the thesis is divided up into two major sections: Section one (chapters 1-3) contains my personal hands-on experience with reengineering, and section two (chapters 4-9) is filled with theory and concerns related to the reengineering discipline.

The first section (chapters 1-3) is organized as a case analysis; it is based on a five-month research study at Giant Corporation's Desktop Technology Group (DTG), a pseudonym, between the period of September, 1993 and January, 1994. Chapter one begins with an introduction on several key information technologies (imaging and document management system and workflow technology) piloted by DTG at Giant, and it ends with some historical background on DTG and my assignment objectives. Chapter two describes my research approach at DTG. The approach itself serves as a good example of how a reengineering project could be conducted. Chapter three then concludes the case with lessons learned through the experience and a potential future direction of DTG.

The second section (chapters 4-9) serves to consolidate some of key issues related to reengineering. Chapter four primary discusses a variety of opinions by practitioners and

researchers on what, why, and how of reengineering; I discuss the merits as well as fallacies of some of these opinions. Chapter five focuses on IDEF and business rule. IDEF is a very structured, engineering approach to model a business enterprise, including its functional requirements, rules, relationships, and others. Future development of IDEF even includes simulation of these models. Formulation of business rules is often used to supplement and confirm our business models. As reengineering is process-centric, defining a corporate standard for process representation is a necessity. John Zachman's information Systems Architecture is a periodic table of process representations. A range of different emerging process representations along with their merits are discussed. As the advancement in information technology (IT) has outdated the fundamental ground rules that govern our business operation, groupware, database, and client-server are three key technologies briefly discussed in chapter seven. In addition, management of IT, outsourcing of IT, and analysis of several cases on IT implementation are included in chapter seven. Because reengineering is about inducing a major change in an organization, change management is hence the focus of chapter eight. Finally, all other key issues related to reengineering, including strategy alignment, vision, culture, organizational structure, learning organization, productivity, benchmarking, and others, are consolidated together in the last chapter - chapter nine.

As the field of reengineering continues to mature, more and more organizations will learn how to institutionalize reengineering and make continuous change (incremental and/or radical) part of their organizational culture. The key concepts behind reengineering, like customer-orientation, cross-functional team and process, information technology leveraging, and value creation and delivery, are likely to stay with tomorrow's organizations; reengineering will not just be a passing fad.

Chapter 1

1. Introduction

The research was conducted at a large semiconductor company, Giant Corporation (a pseudonym). To fully comprehend the information technology initiative at Giant, it is important to gain a good understanding of its history and motivation first. Scope, usage, problems, success factors, implementation issues, users' experiences, and performance are also critical areas of interests.

The Industry and Giant

Giant has been an innovation leader in the semiconductor industry. Despite its rapid growth in revenue and profit during the past few years, the number of employees has stayed relatively constant and the number of management layer was maintained at five. In order to compete in the rapidly changing and extremely competitive semiconductor industry, Giant knows that the organization needs to stay flat, nimble, and flexible, and it needs to innovate and continuously improve itself.

Competition has been fierce. With the convergence of the computer, communication, electronic, and entertainment industries, things are changing rapidly. In facing much uncertainty and rise in capital investment cost, strategic alliances among companies are mushrooming. Two companies are likely to be alliances in one market but competitors in another.

Throughout my past three internship assignments at Giant Corporation, I learn that constant change is in fact a part of life at Giant. The New Jersey multimedia division I worked for during the Summer of 1991 was no longer there in 1992; in fact, the site no longer exists as all technology and personnel were transferred to other Giant's locations including Arizona and Oregan. The VLSI design group I worked for during the Summer

of 1992 was in a state of transition from Oregan to Arizona; I was given the opportunity to travel between the two sites and assist the coordination of concurrent engineering activities. Between September of 1993 and January of 1994, I spent my final internship assignment with Desktop Technology Group (a pseudonym), where this thesis research took place. Before my arrival to Desktop Technology Group (DTG), the group was moved from one division to another, three times in eight months. Just before my departure, DTG was in the process of moving to another division.

Desktop Technology Group & Giant

Designing and manufacturing of semiconductor devices are usually accompanied by piles of documentation. Transferring of these documentation from one site to another of a geographically dispersed enterprise is expensive and time consuming. In 1991, Giant Corporation realized the potential benefit of imaging systems in reducing the amount of papers as well as facilitating document storage and retrieval. It began a project called Electronic Blue Book (EBB) and assigned a team of people to make this possible. After the initial success of building a EBB prototype in 1991 and 1992, the team of people felt that simply transforming Giant into a paperless enterprise produced limited benefit. Only when imaging technology is accompanied by workflow management tool to coordinate tasks and document management systems to integrate applications, the system can deliver bottom-line benefit to the organization. Based on this vision of providing a integrated desktop environment for the whole enterprise, EBB then evolved to become Automated Information Management (AIM), and the team of people became Desktop Technology Group (DTG).

In late 1993, DTG piloted the AIM project at different disjointed internal organizations, including site purchasing, document control, fabrication, and others. Much lessons were learned throughout the piloting stage, and scaling up to the production stage will be the upcoming challenge. At the same time, reengineering is being considered as the alternative approach to deploy information technology to drive and support the enterprise.

The desire and need to continuously improve itself has led Giant to form an Information Technology (IT) division in 1992. The mission of the IT division is to enhance Giant's ability to make decisions through improved communication and availability of timely information. Its charter encompasses the role of leadership and of providing a sound technology infrastructure, ranging from network infrastructure, electronic mail systems, and application development, to support systems. DTG was subsequently placed under the IT organization. The transition resulted in additional role and responsibility for DTG; it is in charge of not only the AIM project but also the overall desktop / client architecture for Giant.

1.1 Use of Information Technology

Information processing has evolved from automation in 1950s, to management information systems (MIS) in 1960s and 1970s, to systems integration in 1980s, and finally to reengineering in 1990s [1].

Automation is to mechanize routine office and factory procedures. MIS utilizes expert systems / knowledge based systems to collect, organize, and analyze data. Systems integration is to connect heterogeneous computer systems together in order to share information. In a nut shell, reengineering is a step towards merging technology with business that the decision cannot made on one end without considering the impact on the other end. We first redesign the processes, changing the way we work. This results in changing the way information move around. Then, we need to change our computer systems to carry that information.

1.2   Background on Imaging and Document Management System

Electronic document management systems and imaging systems have recently become popular as the cost of hardware, especially hard drive, optical drive, and other storage media, has decreased dramatically during the past few years. Today, these document and image-based systems are used by paper-intensive organizations to eliminate the needs for physical documents by converting them into electronic data. At the same time, the handling of these electronic data is streamlined by workflow application.

Imaging technology refers to computer systems, including both hardware and application, that convert documents, pictures, and other images into electronic data that can be stored, accessed, distributed, and processed by computers. By having documents in electronic form, companies are able to locate needed information quickly to improve customer service, to increase accuracy and timeliness of information, and to reduce business cycles. Numerous companies, like American Express, USAA, Northwest Airlines, and Blue Shield have successfully deployed this technology [1].

Today, imaging is no longer a separate system as it becomes just another object at the desktop. With the advent of Dynamic Data Exchange (DDE) and the more recent Object Linking and Embedding (OLE), desktop applications are image-enabled. DDE allows applications to exchange images as OLE goes a step further by "assimilating" image objects.

Another technology that is emerging as a standard in imaging system is the implementation of Binary Large Objects (BLOBs). BLOBs help to route images, as well as multimedia documents. BLOBs are embedded in mail-enabled workflow and queue-based workflow. Because of mail-enabled workflow's store-and-forward capability, the transport of BLOBs could be implemented to reduce user's *perceived* time, even when the actual time is a function of available network bandwidth. Imaging system also needs database-oriented

queue-based workflow to handle transactional workflow processes that are less ad hoc and more rules-based.

Document management systems are much more capable than imaging systems. Imaging systems basically transform papers into electronic format with help from scanner and optionally, optical character recognition (OCR) software. Document management systems go a step further by integrating office automation tools (electronic mail, word processor, spreadsheet, presentation, and others) together.

The reason the word "document" is used is because documents are unstructured, individualized information that provides the flexibility to be integrated with distributed and heterogeneous information systems. Also, a document can be composed of texts, images, audio, video, or a mixture of them; it is a "natural" data type because texts, images, audio, and video are fundamental mechanisms and the nature way of how we interact and communicate with others.

As to be discussed in further details below, workflow application provides much enhanced benefits to a document management system. Also, document management systems need workflow application that is more ad hoc in nature. This means that the tool sets that accompany these systems should be able to support these ad hoc demands. The most common tool is a scripting language that allows for quick application development and integration and workflow design. (for example, Kaola in Keyfile) However, the ideal development tools with more capability will be to support upcoming Microsoft standards of OLE and ODBC, making Visual Basic and Visual C++ ideal candidates.

Workflow and document management system often have to deal with heterogeneous network protocols, client / server, storage devices, databases, operating systems, applications, and file structures. This presents a challenge to systems integrators. Some of the other challenges including security (view, create, delete, modify), indexing approach

and algorithm, network bandwidth, archiving methodology, version control, concurrent usage, and distributed computing.

1.3 Background on Workflow Technology

Although workflow application emerged from document and imaging management systems, it has now become a popular office systems addition. Properly designed and implemented workflow solution can help to redesign processes that are within and across organizations. Workflow streamlines office operations to improve productivity and performance. As a result, workflow management is no longer confined with document /imaging management systems, it is also utilized in conjunction with business process reengineering.

Workflow can be used to analyze, compress, as well as automate business cycles. It improves coordination by bypassing organizational hierarchy and boundaries. Workflow can be transaction-based or ad hoc. In transaction-based workflow, workflow coordinate activities and move information across the enterprise within a time frame under a predefined set of rules. Business process automation systems and imaging systems need more transaction-based workflow application as document management systems need often more ad hoc workflow application. As the workflow approach is maturing in these fields, workflow application will supporting both transaction-based and ad hoc needs and will be seamlessly integrated with electronic mail, automation tools (word processing, spreadsheets, and desktop publishing), and the operating system.

During the workflow design, it is important to separate people from the business process. Upon completion of the redesigned workflow, we'll bring the people back together in new ways. Workflow design and implementation is somewhat similar to reengineering. It is important to have a good understanding of different implementation issues, like systems integration, process redesign, organizational and human factors. Implementors need to

understand existing business process and technology infrastructure. Then identify areas of inefficiency and collapse the business cycle and develop new workflow models.

Because workflow approach is not as "radical" as that of reengineering, the scope of change and the performance improvement are, more than likely, not as dramatic. However, the need for an upfront strategy analysis and a follow-up change management is still apparent. Implementation of any strategic technology like workflow must start with a careful assessment of how the technology contribute to the organization's critical success factors (CSFs) [2]. Analyzing the relationship between the underlying processes and technology with CSFs helps us to be more result-oriented.

One intuitive way to analyze workflow is to look at the time element. The goal is not only to minimize the time to execute a task but also to eliminate the transfer time between tasks entirely. When collapsing business cycles, problems in work habits and culture might appear. It will then be the responsibility of top management to recognize the need for a cultural change and make it happen. (change management issue is discussed later)

One approach to workflow implementation is often first applying the technology to several workgroups within an enterprise and then scaling up the scope to encompass the rest of the enterprise over time. Some prefer to call this the "greenhouse" approach.

One major role of workflow application is to integrate heterogeneous databases together. Often, different workgroups within an enterprise have their own type of databases resulting in "islands of information." The challenge will be to tie them together without creating data redundancy and complexity and sacrificing performance and security.

Workflow redesign without imaging and document management systems provides limited payback because often we are still bound by papers. On the other hand, implementing imaging and document management systems without workflow management, providing the benefit of collecting, storing, archiving, and retrieving of information, is considered a one-stop process. Highest return is realized when they are implemented together, and

along with reengineering [3]. Once information is in electronic form, many options present themselves. For example, when information can be shared, tasks can be performed concurrently. Processes need to be redesigned for automation to provide the highest payoff. Many people call the effort to automate archaic processes as "paving over the cow paths."

1.4 Desktop Technology Group at Giant Corporation

Its Accomplishment

Desktop Technology Group (DTG) is evolved from a Electronic Blue Book project (EBB) in 1991; it had a vision of transforming Giant into a paperless organization. The initial EBB prototype system was used for information transferring at a document control site. The result indicates that a process that used to take about 8 weeks can now be done in 1 hour or less [4]. Upon this initial pilot success, DTG began to leverage the document management, imaging, and workflow-enabled technology to build a collaborative working environment between individuals and groups at Giant. The ultimate goal is that people will be able to access, store, transfer, and share information to support just-in-time decision making and task operation.

The underlying technology is now code-named Automated Information Management (AIM). An example of the AIM setup is shown below in Figure 1-1. AIM project had a total of 15 pilots located at four different U.S. sites and 2 international sites during 1992 and 1993; over 850 users were using the technology. DTG's initial survey of pilot customers proved to be positive (67% of the customers found the technology useful while 25% were neutral and 8% were on hold). The next step is to develop shrink-wrapped installation AIM products and training services so enterprise-wide deployment of the technology would be possible.

Its Organizational Structure

The organizational structure of Desktop Technology Group is unique; it is reflective of what it is trying to achieve -- pilot the technology first and then scale up the deployment to enterprise level. DTG is made up of four functional groups, workflow analysis, assimilation, development, and support (See Figure 1-2). To achieve AIM proliferation, the primary responsibility of business workflow analysts is to work with clients in the analysis of their business processes and requirements; the function of assimilators is to train and educate people, including systems administrators, users, and developers, on AIM technology; the charter of the supporters is to provide technical support for installation and service (supporters will ultimately migrate to become the second layer of support as Site IT will take over the first line support); developers are in charge of delivering quality certified AIM products and developing enhancement to the AIM technology. Often, these functional groups have to join together to form integrated teams to meet customers' needs and solve customers' problems.

Its Environment

Besides interacting with internal Giant customers who are interested in or using AIM technology, DTG interacts with many external suppliers. Much of DTG's underlying information technology are outsourced from these suppliers; therefore, DTG needs to constant evaluate the variety of emerging technologies in the marketplace and determine the technology that is best fit strategically to be Giant's enterprise-wide desktop/client solution.

1.5 My Assignment

As depicted in figure 2, DTG is made up of four functional groups, including workflow analysts, developers, supporters, and assimilators. As DTG is interested in the possibility of deploying reengineering efforts across the enterprise, I was assigned to understand and define the AIM pilot methodology and then to recommend new processes and approaches

for (1) improved pilot methodology, (2) future scale up to the production stage, and (3) potential deployment of reengineering effort.

Figure 1-1: AIM System Components

Jukebox

Document Server

Mail Gateway

AIM Desktop

Printer

OCR, Print, Fax, & Server

AIM Desktop

OCR Scanner
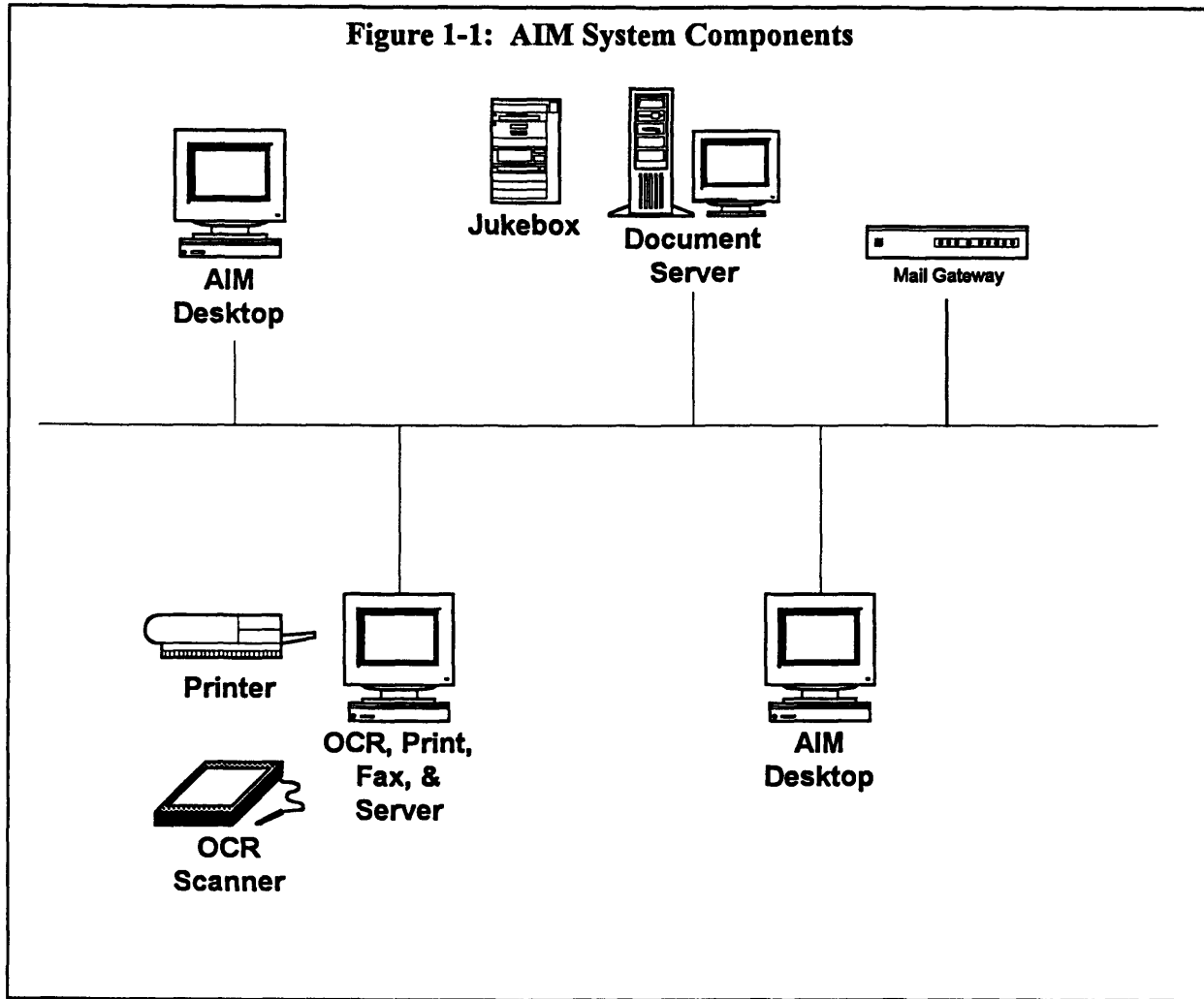
Figure 1-2: Desktop Technology Group - AIM Project

Desktop Technology Group - AIM Project

Workflow
Analysts

Assimilators

AIM Reengineering Project

Developers

Supporters
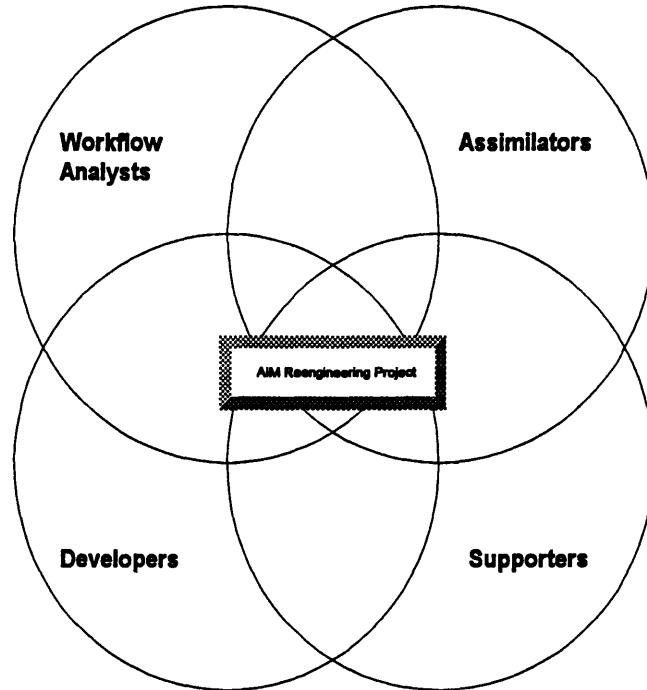
Chapter 2

2. Research Method

The process of my research is analogous to what Edgar Schein termed to be *Process Consultation* [5]. I was in essence an external consultant entering an organization to provide recommendation to its strategy and operation. To accomplish the task, I decided to adopt Davenport and Short's 5 stage approach as shown in Figure 2-1.

Figure 2-1: Thomas Davenport and James E. Short's Approach

Adopted from "The New Industrial Engineering: Information Technology and Business Process Redesign," by Thomas H. Davenport and James E. Short.

Develop Business Vision and Process Objectives
· Prioritize objectives and set stretch targets

Identify Processes to Be Redesigned
· Identify critical or bottleneck processes

Understand and Measure Existing Processes
· Identify current problems and set baseline

Identify IT Levers
· Brainstorm new process approaches

Design and Build a Prototype of the Process
· Implement organizational and technical aspects

In reality, the complete research process did not simply progress in sequential as planned. Often, changes in the environment and introduction of new information contribute to changes in the scope and details of the vision and objectives. Lots of iteration and revisiting of different stages took place.

The complete research process is elaborated below because the process itself is an example of re-engineering. Much learning experience could be extracted from it.

2.1 Develop Business Vision and Process Objectives

As time passed, the vision and objectives continued to evolve as additional information were acquired and as I gained a better understanding of the organization, its culture, its role and responsibility with respect to Giant, its structure, its strategy, and its incentive system.

Making AIM proliferation across the enterprise a reality was no longer the sole vision but one potential goal that awaits further rethinking. A refined vision is to build a sound desktop/client architecture that support information flow, storage, and retrieval across the enterprise. AIM evolved to become an option to make this vision possible.

2.2 Identify Processes to Be Redesigned

Aside from administration processes (budgeting, management by objectives, etc.) that are enterprise-wide common processes, all processes within Desktop Technology Group were considered to be targets for redesign.

Followings are five key processes that were identified to be critical success factors to DTG:

(1) Beta Program Process
(2) Suppliers-DTG's developers-Quality Control-Customer Process
(3) AIM Program Reengineering Process (For example, Develop or Understand Business Vision and Objectives → Identify Key Business Processes → Workflow / Process Analysis → Information Technology Leveraging → Change Management → Performance Evaluation → Business Partner Maturation)
(4) Knowledge, Skills, and Responsibilities Transition Process

(5) Desktop/Client Architecture Development Process

2.3 Understand and Measure Existing Processes

The first step to define or understand the current process is to gather information. Information comes from two major sources, one is indirect contacts and the other is direct contacts.

Indirect contacts refer to information provided by existing reports and documentation, including DTG Project Plan, process flows drawn by different senior staff (Cindy, Joe, and Ken), Peach Book, AIM Program Management Plan Overview, AIM Starter Kit, DTG members' weeklies, DTG MBOs (Management By Objectives), DTG and IT Organization charts, and others.

Direct contacts refer to information obtained through DTG senior staff meetings, DTG meetings, interviews, surveys, questionnaires, observation, and others.

Before performing any direct contacts, I first began obtaining and analyzing indirect contacts information. Making myself more knowledgeable about all aspects concerning the organization first so information gathered through direct contacts will be more valuable and less redundant. I will focus on direct contacts since indirect contacts are rather straight forward. Because for each key process, the stakeholders and information needed are different. Therefore, I will hereby focus on the four-step process of defining one key process -- The AIM Program Reengineering Process:

2.3.1 Identify the stakeholders

The key stakeholders for the AIM Program process are the DTG senior staff who are responsible for managing these processes to be redesigned. The acquiring of buy-in's and commitment from these stakeholders will be crucial before the implementation stage of

future recommendation. One key stakeholder that is often neglected is the customer. The redesigned process will deliver bottom-line benefit to DTG only when the customers value the improvement. Most important of all, the ultimate leader or "champion," who has the authority and willingness to make changes possible at Giant, need to be identified and consulted.

2.3.2 Gather information

Interviews with senior staff were formal and structured. Interviews with DTG members were casual and less structured; I simply just spent time chatting with them.

In direct interviews, the questions asked were structured to be clear, precise, unbiased, and unemotional. Answers to the following key questions were particular sought after during the interviews:

      a. Describe a representative work day.
      b. What are the key decisions that you have to make in your job?
      c. How do you go about in making these decisions? What information do you need to make these decisions?
      d. What are the major obstacles you face? What could be improved?
      e. What do you see to be your role and responsibility within DTG?
      f. What do you see to be the roles and responsibilities of other DTG senior staff?

In sum, I was trying to find out what, why, and how the employee does the things he or she does.

2.3.3 Consolidate information

After acquiring all the information through direct and indirect contacts, I tried to recognize whether there is a mismatch of expectation, role, and responsibility between the management and the employee and between the employee and his or her customers. Further 1-on-1's with managers were needed in order to gain a better understanding of the situation.

2.3.4 Acquire Consensus / Buy-in's

The next step was to acquire stakeholders endorsement and support of current process. Consensus was best achieved through group meetings where all stakeholders participate and all concerns were aired.

2.4 Identify IT Leverages

A repertoire of tools based on AIM were suggested to assist in tracking customer maturation and monitoring performance. Integration of the current AIM system with an on-line help for user-friendliness (IPSS), an on-line support system for faster response to customers (ASR), an architecturally compliant API and DMI for developers across the enterprise were some value-adding key features that await further enhancement.

2.5 Design and Build a Prototype of the Process

Redesigning the current processes requires a sense of creativity as well as an understanding of the capability of information technology. Time-based analysis is a typical approach used during workflow analysis. Value-chain analysis is another one.

Part of the process of redesigning the processes is to again acquire all stakeholders' buy-in's as well as continuous improvement. It is important to remember that the redesigned processes will be difficult to switch to, and the transition takes time and a rigorous planning effort.

As a result of the redesigned processes, role and responsibilities among functional teams were better communicated and understood. Additional resource (i.e., a librarian) was acquired to alleviate the under-resource situation within the organization.

Technologically, the first release of the ASR and API tools were released before my departure, and IPSS, DMI, and customer tracking tools were under development.

Chapter 3

3. Conclusion

Reengineering is a powerful tool; it can deliver significant value to an organization. Subsequently, the risk involved with such a high payback is high. Reengineering often entails rethinking of business strategy, creative leveraging of information technology, and careful implementation of changes in processes, roles, organizational structure, incentive / reward system, culture, and others. As a result, deploying reengineering effort demands the implementors have a sound understanding of a broad range of discipline. In fact, lessons learned through DTG's AIM project is very beneficiary for any future reengineering effort -- an attempt to induce technological change in an organization.

3.1 Lessons Learned by DTG

AIM is a technology, not a solution

AIM is a technology. However, people become emotionally attached to a technology after they have invested much time and effort in trying to make it successful. The past approach has been to "sell" the technology regardless of the business processes. A preferred alternative approach is to understand the key interorganizational processes and determine the best combination of technologies, *not confined to AIM*, that can solve the problems, all in light of a good understanding of the overall Giant business requirements, objectives, and vision.

AIM has been a *pilot* technology. The purpose of piloting is to exploit opportunities and gain the needed experience for potential future large-scale deployment. DTG has been the early outsourcer of this technology, and the experience gained in the process *when fully*

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realized and disseminated will prove to be invaluable to Information Technology and Giant as a whole.

It is important to remember to put things into perspective. AIM has been instrumental in helping DTG to test and enhance the Desktop/Client Architecture. In fact, AIM technology *well integrated* with a workflow application and other value adding functions is a technology that potentially can deliver strategic values to Giant *when implemented properly*. It should remain as an *option*, not the *sole* technology.

Fundamental Enhancement

Given that DTG is composed of cross-functional team that induces technological change in the enterprise, areas that are crucial to future success are (1) communication, (2) planning, (3) resource management and development, and finally (4) policies and processes formulation.

Effective communication in group meeting is particularly important for a team that continuously has to brainstorm and share ideas. In addition, communication, especially of the vision, is especially important during a time of constant change. Open communication is the only way to ensure that people don't feel left out, that they feel they are part of the team, and they can make a difference. The danger is that today's change-survivors become cynical and skeptical about all future changes.

Planning, both short and long term, needs to be done meticulously. It's been said that, " we don't punish bad result, but we punish lousy execution." In Stephen Covey's First Things First, a best selling time management book, planning is often neglected as people are tied up with crises and deadlines. Because the less urgent nature of planning, planning does not act on us; we must act on it. It is through planning that we can prevent these crises from happening. By investing more time in planning, we decrease the number of crises and urgent problems from happening [6].

With today's accelerating technological and organizational changes, there is an increasing need for the DTG members to obtain new skill sets and enhance the old ones. An effective method is to anticipate changes and allocate time to acquire and enhance skills, in not only technical but also organizational concepts, techniques, and tools. Moreover, DTG members has the role of educating and coaching the clients participating in the change effort; this will only be possible when the members themselves have a sound understanding of managerial and technological disciplines.

Clear, structured policies and processes provide boundaries within which DTG members function. People need to be creative and attack any fundamental constraints. Customer and result orientation remain to be its key values.

Need to Have a Holistic Approach

The primary focus of the DTG is to build sound strategies, infrastructure, and processes that are integrated with the corporate and IT strategies, infrastructure, and processes. To be effective, DTG needs to look at the whole enterprise holistically, *not limiting itself in analyzing one functional organization at a time and not confining itself within the scope of the office world.* Without a holistic approach, different concurrent information technology projects based on potentially competing technologies will inadvertently create islands of information and foster information redundancy and inconsistency. Piecemeal development will leave Giant with a number of islands of IT in engineering, manufacturing, and business worlds, today respectively dominated by UNIX, VAX, and DOS/Windows.

DTG, just like most other IT organizations in other companies, has failed to deploy projects in a holistic approach. Often the scope of an DTG project encompasses solely a functional organization, like Accounts Payable (AP) or Document Control (PDDC). Past industrial experience and research have indicated that to really have a bottom-line improvement in speed, cost, quality, and service altogether, we need to expand the breadth of process redesign as well as the depth of the business change.

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Instead of saying, 'let's look at Accounts Payable and see what we can do about it,"DTG should be looking at major corporate working practices and identifying who makes each decision and the kind of information support needed while ignoring existing organizational and functional boundaries. For example, a key working practice might involve Accounts Payable, Purchasing, Receiving / Distribution, and Vendors / Customers altogether.

An overall Giant current technology infrastructure map needs to be in place. During the AIM Program effort, DTG members have discovered that many of the bandwidth problems stem from inadequate subneting of the networks. Also, sharing of server costs and information would also be possible with the map.

Leadership Needed for Technological and Organizational Transformation

Many suborganizations within Giant were undertaking the challenge of reengineering. While they might not be performing "true" reengineering that redesigns interfunctional processes, their lack of understanding of reengineering will undermine the bottom-line success of their projects. On the other hand, a "true" reengineering effort that should be a top-down approach (maybe accompanied by bottom-up TQM approach), requires upper management commitment in order to be successful. Because of the depth and breadth that a reengineering effort entails, the commitment needs to come from as high as the CEO, COO, and CIO. The message needs to be disseminated throughout Giant and buy-in's and commitment acquired from functional managers and key stakeholders. Reengineering, like what has happened with TQM, needs to be recognized as a culture within Giant.

Culture Problem

One major challenge facing DTG is that Giant culture has made *piloting* difficult. The *piloting* customers expect themselves to be treated as *production* customers. In fact, they treat technology groups as servants. An information technology team should be of service to its customer, not a servant.

Politics

Be aware that a political environment will influence people to do things in a certain way, not necessarily the most efficient way. Alternatives / options should be examined before the formulation of the action plan. People often end up settling for a lesser solution just to minimize political barriers.

In addition, IT organizations are known to engage in guerrilla warfare when they possess competing technologies. Efforts should be made to minimize such unproductive, damaging affairs as the best strategic technology will not always prevail in the outcome.

The political fights potentially extend beyond IT and across functional organization (Manufacturing world's Shurpa vs. Office world's AIM). Consolidation of technologies needs to take place. If DTG is in charge of the overall Giant Desktop / Client Architecture, Lotus Notes, Keyfile, different operating systems (DOS/Windows, OS/2, NT, UNIX, VAX, and others), and many other technologies should fall under the umbrella of DTG's Desktop/Client Architecture, not a bunch of competing forces.

Create a Learning Organization

Change inevitably results in skills mismatch or obsolescence. Employees need to be given the opportunity to learn. Furthermore, employees are the most important asset of an organization, especially to an organization that performs many service functions. IT should not be responsible only for tasks but also for the people. With acquired knowledge and capability accompanied by a well structured reward system, employees will then assume responsibility and take initiative to solve problems. They are motivated because they have a goal, a dream.

The demand for having a learning organization is accelerating in this rapidly changing environment. The deployment of any new strategic technology will only deliver results if the users are trained as well as *willing to use the technology*.

Lack of Productivity Measurement and Benchmarking

To set a baseline for productivity improvement, measurements need to be taken. A piloting effort is of no value if no factual data are available to be evaluated. What's the point of investing in an information technology if it doesn't result in better decisions that translate into bottom-line benefit for Giant?

Benchmarking is one effective way to inspire people's creativity. The excellence of some other organizations serve as the model to motive us to achieve and surpass them.

Develop Cross-Discipline Knowledge

Technologists using technical tools to solve business problems might prove to be a mistake. There is increasing need for information technologists to team with organizational specialists who understand organizational choices, change management, and working practices within Giant.

3.2   Lessons Learned Personally As a Consultant

Communication

Throughout the months at DTG, I began to realize my lack of soft skills, including interviewing, holding group meetings, doing presentations, writing reports and others.

In leading a group meetings, I was responsible for maintaining the group both internally and externally [5]. Preparation of agenda prior to a meeting and performance of task-oriented, maintenance-oriented, and boundary management oriented functions would have resulted in more effective meetings.

One area that I did well and helped me tremendously was listening. I was actively listening to different people and was sensitive to their perspectives. Upon gaining a good

understanding of the roles and responsibilities of the participants, I learned to ask better questions.

Customer Orientation

One key thing I failed to do more extensively is to interview the customers of AIM. This is in fact the most crucial interviews. Interviewing customers helps to uncover the fundamental problems that customers worry about. By redesigning the processes to solve customers' problems, we can deliver bottom-line benefit to the organization.

Think Beyond AIM

In the process of identifying IT levers, no alternative information technology other than AIM was considered because I saw the team has committed much in this technology.

Look at an Organization Holistically

I begin to see an enterprise composed of processes, besides functional organizations. This allows me to gain a holistic view of an enterprise and understand the interdependency of different functional organizations.

Strategy First

The foremost important first step that a process analyst needs to do is to understand the vision, objectives, and strategies of the organization. Identifying the key processes and focusing on those key ones should be the foremost important task.

3.3   DTG's Future

Looking beyond the architectural focus of DTG, I believe that the past learning experience of DTG's AIM Program will have startling benefits to Giant. Its ability to carry out the newest and best strategic technology from pilot to deployment, its ability to overcome political barriers and look beyond organizational barriers, its ability to be creative and

innovative, its ability to provide quality and timely service, its ability to assimilate customers / business partners, and its ability to ease the pain of change for its customers / business partners, all deliver bottom line values in time, cost, quality, and service to Giant.

An Alternative Approach

According to Michael Hammer, a reengineering approach is one that starts with a white sheet of paper after knowing the vision and objectives of the organization. Reengineering is about starting from scratch without constraints by past processes. To start from scratch, followings are some questions that could be used to help redesign the core process of DTG:

1. "Who are the customers?"

• Giant enterprise-wide workgroups.

(e.g. Document control and management, financial document tracking, collaborative workflow, applications development, legal, Forms Improvement Taskforce (FIT))

2. "What requests does the customer make of us?" ("what offers do we make to the customer?" & "what is management holding this organization accountable for?")

• Interested in AIM and want to know more.

• Want to pilot/use AIM.

• Have problem with using AIM, need to be trained "better."

• Have hardware/software problem.

• Need more toolsets to do work.

• Uncover some AIM bugs or recommendation for change.

• Want to install new equipment.

• Want to expand the group.

• Want new AIM software release/version.

3. The roles involved in relating to the customer and fulfilling the request or offer are identified. It's better to err on the side of too many rather than too few (easier to combine than to split up later).

- customer information collector

- brochure provider

- demo disk provider

- video provider

- lab tour provider

- peach book provider

- AIM certifiers

- hardware supporter

- software supporter

- toolsets developers

- bugs fixers (contact people to Microsoft & Keyfile)

- reengineering team

    help to develop a goal and objective for using AIM

    identify the processes to be redesigned

    analyze, understand, and measure existing processes

    identify IT tools that can help

    design & build a prototype of the processes

    software installer

    hardware installer

    toolsets developers

    trainer

- training staffs

4. Arrange the roles in a customer-supplier chain. (Try scenarios starting with the initial customer in the chain and "walking" the customer's request through the entire chain.) Mark the complex relationships (customer's request conditioned on

an agreement from a supplier) and mark the speech acts that cause changes in the state of the relationships.

See DTG Process Maps in Appendix A.

5. Detail the procedures followed to fulfill each role's individual accountabilities. The use of computer automation would be used. Decide how to deal with exception.

See DTG Process Maps in Appendix A.

For details of alternative methodologies used by different consulting firms, information engineers, US Department of Defense, and others, please refer to the second part of my thesis which contains more details information on reengineering.

"Managing change in complex organizations is like steering a sailboat in turbulent water and stormy winds. If you're on a course to some destination and the wind is blowing at gale force dead broadside, you have to make a number of critical choices. If you head into the wind, you'll lose speed and direction although you probably can ride out the storm. If you let the wind carry you too far, it might blow the boat over; and if you let it go a little less far than that, it may well drive you off course. If you decide to hold rigidly to your course at all costs, you may find that the winds rip the sails or even break off the mast.
The true sailor, knowing these choices, works with the wind. He or she will bring the boat up close between gusts, 'fall off ' a little on the next gust, and come back up to course in such a way that the boat stays on the compass heading toward its destination through many short-term decisions, which go with or against the prevailing winds in an appropriate combination." - Richard Beckard, professor emeritus, MIT Sloan School of Management; and Reuben Harris, a principal of the Tom Peters Group.

Chapter 4

4. Reengineering

4.1 What is Reengineering?

Is reengineering just another one of those management fads?

4.1.1 Michael Hammer and James Champy's Reengineering

Michael Hammer, the originator of the concept of reengineering, believes that simply speeding up business processes cannot address the fundamental productivity deficiencies in corporate America today [7]. His 1990 *Harvard Business Review* article 'Reengineering Work: Don't Automate, Obliterate." stimulated the reengineering surge in the 1990s [7].

According to Michael Hammer and James Champy, reengineering is "the *fundamental* rethinking and *radical* redesign of business *processes* to achieve *dramatic* improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed." And they forewarn that reengineering practitioners need to keep in mind the four keywords: *fundamental, radical, dramatic,* and, most important of all, *processes* [8].

A process is a set of activities that collectively and synergistically deliver a result of value to customers. Hammer and Champy's book is very much process-centric. The emphasis on process analysis is ubiquitous throughout the book. Hammer articulates the importance of process by stating, "Products have limited lifespans, and even the best soon become obsolete. It's not products but the processes that create products that bring companies long-term success. Good products don't make winners; winners make good products."

The reason an incremental improvement approach (i.e. TQM) is often not the best approach is that the efficiency of a company's parts might come at the expense of the efficiency of its whole. Therefore, it is important that we concentrate on the complete process that create value for customers. It is an all-or-nothing proposition; hence, it's a *radical* redesign. The right question to ask is not "How we can do what we do faster, better, and cheaper?"; instead, it should be "Why do we do what we do at all?"

In reengineering, we need to break away from the *fundamental* rules (a basic notion he called *discontinuous thinking*) in order to achieve quantum leaps in productivity. What Hammer and Champy call the *fundamental* rules are today's organization's culture and infrastructure that have originated from Adam Smith's principle of the division of labor [9], which was later applied to production by Henry Ford, creating moving assembly line that brings work to the workers. Then the principle was applied to management by Alfred Sloan in creating smaller, decentralized divisions monitored by a corporate headquarter. Division of labor has resulted in (1) increasing distance between senior management from the customers because work fragmentation requires layers of middle management to provide check and control, (2) no one is responsible for the complete process, and (3) there are too many hand-offs that degrade the responsiveness of service and product delivery as well as their quality. Reengineering in a sense reunify the tasks into coherent business processes and eliminate the non value-adding players as well as the number of hand-offs.

If reengineering is properly carried out, productivity is not only enhanced, performance is improved. Improvement in performance means that we can now do more with less. We have achieved *dramatic* improvement.

The key element that is enabling reengineering is information technology. Information technology has the disruptive power that breaks the rules which confine the way we perform our works. We need to learn to think inductively when exploiting the capability

of IT. Alan Kay, the inventor of PC, once said, "An important technology first creates a problem, and then solve it." Being inductive, we will then be able to recognize a solution that can solve problems which the company doesn't even know it has.

4.1.2 Davenport and Short - The New Industrial Engineering

Thomas H. Davenport of Ernst and Young and James E. Short of the MIT Sloan School of Management call the exploiting of the relationship between information technology (IT) and business process redesign (BPR) as "the new industrial engineering [10]." They believe that BPR and IT are natural partners. They are the two new tools that are transforming organization.

While IT supports business processes, it is also important to see how business processes can be transformed using IT, a recursive relationship. (See Figure 4-1) The supporting of business processes has always been the role of IT, that of the "back office." The ability of IT to transform business processes is the key issue here. Some consultants call this competitive advantage from IT and some call it strategic alignment.

Figure 4-1: The Recursive Relationship between IT Capabilities and Business Process Redesign

Adopted from "The New Industrial Engineering: Information Technology and Business Process Redesign," by Thomas H. Davenport and James E. Short.

How can IT support business processes?

Information Technology Capabilities   Business Process Redesign

How can business processes be transformed using IT?

In the field of industrial engineering, IT is used in manufacturing environment, especially in factory floor automation, production control and scheduling, materials management, logistics, and process modeling and analysis. Applying IT in the office environment is hence called the "new industrial engineering." Davenport and Short claims that "IT should be viewed as more than an automating or mechanizing force; it can fundamentally reshape the way business is done [10]."

This "fundamentally reshape the way business is done" concept is parallel to Hammer's definition of reengineering; in fact, their articles/book delivers the same message: reengineering and new industrial engineering are both process centric. Davenport and Short define process as "a set of logically related tasks performed to achieve a defined business outcome." A set of related tasks are recombined to create a process. An emphasis is that processes have customers and cross organizational boundaries [10]. Like Hammer, they have observed that a typical problem in today's company is that an entire process from a customer's order to deliver has never been looked at and measured. For example, sales, credit checking, and shipping departments had optimized its own productivity, but the overall process from a customer's order to deliver was in fact lengthy.

4.1.3 Others

Robert Seltzer, president of Meta Software, sees reengineering as "the methods and approach of systems engineering.....people, machines, processes, and how they interact [11]."

William G. Stodard, director of Andersen Consulting's reengineering practice, said, " Departments are stovepipes. We work in sewer pipes [12]." The emphasis is again that reengineering is cross-functional.

Not all consulting firms use the term "Reengineering." Andersen Consulting calls it "Business Integration." IBM names it "Business Transformation." McKinsey divides it

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into a Core Process Redesign practice and an Organizational Performance practice. Price Waterhouse labels it "Change Integration." Many dub it "Business Process Redesign." Underlying each term is each consulting firm's own propriety methodologies to carry out its practices.

To further illustrate the confusion in the meaning of reengineering, in May, 1993, Forrester Research Report, 30% of the fifty surveyed companies say they are developing new processes during reengineering, 28% say that the are reorganizing MIS, 23% say they are automating existing processes, and 19% say they are downsizing applications [18]. Strictly speaking, reengineering entails developing new processes and reorganizing MIS to support those processes, and they come hand-in-hand and should not be separated. Simply automating existing processes is exactly what people call putting new wine in old bottle and is not reengineering. Downsizing applications presents an opportunity to reengineer processes, and downsizing applications is often part of the overall reengineering process, not a necessity. Reengineering is becoming an universal term that is used by companies in all form of corporate internal change.

4.1.4 My Definition

What all the terms above have in common is that business process redesign is all enabled by information technology, besides the fact that many of them start with "re-". (reengineering, redesign, restructure, rethinking)

It seems like the proper definition of reengineering should be: "the *fundamental* rethinking and *radical* redesign of **interfunctional** business *processes* to achieve *dramatic* improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed."

A business process is nothing other than a collection of human interactions with other humans and with machines (computers, software, communication technology).

Reengineering is trying to change the way how people, technology, and business strategy meshed together.

Reengineering is a "mind-set" [14] that encompasses disciplines from organization development [15], coordination science [16], and information technology. In order to "reengineer" a corporation, it is not only important to have a good understanding of these disciplines, but also how they are applied together to deliver the ultimate outcome - a lean, flexible, responsive, innovative, competitive, efficient, customer-oriented, profitable organization.

Organizations are just beginning to realize the benefits of changing business processes and workflow to take advantage of the technology.

In a survey by Gateway Information Services, the definition of reengineering is seen with 46% calling it process redesign, 17% technology change, 16% product improvement, and 8% efficiency improvement [17]. This indicates the wide variety of opinion on the definition. Reengineering clearly encompasses all of them.

4.2 Why Reengineering?

> "The globalization of the economy, the rise of the Pacific Rim, the unification of Europe and the dissolution of the Soviet bloc have disrupted post-World War II economic assumptions with an impact equal to the Cretaceous / Tertiary boundary catastrophe that rocked the mammals into dominance. But unlike the dinosaurs, our way of doing business need not succumb to random natural events. Our destiny, remember, lies in the intricate pattern and exquisite detail of the human mind [11]."

4.2.1 Hammer's 3 C's

The 3 C's are customers, competition, and change [8]: (1) The customers are taking charge. Mass production of the past no longer apply today. Each customer wants a product that fit his or her specific needs. It is an era of mass customization. (2) Competition has intensified globally. Today, there is even competition across different industries. For example, deregulated banks, insurance companies, brokerage houses are competing for the same investment money. People are competing in quality, price, selection, and services. (3) Change has become constant. The service and product life cycle has diminished as well as the time available to develop and market the new product and/or service. (John Rockart, head of the Center for Information Systems Research at MIT's Sloan School, calls this the diminishing of *buffers* of space, time, people, and inventory [18].) These 3 C's are forcing companies to adjust and alter the way they operate. Today's companies need to move fast; otherwise, they will not be moving at all.

4.2.2 Others

Thomas A. Steward claims that the two principal reasons why people reengineer are fear and greed [12]. Many companies running mainframes fear that they can no longer compete with cost-effective little guys that have PC's. Some companies sustaining its market lead want to leave its competitors in the dust by further reengineering their business processes.

Many reengineering practitioners, including Hammers, Champy, Davenport, Short, and more, have shown with hard evidence that reengineering is not just a passing management fad. For example, Ford radically changed their processes and reduced their accounting staff from 500 to 125 [8]. Many organizations have great success stories to tell. In fact, Dun & Bradstreet software determined that almost 60% of the 350 surveyed organizations were reengineering part of their businesses now or would be in the next 12 months [17]. In a survey of 23 CEOs and CIOs of major U.S. companies, Dataquest Inc. found almost

75% are reengineering [17]. People are jumping on the reengineering bandwagon as fast as they can.

However, reengineering at times seems to be driven more by the suppliers of services and products more than the users of the services and products. This brought out the danger that customers might not care that its suppliers are reengineering if the results of reengineering don't provide benefit to them. Therefore, strategic alignment is very important.

There is no double that product cycle has shrunk. Hewlett Packard acknowledged that "two-thirds of their revenue comes from products that are less than three years old [19]."

Forrester Research found that 26% of the fifty surveyed companies reengineer to provide data to business units, 21% use reengineering to lower cost of operation, 20% to generate new sales, 18% to fulfill orders faster, and 15% to answer customer inquiries more quickly [20]. I believe, chances are companies want to achieve a combinations of all these objectives, and reengineering always bring most of these benefits at the same time.

In the same report, Forrester Research asserts that companies in the 1980s looked outside, like seeking government protection from imports, buying new businesses, and spending lots of money on high technology, and failed. Today, they look inward to find organizational problems that inhibit success. Besides reengineering, Forrester believes that "management has no other strategic cards left to play [20]."

According to Gross, Pascale, and Athos, the reason that Kodak, IBM , American Express, and General Motors have sacked their CEOs in the 1990s is that they fail to *reinvent* themselves [21]. Merely improving themselves was not enough. Reinvention, like reengineering, 'is not changing what is, but creating what isn't." Gross, Pascale, and Athos believe that it's time to ride the reinvention roller coaster [21].

In sum, the trend toward globalization and the pervasive forces of technology are reshaping industries and profoundly affecting ways of competing. Companies have to change in order to survive, and reengineering is simply one way to describe this change imperative.

4.2.3 Driven by Technology

Companies might found the necessity to reengineer processes and then look for the technology to help them to achieve the goal. However, more often, reengineering seems to be driven by other trends in the industry, especially the proliferation of imaging management system/workflow software, electronic messaging, and downsizing (moving from mainframe to client/server technology, which will be discussed later). In fact, implementation of new technology always profoundly affect the way we work and a reevaluation of the business strategy and processes should take place.

One strong driving force is definitely the wide acceptance of PCs and LANs that link them together. In 1992, the installed base of PCs in the U.S. reached 60 million units, and according to International Data Corporation (IDC), the number of PCs linked to LANs was over 50% [17].

4.2.4 Reengineering is not for everything

Davenport said, "This hammer is incredibly powerful, but you can't use it on everything [12]." Reengineering should be used for big processes that really affect the business.

In *Rethinking the Corporation*, author Robert M. Tomasko states the sentiment that don't reengineering if you don't have to [22]. Strategy is the first thing companies should look at. Find out where the competitive advantage will come from and work towards that.

Another approach to answer the question of "why reengineer?" is to look at the costs of not reengineering. In the past, reengineering practitioners were inexperienced and different workflow and downsizing tools were not in place; as a result, competitive penalty of not reengineering has been low. However, with reengineering experts equipped with maturing technology, a well-automated enterprise are now producing high quality products and services at the most cost effective way.

Hall, Rosenthal, and Wade of McKinsey & Company wrote an article on why most reengineering efforts in many companies fail to deliver long term profit [23]. Their study shows that the key factors are the breadth of process redesigned and the depth of business change. It is somewhat common sense to see that the greater level of breadth and depth delivers greater level of the bottom-line success; at the same time, the greater level of risk.

To me, the reason that most of these companies have not seen remarkable result from their reengineering efforts is that they never truly understand the meaning of reengineering. Reengineering is suppose to redesign interorganizational processes that are of great breadth which results in great depth of business change.

4.3 How to Reengineer?

Reengineering practitioners have to worry about employees and managers' resistance to change, immature technology infrastructures, developers' unfamiliarity with new technology tools and platforms, accidental mistakes by the vendors, top management's commitment, up-front capital investments, global economics, and the list goes on. Some people call reengineering is like rebuilding a car engine while the motor is running; some say it's like trying to change the tires while a car is running. Reengineering is no simple task.

4.3.1 Hammer's Approach

"Don't automate the past, create the future!" - Michael Hammer [24].

Hammer believes that reengineering has to be driven by the upper management; it has to be a top down approach. The leader of the reengineering effort must have the authority over the resources involved as well as the authority to overcome the resistance to change by various stakeholders because reengineering often crosses functional boundaries. The assigned process owner needs to possess prestige and credibility; his or her job is to motivate, advise, and inspire the reengineering team. The reengineering team should be composes of the company's best, brightest, and most credible people to indicate that the serious nature of the reengineering effort. The team should be composed of not only insiders, but also outsiders who can bring objectivity and different perspective to the team. The reengineering team needs to understand the customers better than the customers understand themselves. Because reengineering a process requires every participant's full devotion, no team should be allowed to reengineer more than one process at a time. A steering committee needs to be formed; it is a body of senior managers who develop the overall reengineering strategy as well as monitor the progress. The responsibility for developing reengineering tools and techniques will be assigned to a reengineering czar. It is also the czar's responsibility to achieve synergy across company's separate reengineering projects by developing the infrastructure for reengineering, coordinating reengineering activities, and enabling process owners and reengineering teams. Simply put, "the leader appoints the process owner who convenes a reengineering team to reengineer the process with the assistance from the czar and under the auspices of the steering committee [8]."

Because reengineering entails major changes in culture, processes, and organizational structure, it is important for the leader to create a case for action and a vision statement. The case for action contains business problems, market demands and diagnostics, and costs of not reengineering; it tells people why we must reengineer. The vision statement contains measurable objectives and provides a continuing focus to the reengineering participants; it tells people what we will achieve when reengineering is complete.

Upon competing the allocation of resources, the case for action, and the vision statement, the selection of the right processes to be reengineered follows. The selection is based on three criteria: dysfunction, importance, and feasibility. We are trying to find the processes that are in deepest trouble (dysfunction), have the greatest impact on our customers (importance), and are most likely to be successfully reengineered (feasibility).

It is essential to keep the processes simple and have multiple versions to handle exceptions. Simple processes can satisfy the criteria of quality, flexibility, and low cost. Also, we should not analyze a process in agonizing detail; reengineering has a propensity towards action.

Some important characteristics of a successful reengineering effort are (1) several jobs are often combined into one, (2) a case worker or case team will be the single point of contact to the customers, (3) workers are empowered to make their own decisions, (4) process steps are performed in natural order, (5) checks and controls and hand-offs are reduced, (6) jobs become multidimensional instead of task-oriented, (7) job prepare changes from training to education; instead of teaching "how" in training, education enhances insight and understanding and focuses on "why", (8) managers are coaches, not supervisors, (9) advancement in ranking is based on ability, not performance, (10) flattening of the organizational structure, (11) executives are leaders, instead of scorekeepers, (12) focus is on customers' needs, not bosses', and (13) work units has changed from functional departments to process teams as reengineering is often boundary-crossing.

Because success lies in knowledge and skills, not in luck, Hammer lists out the common reengineering faults that resulting in failures: (1) try to fix a process instead of changing it, (2) focus on technology rather than business processes, (3) focus only on process redesign without paying attention to the changes in job designs, organizational structures, management systems, and culture, (4) is willing to settle for minor results, (5) quit too early, (6) place constraints on the definition of the problem and the scope of the effort, (7)

unable to overcome resistance, (8) attempt to make reengineering happen from the bottom up, (9) leader doesn't understand reengineering, (10) inadequate resources devoted and inadequate commitment, (11) reengineering is not given a high priority in corporate agenda, and (12) drag the effort out too long.

In October, 1990 Computer Economics Inc. Conference, Hammer said, 'Reengineering is not brut-force automation, cutting fat, squeezing, downsizing, and incremental thinking. Reengineering is starting from scratch, reject conventional wisdom, and it ain't broke yet means you still have a chance to fix it! It requires courage, commitment, consistency and a touch of fanaticism [24]." The most important success factor in reengineering is leadership [25].

4.3.2 Davenport and Short's Approach

Davenport and Short have a well defined five steps approach to redesign business processes with IT (See Figure 4-2): (1) Develop the business vision and process objectives; it is important to set specific, quantifiable objectives; (2) Identify the processes to be redesigned; exhaustive and high-impact are two different methodologies to identify processes. Just like what the name imply, exhaustive methodology means that all processes are identified and then prioritized to be redesigned; on the other hand, high-impact methodology means that only the most important processes are identified first and redesigned; (3) understand and measure the existing process; (4) identify IT levers. IT impacts an organization in eight different ways (See Table 4.1); and (5) design and build a prototype of the new process [10].

An additional dimension in Davenport and Short's article is that they differentiate the processes into different types, which will require different forms of IT support and will need different levels of management attention. (See Table 4.2)

In terms of resource allocation, Davenport and Short feel that it's important that the customer of the process participate in the BPR team, even when it is an external customer. Additionally, an ideal team would be composed of representative from multiple functional areas since BPR often cross functional boundaries. A strong and visible commitment from upper management is also needed to make the team successful. Process managers need to develop new skills, like facilitation and persuasion, and "new industrial engineers" need to have analytical and interpersonal skills.

Figure 4-2: Five Steps in Process Redesign

Adopted from "The New Industrial Engineering: Information Technology and Business Process Redesign," by Thomas H. Davenport and James E. Short.

Develop Business Vision and Process Objectives
· Prioritize objectives and set stretch targets

Identify Processes to Be Redesigned
· Identify critical or bottleneck processes

Understand and Measure Existing Processes
· Identify current problems and set baseline

Identify IT Levers
· Brainstorm new process approaches

Design and Build a Prototype of the Process
· Implement organizational and technical aspects
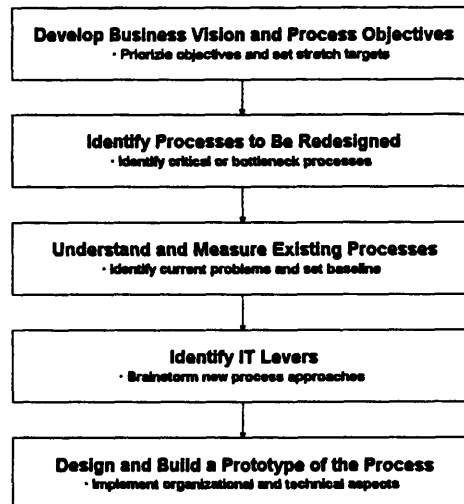
Table 4.1: IT Capabilities and Their Organizational Impact

Capability	Organizational Impact / Benefit
Transactional	IT can transform unstructured processes into routinized transactions.
Geographical	IT can transfer information with rapidity and ease across large distances, making processes independent of geography.
Automational	IT can replace or reduce human labor in a process.
Analytical	IT can bring complex analytical methods to bear on a process.
Informational	IT can bring vast amounts of detailed information into a process.
Sequential	IT can enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously.
Knowledge Management	IT allows the capture and dissemination of knowledge and expertise to improve the process.
Tracking	IT allows the detailed tracking of task status, inputs, and outputs.
Disintermediate	IT can be used to connect two parties within a process that would otherwise communicate through an intermediary (internal or external).

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Table 4.2: Types of Processes

Adopted from "The New Industrial Engineering: Information Technology and Business Process Redesign," by Thomas H. Davenport and James E. Short

Process Dimension and Type	Typical Example	Typical IT Role
Entities Interorganizational Interfunctional Interpersonal	 Order from a supplier Develop a new product Approve a bank loan	 Lower transaction costs; eliminate intermediaries Work across geography; greater simultaneity Role and task integration
Objects Physical Informational	 Manufacture a product Create a proposal	 Increased outcome flexibility; process control Routinizing complex decisions
Activities Operational Managerial	 Fill a customer order Develop a budget	 Reduce time and costs; increase output quality Improve analysis; increase participation

Because switching from traditional functional organization to process organization presents much risk, the article proposed a conservative alternative which is to create "a matrix of functional and process responsibilities [10]." At the same time IT personnel should devote their time to develop a technology infrastructure on which processes applications can be built, like a standardized architecture and shared databases; it is also important to ensure such technology infrastructure is robust as technology is continuously advancing.

According to Davenport and Short, existing process need to be stabilized first before process improvement so that the process is predictable and accessible to analysis and improvement. "Continuous process improvement occurs when the cycle of stabilizing, assessing, and improving a given process becomes institutionalized [10]."

4.3.3 Top-Down + Bottom-Up Approach

Hammer and Champy believe that reengineering has to start at the top and it doesn't bubble up. The most common starting point has been the chief operating officer since CEO is worrying about Wall Street, Washington, financing, and shareholders [26].

Unlike Hammer and Champy who believe that reengineering is a top-down approach, some advocate a combination of top-down and bottom-up approach to reengineering. There is no doubt that a sole bottom-up approach will fail as these processes to be redesign cross organizational boundaries; however, top-down and bottom-up don't conflict with each other. It is important to carry out continuous improvement or TQM projects at the same time as reengineering. This helps to foster employee involvement. Employee need to feel that they are contributing to the effort for them to accept the discomfort that comes with changes.

Julie Schwartz, an associate director of professional services, Worldwide Services Group of Dataquest Inc., is a believer of both a top-down and bottom-up approach. She states that 'business process reengineering must be viewed as a continuum - process improvement on one end, process transformation on the other [27]." Schwartz also states, 'Business process reengineering defined as an all-or-nothing proposition is doomed to fail [27]." Not all organizations can withstand the stresses of a radical enterprisewide redesign, and she calls for a new definition of the concept.

Schwartz is wrong. Strictly speaking, reengineering based on Hammer's definition will have to be a top-down approach as processes are cross-functional. The all-or-nothing

proposition should not be taken so literally. Hammer is simply trying to encourage people to go for radical change and design the future without being constrained by past business paradigm. The bottom-up approach mentioned as process improvement is that of TQM, not reengineering. I feel that Schwartz can confuse the meaning of reengineering by stating that 'business process reengineering must be viewed as a continuum - process improvement on one end, process transformation on the other." She has decided to put TQM to be part of reengineering. Hammer never discredit the needs for TQM; in fact, he praised that TQM contains some powerful ideals, including customer orientation, team orientation, and others [28]. TQM and reengineering can co-exist together; together they can then be viewed as a continuum.

In fact, many consulting firms embrace both TQM and reengineering. For example, American Management Systems recognizes the difference between the two and describe a harmonic way or 'hybrid approach" to integrate reengineering and TQM together [29]. It has successfully applied this hybrid method at the U. S. Naval Shipyards under the management of the Naval Sea Systems Command (NAVSEA) [30]. To the extreme, IBM Consulting Group is a consultancy that merges quality management and reengineering practices in all of its practices [31]. Both reengineering and TQM are merged under one umbrella - Business Transformation.

4.3.4 American Management Systems' Approach

American Management Systems (AMS) utilizes Corporate Renewal Method^{sm} as its business process reengineering practice. Corporate Renewal Method^{sm} (CRM) is comprised of four stages: (1) Assess - 'Define the core business, model today's processes, and identify opportunities for innovative improvement. A 'quick-look' approach, focusing on assessing your business and the status of the competition [32]." Current technical and cultural environments are evaluated and tools, like IDEF0 (discussed later), Organizational Workflow Model^{sm} (discussed later), and Organizational Model are used. (2) Envision - 'Develop a 'blueprint for the future.' Take senior managers back to first principles,

examine potential scenarios of the future, look beyond today's paradigms and define a vision for the future that encompasses new business **processes**, enabled by **organizational, technological, and cultural** changes. Develop a business case to determine net gains [32]." During this stage, breakthrough concepts are proposed, often by brainstorming. Future technical and cultural environment are determined, and the same modeling tools as in previous stage are used. (3) Engineer - "Transform the blueprint into detailed specifications of the new business processes and supporting organizational **structure, technology, and culture.** Engineer specific products (e.g., desk guides, training materials, software) required for implementation [32]." Information systems and change strategy are engineered. (4) Implement - "Implement the engineered business **processes, organization, technology, and cultural** changes. Establish an environment for continuous improvement [32]."

AMS believes that the key issues to a successful reengineering are (1) senior management's **commitment**, (2) a **return to first principles** to ensure core business are supported, (3) **breakthrough thinking** to break away from today's paradigms, (4) **ownership** of the processes, and (5) a **blueprint** to guide the reengineering effort [32]. This is very much similar to Hammer's beliefs (discontinuous thinking, radical redesign, fundamental rethinking, top-down approach, and others) on what should take place during reengineering.

4.3.5 Department of Defense's Functional Process Improvement

The U.S. Department of Defense (DoD) faced with shrinking budgets in the 1990s is trying its best to retain as much military capability as possible. The key tools that are used for its functional process improvement, DoD's term for BPR, are process modeling, data modeling, and financial analysis [33]. IDEF is a process model representation technique that will be discussed later. It has been widely utilized in military bases. A Department of Transportation's reengineering eight steps approach is seen in Table 4.3.

Table 4.3: DoD BPR Approach From Start to Finish

Step	Description	Output	Functional Process Improvement Methodology
1	Articulate Business	Goals, Mission	Strategic (business) plan
2	Develop 'as-is" process model	Process: (product, service) Step: (activities, inputs, controls, mechanisms)	IDEF0
3	Develop data model	Entity, attribute, relationship	IDEF1
4	Conduct activity-based costing (ABC)	Total activity cost, unit cost for each output, unit of measure for outputs	Activity-based costing
5	Assess opportunities for Improvement	IT enablers, improved business processes	Functional economic analysis
6	Develop 'to-be" data, process models; apply ABC	To-be process and data models	Functional economic analysis
7	Project costs, risks, benefits; conduct financial analysis	Seven-year costs, risks, benefits	Functional economic analysis
8	Recommend business change	Cost-effective, minimal risk business process improvement	Functional economic analysis

One key element to learn from the DoD's approach that it has tried to 'institutionalize BPR" through a supportive infrastructure:

(1) Data Administrator (DA) : formulate policies, disseminate guidance, and provide support to functional data administrators. In addition, it's responsible for 'issuing standards for modeling, definition, standardization, configuration management, storage, retrieval, protection, validation, and documentation of the DoD's data asset [33]." It plays the critical role of extending data modeling and data quality to Functional Process Improvement / BPR in five areas: a. DA provides DoD-wide perspective. b. DA cultivates

and encourages cross-functional communications networks. c. DA envisions commonality through data standardization and data model integration. d. DA ensures data quality, and e. DA is the custodian of DoD's information assets.

(2) Functional Data Administrator (FDAd): Some of the functional areas within DoD include personnel, procurement, production and logistics, and heath affairs. Each function area independently services customers, like Army, Navy, and Air Force. One of FDAd's role is to manage applications and systems as DA's role is to manage data. Each FDAd's personnel is valuable in providing authority across the DoD for a functional area, providing knowledge and understanding of a function across organizational units, and supporting DA activities in the area of data-related costs, benefits, and risks assessment.

(3) Functional Activity Program Manager (FAPM): Each functional area contains several functional activities. An FAPM is responsible for each activity just like an FDAd is responsible for each functional area. FAPMs know the details of the activities. They are supported by a joint functional/technical team and use functional economic analysis (FEA) for systematic assessment of BPR opportunities and for quantifying costs, benefits, and risks of each alternative.

The perspective here is a bid different from before. We are in a sense 'reengineering the way [our] enterprise sees, interprets, invests in, accesses, respects, and protects its data assets. Think of BPR as an exaggeration of these skills - it's a natural extension of these skills into process, data, and financial analysis [33]."

Government agencies are known for developing rigorous and well-specified methodology. There are some shortfalls, include the speediness of returns on investment (ROI): DoD expects ROI to happens in approximately five to eight years [33], and it took Air Force 10 months to completely diagrammed a 4,000 person organization [34]. However, much learning can be extracted from their experience, especially in the area of institutionalize management of data and functional processes. As IDEF is enhanced to include simulation

and object orientation (discussed later), the DoD's approach to reengineering, as well as other military bases' approaches, will become more and more appealing.

4.3.6 Strategy Comes First Approach

Who is in better position to advocate the importance of business strategy than McKinsey, the preeminent management and strategic consulting firm. John Hagel, a reengineering specialist at McKinsey, said, "We did an audit of client experiences with process reengineering. We found lots of examples where there were truly dramatic impacts on processes - 60% to 80% reductions in cost and cycle time - but only very modest effects at the business level, because the changes didn't matter in terms of the customer [12]." *Reengineering is about operations, and strategy will tell us what operations matter.*

McKinsey is called 'the font-end loaders [35]," given their ability to help clients in defining long-term vision, goals, and objectives, redesign processes, and map out organizational models. To demonstrate the importance of upper management's commitment to reengineering, John Hagel, a McKinsey principal who heads the reengineering activity, says, "We'll walk away from any job where there's no active CEO sponsorship, a poor strategy, or an unwillingness to wait. We don't do slash-and-burn reengineering [35]." Its approach will be to 'take any business and rethink it into three to five horizontal operational processes that deliver primary value to the marketplace [35]." However, McKinsey is not strong on the technology front. Its own internal client/server project, the PeopleNet, cost $12 million, almost two-and-a-half times its original budget, and lasted more than 3 years, three times its original target [36].

Unlike McKinsey, Andersen is known for its powerhouse skills of systems integration and application design and engineering. Moreover, Andersen Consulting also sees that strategic alignment as the first of its overall four-step consulting process [17] and reengineering follows that: (1) Strategic alignment, (2) Business process reengineering, (3)Change management, and (4) Systems integration. Andersen's 'business process

reengineering" doesn't encompasses strategic alignment, change management, and system integration as they are all separate steps. This in a sense helps to clarify the exact step that will take place as BPR is self-contained and it's process centric.

As mentioned before, Andersen Consulting defines its practice as 'business integration." Business integration is to link strategy, processes, technology, and people together [37]. "Value-driven reengineering," Andersen's methodology, concentrates on orienting the reengineering process to the value of the people in the company and especially to the CEO's strategic vision [38]. Andersen has four major specialized services: Systems Integration, Change Management Services, Strategic Services, and Business Process Management. One criticism of this specialty services approach is that these the services are not tightly integrated. (Part of this paper's intent is to integrate major concepts in each of these fields to give a holistic view of the management challenge.)

Arthur D. Little's approach: "A. D. Little begins with an assessment of how well the client is meeting the expectation of its 'stakeholders," including customers, shareholders, and employees. Next on the agenda: figuring out which of the stakeholders' expectations must be met to stay even with competitors, and which expectations should be met to garner a competitive advantage. The firm helps clients figure out how to redesign processes to meet those expectations [39]." In another word, its consulting service starts from helping clients in strategic issue and end in mapping out IT solutions. A. D. Little doesn't go down to the bit and byte (programming) level.

Like A. D. Little, Coopers & Lybrand, CSC Index, and many other consulting firms don't implement technology. However, they team up with systems houses like IBM, Hewlett-Packard, and Digital Equipment [40].

Price Waterhouse's reengineering methodology is 'evaluation, envisioning, empowerment - that ties together processes and systems, cultures, corporate structures, and enabling technologies [41]." Lotus Notes is one of its major reengineering tools.

4.3.7 A Pure Bottom Up Approach, Beyond Reengineering

Many companies are hiring anthropologists to help them improve productivity [42]. This is an attempt to understand what a job really entails and how employee see the way to enhance productivity. From the uncovering by these anthropologists, top management hope to learn about workers interactions and their working habits, the corporate culture.

Anthropologists' approach is different from management consultants' approach. Management consultants match employee interviews against a preconceived culture as anthropologists gather information first before forming any conclusion. Also, anthropologists are obligated to protect the people studied based on the science's code of ethics, established by American Anthropological Association. Xerox's experience with anthropologists has been very positive as many hidden factors that profoundly affect jobs were uncovered [42]. General Motor, by using anthropologists, found out that while upper management was promoting overseas assignments, the lower level executives were discouraging them, resulting in counterproductivity [42].

Anthropologists' approach is clearly not reengineering, despite some call it reengineering. It is merely another management tool to improve productivity.

4.3.8 Others' Approaches

John Holton, Unisys vice president of Strategic Accounts Marketing, states that "Unisys Seven Commandments of Reengineering" are (1) Thou shalt formulate and understand your objectives, (2) Thou shalt plan, (3) Thou shalt insist on working with experienced systems integrators, (4) Thou shalt be open, (5) Thou shalt not automate junk, (6) Thou shalt listen to the end-user, and (7) Thou shalt not view new possibilities based solely on your organization's current skill set: reengineering means reeducation and challenging your team to stretch and grow [11]. Also, reengineering needs to be in an environment of leadership, risk-taking, and empowerment.

Steven Patterson, Gemini Consulting's chief reengineer, states, "To cross multiple boundaries in the company, you need a view of the organization that everyone agrees on but that doesn't depend on today's geography. So you start from the customer-then figure out how to execute the work [12]." Glenn Hazard, the process reengineering vice president of AT&T's Global Business Communication systems, concurs:" Designing from the outside in-all the way through-was the most critical success factor [12]."

Gantz, John, a Senior Vice President of International Data Corporation, states that in theory, "the process is re-engineered first, then the data, then the application [17]."

Dorine C. Andrews and Susan K. Stalick wrote an article in the May, 1992 issue of *American Programmer* on critical success factors of reengineering: "a vision of the reengineered environment; a reengineering methodology; participation from all levels, including the top of the organization; flexibility, temporary teams; continued quality improvements; team training; systemic thinking, and visible, active leadership [17]." And they note three systems that need to be addressed: (1) physical system (workflow, hardware, software, and group and team assignments), (2) support system (metrics for measuring project performance, reward structure, and management structure), and (3) value system or organizational culture and employee attitudes.

James Champy, CSC Index's chairman and chief executive, believes that 'Reengineering is contextual. It's a function of how an organization behaves, its belief systems, its position in the marketplace, the character of its people [43]." As a result, it's not possible to have a structured approach. Consultancy has been criticized to have a cookbook approach to problems, and it is clearly that every consulting firm is trying to break away from such image. Methodology should be a stimulus, not a rigid set of rules.

On the other hand, Tom Davenport, director of research at the Center for Information and Strategy, Ernst and Young, believes that "written steps play a critical role in the knowledge transfer process [44]." 'If nothing else, they give our consultants a point of

departure," claims Davenport [44]. Terry Ozan, national director of Performance Improvement Services, agrees with Davenport. Ozan believes that methodology is a good way to motivate and train the clients, making sure that they understand what are the key things that need to be accomplished. As a result, Ernst and Young has a strong reliance on method while some other competitors claim to have teams of "smart guys who can figure it all out on the fly."

Richard Ligus, President of Rockford Consulting Group, believes that the ultimate keys to reengineering are flow and time - improve agility of a company [45]. We need to tear down the physical walls that are blocking communications. Ligus advocates that each small business unit focusing by market or by product should not have more than three management layers.

It's important that we don't let technology overshadows all other essential ingredients needed in reengineering effort. Technology should be used to stimulate thoughts and help us think inductively. On the other hand, when reengineering effort is driven by the business side of the enterprise, don't fall into the common mistake of involving IT professionals too late in the process.

The three major reasons that reengineering efforts fail are (1) corporate resistance, (2) unrealistic expectations, and (3) weak corporate support [46]. Because the chances for failing at reengineering has been greater than the chances for succeeding, many organizations are scaling back which makes it even harder for reengineering to succeed. An organization should get ready for reengineering by establishing business analysis methodologies and learn from DoD's institutionalizing approach. It is very important that standardization of modeling, definition, security, forms, and many others to take place, building of a synergized business and technology infrastructure.

As have been expressed by Hammer and Champy, only a minority of people really understand reengineering [26]. People who really understand reengineering have "a bias

toward action" and have "an appetite for change." Executives have to be comfortable with ambiguity and chaos and at the same time should try to achieve tangible results in six to 12 months - this will require us to "design big and implement small." This is parallel to what George Bennett, founder of Symmetrix Inc., calls the "greenhouse" methodology [47]. "Greenhouse" methodology focuses on small vertical slices of a business process and then generalize from those slices to finish reengineering the complete process. In the process, a common vocabulary will be developed.

The common consensus is that you definitely need a "champion" with vision and resources in order to plan and orchestrate the reengineering effort. Reengineering is to remove nonvalue-adding elements and induce velocity in the process. Another key consensus is that customer unit should be involved in the reengineering process.

Hall, Rosenthal, and Wade, consultants at McKinsey & Company, identified five keys to a successful redesign [48]: (1) Set an aggressive reengineering performance target that is of sufficient breadth. (2) Commit 20% to 50% of the chief executive's time to the project. (3) Conduct a comprehensive review of customer needs, economic leverage points, and market trends. This include customer interviews and visits, competitor benchmarking, analysis of best practices, and economic modeling of the business. (4) Assign an additional senior executive to be responsible for implementation. (5) Conduct a comprehensive pilot of the new design to test the design's overall impact and the implementation process. They also pointed out the four major ways why they fail: (1) Assign average performers who lack the credibility. (2) Measure only the plan, not the process performance. (3) Settle for the status quo because of political infighting. (4) Overlook communication needs.

4.4 Which Process to Reengineer?

According to Hammer, Champy, Davenport, and Short, processes always cross organizational boundaries. This raises the following issues: (1) Are processes that don't cross organizational boundaries really processes or are they just tasks? Davenport and Short do consider them as processes, more specifically interpersonal processes. Hammer and Champy might prefer to call them tasks. (2) When we try to optimize these tasks or processes, are we 'reengineering'? Optimizing these interpersonal processes certainly do not satisfy Hammer's definition of *"radical* redesign of business *processes* to achieve *dramatic* improvements." Maybe, what this means is that we should focus primary on processes that do cross organizational boundaries and reengineer only them. This is the exact sentiment of many reengineering specialists, including Davenport. The question to be answer is then "which are the processes we should reengineer?"

Learned from the lessons by Desktop Technology Group mentioned in previous section, the processes to be focused on should be cross-functional, customer-oriented, end-to-end oriented, and value creation and delivery (See Figure 4-3). In a sense these criteria are inter-related. In order to deliver bottom-line benefit to an organization, the improvement needs to be realizable by the customers. In order for the customers to realize the improvement, we need to involve the customers throughout the reengineering effort. This also means that up-front business strategy formulation and understanding is important. End-to-end refers all key value-adding parties who contribute to the final delivery of products or services to the customers; in Figure 4-3, this includes all the cross-functional organizations, like purchasing, design, engineering, manufacturing, distribution, sales, and service, as well as the *supplier* and the *customer*. In sum, a process worths reengineering is a repeated set of activities that result in the creation and delivery of value for a customer.

Figure 4-3: An Example of a Process
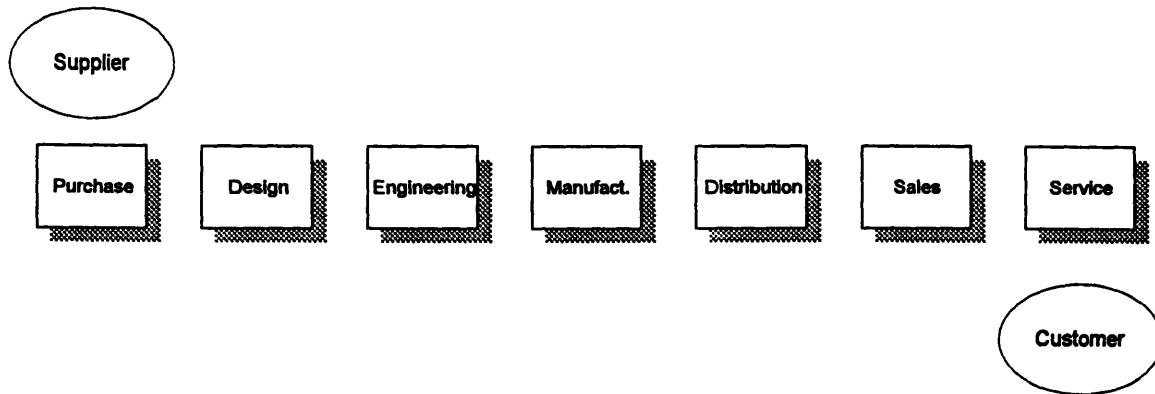
4.5 Hiring Outside Consultants

Hammer believes that it's important to have outsiders in the reengineering team because they bring objectivity and different perspective to the team. He also feel that a ratio of two or three insiders to each outsider is best [8].

An article by Cheryl Currid in *InfoWorld* claims that three major reasons that in-house reengineering teams fail are (1) an in-house team does not provide balance with required skills, (2) all in-house team could succumb to corporate consensus / politics, and (3) IS, by nature, is so methodology driven that it has trouble responding quickly enough for reengineering projects [4].

Before hiring outside consultant, a company should know what it wants to accomplish by hiring them. A strategic and process focused consulting firms might not be experienced enough to implement systems integration and change management, and vice versa. If planning and implementation are to be performed by different consulting specialty companies (or even when it's by different groups of the same consulting firm), it's important to ensure that planning and implementation are well integrated.

The "right" consulting firm for a company is one that has had varying scopes of experience in the industry that the company is in; one that has produced good results for their clients. The success of reengineering often boils down to the philosophies, talents, and skills of the company people and the outside consultants, and how they can work together in synergy.

Consultants are brought in to solve problems in a fast, cost-effective way and for the client to acquire some new knowledge. However, review should take place regularly to ensure that different issues are understood. No matter what, it is the client who knows its own organization best. It is a partnership and things need to be done together. Open communication is important and client should not be uneasy to bring out its embarrassing mistakes and problems. Mutual expectations, in term of objectives, budget, resources available, and others, need to be understood.

4.6 Reengineering is Expensive

Since reengineering often requires rebuilding of the information systems, the implementation is very labor intensive and this adds an extra layer of cost. Therefore, some companies insist that each stage of reengineering had to generate enough savings to pay for the next. Rules like this not only keep costs in line but also force reengineering participants to be detail oriented.

A survey by Gateway Information Services indicate that 65% of the respondents had no line item in their budgets to fund reengineering and 28% its CEOs expected evidence of reengineering success within six months in order to keep funding it [17]. Part of the reason is that reengineering is expensive and it takes a great deal of commitment to carry it out.

The cost of a reengineering project can be estimated by looking at several key factors. A reengineering project is process oriented in scope, has tight focus, high stakes, specific

goals, discontinuous change, top-down approach, intensive senior management commitment, and fundamental information technology enablement.

4.7 Is Reengineering Really New?

Some argue that there is really nothing new about reengineering. Management consulting has always been looking at companies holistically. So what's new about reengineering?

The closest and hottest thing that comes close to reengineering is Total Quality Management (TQM). Quality movement in the 80s has already brought us the concepts of process thinking, customers orientation, and team orientation. However, it has been ritualized that it has lost its strength, especially in the process thinking area [50].

Since TQM is driven bottom-up, meaning that it's often without senior management involvement to provide a long term vision, TQM practitioners cannot see through organizational barriers and are also unable to propose *radical* processes that can *dramatically* improve the performance of a company. TQM teams usually don't see the fragmented accountability and non value-added hand-offs across functional organizations. Because of the radical change inherent in reengineering, corporate strategy, change management, technology infrastructure, and organizational structure are issues that need to be understood.

There is not either/or decision in using BPR and TQM to solve business problems. They are there to stimulate ideas, not rigid set of rules that practitioners follow religiously. Reengineering and TQM can coexist. We should leverage their strengths and apply them accordingly. In fact, they should be implemented hand-in-hand. In Figure 4-4, we can see that a reengineering effort results in radical improvement as TQM results in continuous improvement. After an reengineering effort, it is important to continue to fine-tune the process.

Figure 4-4: Reengineering & TQM Can Go Hand-in-hand

Performance

Time
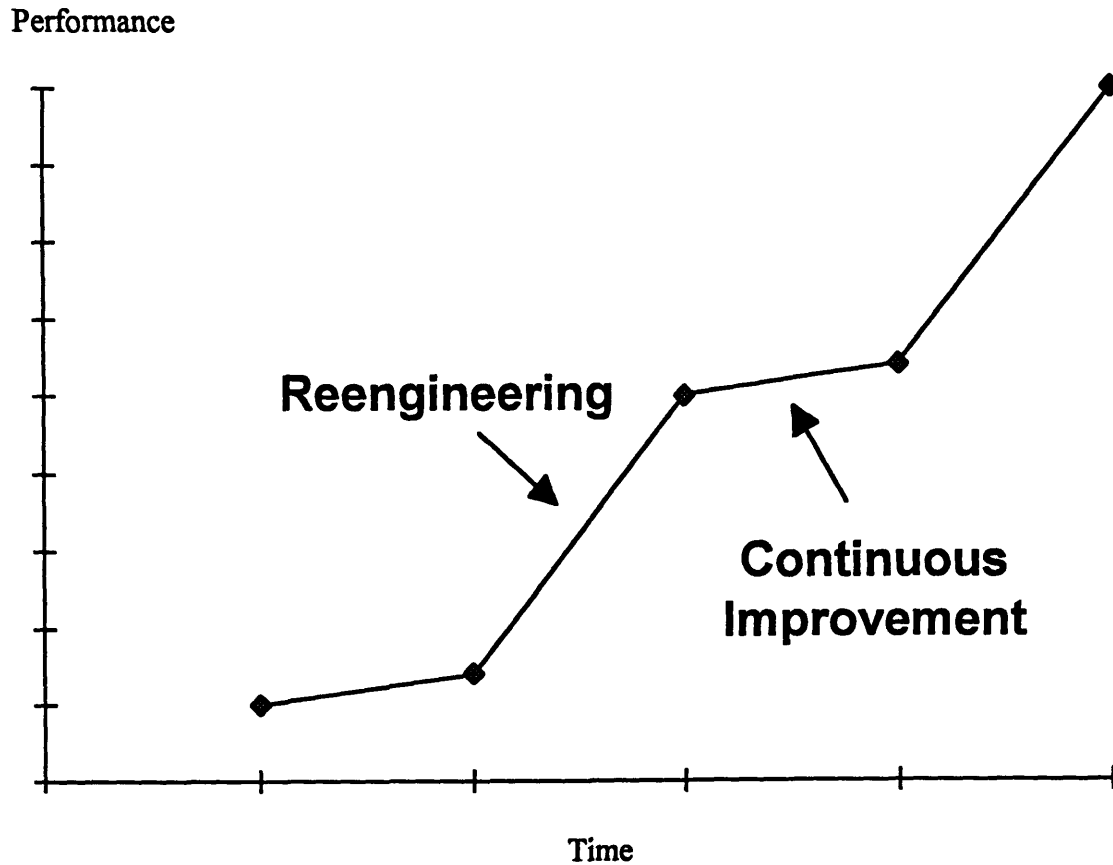
When evaluating the outcome of TQM in the past, people often conclude that TQM, properly applied, will reduce costs and increase productivity. However, the success is placed on proper execution and understanding of the concept. The same will hold true for reengineering efforts.

Experience and lessons learned from TQM should be used during reengineering efforts. By observing what has happened to many companies, like Mueller Chemical Company, and East Coast Engineering Consulting Firm during their TQM efforts, we realize that companies should not lose its sense of direction during their reengineering efforts [51].

During a crisis or organizational downsizing, it's often easy to resort to the old ways and abandon efforts like TQM and reengineering. Keith Ferrazzi believes that during restructuring to face a crisis is in fact the best time to create an *adaptable* company that embraces TQM, reengineering, and change [51]. People need to learn to regard downsizing, a type of change, as an opportunity and a challenge.

It has been found that often TQM does not deliver what it promises when practitioners focus on TQM activities themselves instead of results [52]. 'Companies' quality-improvement efforts tend to highlight the breadth of activities they are implementing, rather than the outcomes achieved," according to an article in *Training & Development* by Richard Y. Chang [52]. Similarly, result orientation is important during reengineering. Systematic deployment strategy and long-term implementation plan should be in place.

Chang further depict out common symptoms to TQM's Excessive Activity Syndrome (EAS) [52]. In a sense, many companies are trying to do too many TQM projects in a short period of time. In reengineering, selection of the right process to reengineer is even more critical since reengineering entails radical change that could result in radical disaster. A set of selection criteria should be in place. Also, we need to make reengineering become part of the company's culture, just like TQM.

4.8 Other Issues

One key disagreement among consultancy is the time it takes to see result in reengineering. McKinsey believes that its clients need to have the patience to wait for the result [35]. However, Hammer, Champy and many others think that reengineering should generate results "within six to 12 months [26]." Some, like Robert Selzer, president of Meta Software, go to the extend to say that reengineering project 'should be ready to deliver success in six to eight weeks, no matter how large the project [11]," and it has to be a success that everyone agrees is a success and then scale up the project.

I think the "six to eight weeks" (especially the part on "no matter how large the project") figure is impossible, given the fact the reengineering contains many disciplined steps and the scope of change in reengineering is high. Identifying, prioritizing, and understanding the core business processes to reengineer, this alone will likely take six to eight weeks. In fact, it took some Xerox divisions three months to identify all their processes [10]. On top of that, implementation of redesigned process and organization is always the biggest challenge. Clearly, there are many people who don't know and overlook the hard reality of implementation. It is definitely important to set performance measurements and short-term targets in order to see short-term results throughout the process, but to deliver success in such a short time is unrealistic.

I believe management leaderships is the key no matter whether it is reengineering or TQM. (However, it is arguably that management leadership is more important in reengineering than in TQM; management commitment might be sufficient for TQM to be followed through)

However, this gives rise to the question whether a pure process-oriented organization will be "smaller." A first look at the issue indicates that a pure functional organization should be smaller than a pure interfunctional process-oriented organization. This is because the number of different interfunctional processes is tremendous, and in order to take care of each special case process, a different combination of functional units is needed. The number of needed exception processes will grow with the advent of mass customization. Therefore, I question the possibility of a purely process oriented organization; most likely, tomorrow's organizations are consist of a hybrid of processes and functional organizations.

The problem with functional organizations is because of the much checks and controls that take place. However, often they are needed in order to avoid chaos. Until an

organization learns to function well in chaos (or "strive in chaos," a term used by Tom Peter), it will be much better to keep within the scope of moderate checks and controls.

Empowering the employee or liberating the employee is also becoming a prevailing concept. This is also an attempt to reduce checks and controls, passing down the decision making authority to people who are dealing with the customers. However, empowering the employee means that the employee better be prepared to take on the new challenge and acquire the needed skill sets to meet these challenge. Flattening the organizational structure in a sense is already making the CEO closer to its customers; is it really essential to fully empower one's employee?

Reengineering is the ultimate management challenge, with underlying extensive strategic, operational, organizational, and cultural transformations. It is very important that reengineering participants have a good understanding of the terms, concepts, process, and tools. An empty reengineering effort is worse than none at all. Reengineering is a continuous process, not just a program. Organizations that undergo reengineering efforts will evolve from a developmental stage to a mature stage.

Reengineering is an attempt to solve problems in speed, cost, quality, and service altogether. Many of today's organizations no longer have the luxury of solving a problem at a time.

I believe that a key to increase cycle time, reduce cost, improve quality and service is to achieve process simplification. A simple process is not only easier to perform and cost less but also produces more consistent results, hence quality. And a consistent track record is of enormous value to customers, hence bottom-line benefit to the organization.

Chapter 5

5. Methodology

Methodology adds structure to reengineering projects.

5.1 IDEF

IDEF is a document and process improvement methodology known as the ICAM (Integrated Computer and Manufacturing) Definition Methodology. It was developed by the U.S. Air Force to support its ICAM program. ICAM's mission is to help Air Force contractors increase their productivity as military products are usually composed of hundreds of subassemblies and thousands of component parts. Because IDEF was invented in the military community; it is widely used for reengineering efforts in aerospace and other military bases. In the past, IDEF has been used primary to document "as-is" processes for new contracts, instead of being used to focus on reengineering [11]. The advantage of IDEF methodology is that it not only documents inputs and outputs of a system, it also takes in controls and mechanisms.

Within the IDEF family there are IDEF0, IDEF1, IDEF1X, IDEF2, IDEF3, IDEF4, IDEF5, and IDEF6 (some are still under development). Table 5.1 gives a summary of what each IDEF's function is. In sum, IDEF has evolved from static designs and relational data model in IDEF0 and IDEF1/IDEF1X to the world of simulation and objects in IDEF2 and beyond. Simulations let people test a hypothesis, validate a design, and find out cost and benefit of the implementation. Object oriented methodology allow process and data to be combined tightly. This integration of design, analysis, and simulation of dynamic models has the potential to become the standard way of business model building in the future.

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Table 5.1: IDEFs

IDEF0	A modeling method that captures functional requirements.
IDEF1	An analysis tool to identify information in an enterprise, the rules governing its management, and the logical relationships among the information.
IDEF1X	A tool that is used to design relational data bases.
IDEF2	A graphic simulation language to translate IDEF0 models into dynamic simulations.
IDEF3	A tool that captures the behavior of objects of an enterprise through process flow descriptions and state transition diagrams.
IDEF4	A tool that adds object-oriented data modeling to enhance insufficiency of data description in relational technology.
IDEF5	A common framework for large projects by defining a repository of conceptual information, used across functional boundaries.
IDEF6	A tool that capture design knowledge, thinking, and intention in framing other models.

IDEF0 and IDEF1(x) are the most common and most mature tools. IDEF0 are usually first used to model the 'as-is" activities that serve as a baseline. The 'to-be" IDEF0 models are then constructed to reflect how things should be done. These IDEF0 models, serving to identify data requirements, then become the sources of input for the IDEF1X models. IDEF1X provides the shared information requirements of the organization. In a sense, IDEF1x is a graphical representation of business rules [53]. Business rules are rules that define and related data to each other.

In the words of a founder of ICAM and IDEF concept, Dennis Wisonsky states that IDEF are designed to (1) identify what I need to do (IDEF0), (2) identify what I need to know to do what I need to do (IDEF1), and (3) identify when I need to know what I need to know to do what I need to do (IDEF2) [34]." More specifically, IDEF0 is based on six activities per level and focuses on functional aspects; IDEF1 stresses information through its entity relationship diagrams; IDEF2 represents the dynamic of functions, information and resources.

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Figure 5-1 shows an example of an IDEF activity box or node having four sides, each side with its own specific purpose: the left side are inputs, the top are controls, the right side are outputs, and the bottom are mechanisms.

Figure 5-1: IDEF Activity Box

Adopted from Rasmus, Daniel (1988). "Redesigning the Corporation with IDEF's Help," Manufacturing Systems, December, 1988.

Used AT:	AUTHOR: Mark M. Lee	DATE: 12/ 12/93	Working	READER	DATE	CONTEXT:
	PROJECT: IDEF Example	REV: A	DRAFT			
			X RECOMMENDED			
	NOTES: 1 2 3 4 5 6 7 8 9 10		PUBLICATION			

Systems Requirements Budgets

User Requirements Schedules

Market Research → PRODUCE SOFTWARE PRODUCT A₀ → Product Plan

Product Development Team

| NODE: A - 0 | TITLE: | NUMBER: |
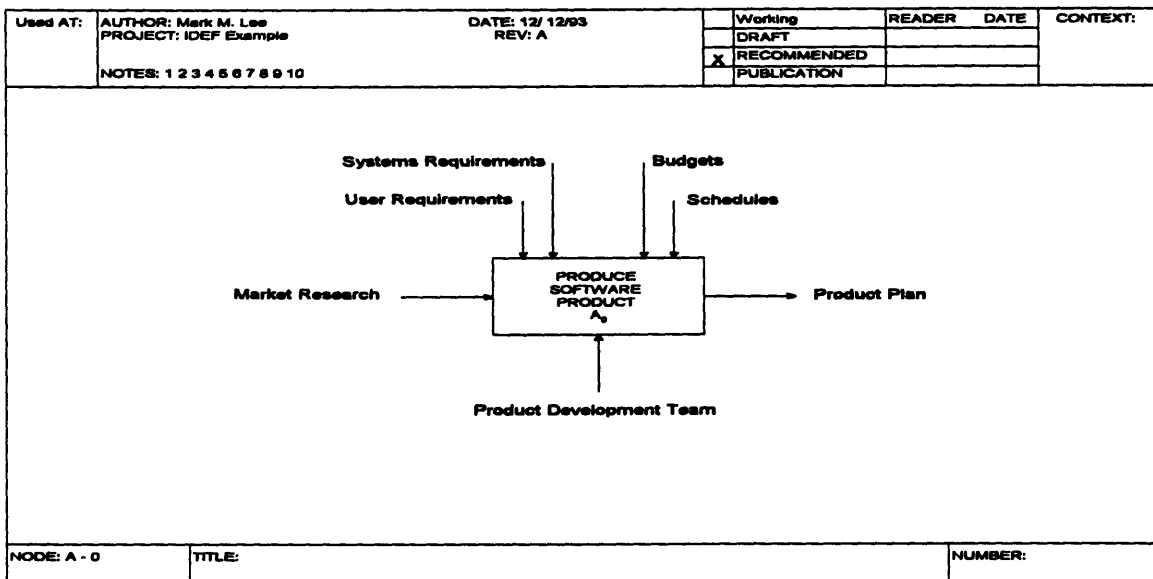
IDEF has many rigid rules that the users often don't follow, especially the constraints on pen color for comments and the rigidity of the review cycle [34]. Like any other modeling methodologies, planning is important in IDEF. To avoid creating useless organizational model, designers need to think about what they want the diagram to illustrate and which aspect of the business will be the focal point. During the IDEF project, designers need to learn to cooperate and compromise as people have different view points, and they need to pay attention to details.

5.2 Business Rule

Business rules are "the materialization of thought [54]!" If we use business rules "to supplement or confirm our models, we are, in fact, formalizing the thoughts of the enterprise [54]." As information analysis moves from structured analysis to object-oriented analysis, Terry Moriarty proposes business rule analysis as the next emerging paradigm [55]. Moriarty categorized business rules into three groups: (1) Entity - a person, place, thing, event, or concept important to an enterprise. (2) Attribute - a specific fact of interest to the business; and (3) Event - a request to perform a specific activity. Analysis methodologies has focused more and more on data over processes because data are considered to be more stable than processes.

Warren Keuffel has found that "human factors research seems to indicate that text contributes to processing accuracy, while graphics contribute speed....We must have equal access to text and graphics if we want to maximize our understanding our users' understanding of our analysis effort [56]." Defining business rules is also in an attempt to alleviate some of the deficiencies in using today's CASE tools that don't provide adequate balance in the use of diagrams and text in analyzing business information [55].

Barbara Von Halle describes a seven steps approach to analyze business rules [54] (See Table 5.2). Some of the reasons for collecting business rules include (1) validation of data and object model diagrams, (2) enablement of correct interpretation of data values, (3) representation of business policies, and (4) aid in managing and predicting business change.

Table 5.2: Practical Steps in Business Rule Analysis*

Step 1	Determine the purposes of capturing business rules. Focus on the purposes that enhance the intended use of your models.
Step 2	Determine the types of business rules you must capture to meet the intended use of your models.
Step 3	Determine the attributes to collect about your business rules.
Step 4	Determine how and where to store business rules and their attributes.
Step 5	Create a metamodel of your enterprise's objects that includes an object for business rule.
Step 6	Identify business rule reporting requirements.
Step 7	Determining Procedures for business rules validation and the business custodian/steward's role in this process.

Chapter 6

6. Modeling

During reengineering, companies are trying to develop an enterprise wide infrastructure for electronic messaging so that workflow and other applications can be built on top of this communication protocols to coordinate activities throughout a process. However, without a common process representation across organizational boundaries, these applications will have a difficult time in getting wide acceptance and utility.

Experience has indicated that process must be documented and people must be trained in the process application so that tasks are performed accordingly. The performance needs to be enforced and measured and then methodical improvement of the process will be possible.

In the past, one increasing problem was that process document is not updated as process change. As the process document is integrated with workflow application, it becomes an on-line tool to monitor and coordinate activities. At the same time, this enforces that process document be updated first so the process can be monitored and coordinated by computer systems.

'Using any model provokes the dangerous temptation to treat the model's abstractions as if they were the whirling reality - or alternatively, the temptation to dismiss the model as mere jargon... [The model should be treated] as a tool, a walking stick to help us navigate difficult terrain, rather than as an end in itself [57]."

By surveying these different disciplines, we can leverage these knowledge and tailor them to our specific needs.

Modeling process itself is beneficial to an enterprise. As people of cross-functional discipline are brought together, people gain a better understanding of how the business works and how each functional group has contributed in the value chain.

An alternative way to read this chapter is to read section 6.4 first. The ISA framework is in a sense a periodic table of process representation, and all representations found in other sections of this chapter can be considered as a segment or part or the ISA framework. For example, the software process model is actually based on the designer's perspective of the ISA framework, constitute one row of the framework.

6.1 Process Modeling

Five basic uses for process models have found to be 1) facilitate human understanding and communication, 2) support process improvement, 3) support process management, 4) automate process guidance, and 5) automate execution support (See Table 6.1); they have often been applied to 1) business process reengineering, 2) coordination technology, and 3) process-driven software development environment [57]. The usage of process model range from "comprehensibility to enactability." As a result, traditional life-cycle high level plan are too abstract to be *comprehensible* and do not provide the how-to information to be *enactable*.

Table 6.1: Process Modeling Objectives and Goals

Concept adopted from Curtis, Bill; Kellner, Marc I.; Over, Jim (1992). "Process Modeling," *Communications of the ACM*, September 1992, vol.35, no.9.*
* With minor modification to make the table related more to general process, rather than that of a software process depicted by Curtis, Kellner, and Over.

Facilitate Human Understanding and Communication
- Represent process in form understandable by humans
- Enable communication about and agreement on processes
- Formalize the process so that people can work together more effectively
- Provide sufficient information to allow an individual or team to perform the intended process.
- Form a basis for training the intended process

Support Process Improvement
- Identify all the necessary components of a process
- Reuse well-defined and effective processes on future projects
- Compare alternative processes
- Estimate the impacts of potential changes to a process without first putting them into actual practice
- Assist in the selection and incorporation of technology (e.g., tools) into a process
- Facilitate organizational learning regarding effective processes
- Support managed evolution of a process

Support Process Management
- Develop a project-specific process to accommodate the attributes of a particular project, such as its product or organizational environment
- Reason about attributes of software creation or evolution
- Support development of plans for the project (forecasting)
- Monitor, manage, and coordinate the process
- Provide a basis for process measurement, such as definition of measurement points within the context of a specific process

Automated Guidance in Performing Process
- Define an effective product or service environment
- Provide guidance, suggestions, and reference material to facilitate human performance of the intended process
- Retain reusable process representations in a repository

Automated Execution Support
- Automate portions of the process
- Support cooperative work among individuals and teams by automating the process
- Automatically collect measurement data reflecting actual experience with a process
- Enforce rules to ensure process integrity

To begin, it's important to understand the meaning of process modeling. The purpose of a model is 'to reduce the complexity of understanding or interacting with a phenomenon by eliminating the detail that does not influence its relevant behavior [57]." As a result, the model reveals what its creator perceive as important. A process is 'one or more *agents* acting in defined *roles* to enact the *process steps* that collectively accomplish the goals for which the process was designed [57]." Collectively, a process model is then defined as 'an abstract description of an actual or proposed process that represents selected process elements that are considered important to the purpose of the model and can be enacted by a human or machine [57]."

There are four major perspectives usually taken by process-modeling languages and representations: (1) Functional - tells *what.* (e.g., what's performed and what's the flow of information) (2) Behavioral tells *when* and *how.* (e.g., when and how processes are performed) (3) Organizational tells *where* and *by whom.* (4) Informational tells *informational entities*, including data, artifacts, products, and objects, *produced.* By combining all of these perspectives, we should have a 'complete" process model, hypothetically speaking. However, language constraints (text and graphics) have often bound our ability to incorporate all these perspectives in one complete process model. Therefore, it is necessary to utilize several different process representations in order to completely depict a process. It is then impossible to say which process model mentioned below is really the best, often depending on the goals and objectives of the resulting model.

6.2 Software Development Specific

Software engineers are accustomed to modeling as a result much research on process modeling has proliferated in the software engineering field. (e.g., International Software Process Workshops established in 1984). Some of the software process modeling approaches include APPL/A (programming model; building software processes as a

software application), STATEMATE (multi-paradigm, referring to the covering of multiple perspectives at the same time), GRAPPLE (plan-based / constraint-based; determine actions based on the satisfaction of their preconditions; artificial intelligence based), HFSP (functional model; utilizes mathematical functions to depict relationships among inputs and outputs), systems dynamics (quantitative model, by setting quantitative relationships among variables of interest which makes simulation of behavior possible), and others. Each of these approaches satisfies some of the four perspectives (functional, behavioral, organizational, and informational) mentioned above [57].

However, after examining these models closely, the time it takes to fully understand the concept and language is no simple task and beyond the scope of this thesis. They have lost their attractiveness to be human enactable as they cannot be easily understood. (This has often been the pitfall of the research community, focusing too much on machine enacting instead of human understanding and communication.) Part of the reason is that these models have precise execution semantics that will be necessary for computer to automate. However, human being often don't need the "granularity and precision" that these approaches provide.

On the other hand, much knowledge can be extracted from these software process modeling approaches and experience. The research has been focusing on properties of process languages. A technique is being used to integrate all four perspectives: 'a 'common denominator schema' can be defined and evolved that will contain the union of all vital process information handled by the various representation [57]." Also, the software development community have found that 'they should first focus on defining the processes used in their software business, and only then select tools and methods to support these processes. Thus, when used to integrate people, tasks, tools, and methods, a well-defined and documented software process can provide an underlying foundation for long-term productivity and quality growth [58]."

6.3 Process Maturing

I have found that Humphrey's Capability Maturity Model can help organizations to mature their processes, not necessary only in the software process arena [58]: The first stage that organizations encounters is a 'fire-fighting" mode. The organization is crisis-driven and processes are ad hoc and often chaotic. In order to move to the second stage, project management needs to get under control through 'sound project planning and tracking, management of subcontractors, controlling product baselines and changes to requirements, and assuring the quality of management processes [57]." Stage two is a sound management infrastructure where works gets done. Stage three focuses on building an organization-wide process engineering infrastructure that can be tailored to the conditions of each project. This infrastructure becomes an asset and knowledge that organization can leverage to produce high quality products and services quickly and efficiently, providing competitive advantage. In stage four, productivity measurement and quality targets are set for the product, service, and the process. During stage five, continuous process improvement, technology innovation, and defect prevention programs are guided by the measurement and targets set in stage four [57].

6.4 John A. Zachman's Information Systems Architecture (ISA)

Zachman proposes a framework to model information systems ; this framework, Information Systems Architecture (ISA), is to demonstrate how different techniques, including flowcharts, entity-relationship, tables and operations (relational databases), objects and operations (object-oriented systems) fit together [59]. In a sense, it is a "periodic table' for information entities," or I would prefer to call it a periodic table or repository for model representation. Only with a framework, we can then begin to comprehend the complexities of today's enterprise and solve the problems within it.

The ISA framework takes on the metaphor of how to construct a house. In building a house, the five important perspectives (put into 5 rows) are those of the planner/investor, the owner, the designer, the builder, and the subcontractor, each person is respectively constraint by financial/external, usage/policy, structure/operation, technology, and implementation. To reduce the complexity during design, six levels of abstractions are used (put into 6 columns): data (or entity), function (or process), network (or location), people (or role), time, and motivation (or goal). (See Figure 6-1) This six abstraction answers the questions of *what, how, where, who, when, and why*. These abstractions with exception of *why* are considered as perspectives in software modeling by Curtis, Kellner, and Over [57].

The framework does not tell us which abstraction (or column) needs to be looked at first. Often, there is inevitable tradeoffs; looking at any abstraction first, for example, the data abstraction, will force the other abstractions, for example, function and network, to compromise and become suboptimal.

It is also important to look at the connections between the variables. For example, the data column's variable is entity and the connection is relationship as the function column's variable is function and the connection is argument. Understanding how the variables interact with one another through the connections is important during design.

Since every column and every row is unique, every cell is unique as well. Programmers who are interested in application function would look use Cell B3 as the methodology. Reengineering practitioners would focus on business processes which is represented in Cell B2. Reengineering often involves the rebuilding of the organization as well as the information systems; these will entail examination of every single cell of the ISA 'periodic chart."

Examining and applying the framework to product, enterprise, information systems, and CASE tool manufacturer, Zachman observes a chain relationship between them as well as

the applied frameworks: 'the owner of the product is the customer of the enterprise; the owner of the enterprise is the customer of the information systems; the owner of information systems is the customer of the CASE tool manufacturer [59]." As a result, 'for example, Cell A2 of the enterprise framework (owner's row, data column) is a model of the product framework because in manufacturing the product, the enterprise, by definition, is producing all of the cells of the product framework [59]." Extending the concept further, 'cells of Row 2 (owner's row) of the enterprise framework are metamodels of the product framework extended as required to manage the enterprise resources [59]." (See Figure 6-2)

Figure 6-1: ISA Framework

	DATA (Entity) - Entity - Relationship	Function (Process) - Function - Argument	Network (Location) - Node - Link	People (Role) - Agent - Work	Time - Time - Cycle	Motivation (Goal) - Ends - Means
SCOPE Planner Constraints: Financial / External	List of THINGS Important to the business Entity = Class of business THING	List of PROCESSES the business performs Function = Class of business PROCESSES	List of LOCATIONS in which the business operates Node = Major business LOCATION	List of ORGANIZATIONS/ AGENTS important to the business Agent = Major ORGANIZATION UNIT	List of Events significant to the business Time = Major business EVENT	List of business GAOLS/ STRATEGY Ends / Means = Major bus. GOAL / CRITICAL SUCCESS FACTOR
ENTERPRISE MODEL Owner Constraints: Usability / Policy	E.G., "ENT/REL Diagram" Entity = Business Entity Reln = Business Constraint	E.G. "Process Flow Diagram" Function = Business Process Arg = Business Resources	E.G., "Logistics Network" Node = Business Location Link = Business Linkage	E.G., "Organization Chart" Agent = Organization Unit Work = Work Product	E.G., "Master Schedule" Time = Business Event Cycle = Business Cycle	E.G., "Business Plan" Ends = Business Objective Means = Business Strategy
SYSTEM MODEL Designer Constraints: Structure / Operation	E.G., "Data Model" Entity = Data Entity Reln = Data Relationship	E.G., "Data Flow Diagram" Function = Application Func. Arg = User View	E.G., Distrib. System Arch. Node = I/S Function Link = Line Characteristics	E.G., Human Interface Arch. Agent = Role Work = Deliverable	E.G., Processing Structure Time = System Event Cycle = Processing Cycle	E.G., Knowledge Arch. Ends = Criterion Means = Option
TECHNOLOGY MODEL Builder Constraints: Technology	E.G., Data Design Entity = Segment / Row Reln = Pointer / Key	E.G., "Structure Chart" Function = Computer Func. Arg = Control Block	E.G., System Architecture Node = Hardware / Sys. Soft. Link = line Specifications	E.G., Human / Tech. Interf. Agent = User Work = Job	E.G., Control Structure Time = Execute Cycle = Component Cycle	E.G., Knowledge Design Ends = Condition Means = Action
COMPONENTS Subcontractor Constraints: Implementation	E.G., Data Definition Description Entity = Field Reln = Address	E.G., "Program" Function = Language STMT Arg = Control Block	E.G., Netowrk Architecture Node = Address Link = Protocol	E.G., Security Architecture Agent = Identity Work = "Transaction"	E.G., Timing Definition Time = Interrupt Cycle = Machine Cycle	E.G., Knowledge Definition Ends = Subcondition Means = Setup
FUNCTIONING SYSTEM	E.G., Data	E.G.., Function	E.G., Network	E.G., Organization	E.G., Schedule	E.G., Strategy

Figure 6-2: Set of Interesting Metaframeworks*

CASE TOOL FRAMEWORK

INFORMATION SYSTEMS FRAMEWORK

ENTERPRISE FRAMEWORK

PRODUCT

PRODUCT FRAMEWORK

Conceptual graphs is the proposed language that can describe all the cells in the ISA framework. "Conceptual graphs are a system of logic designed to map to and from natural languages in as simple and direct a manner as possible," stated John Sowa, "They are based on the existential graphs by the logician Charles Sanders Peirce, the dependency grammars by the linguist Lucien Tesniere, and the semantic networks that are widely used in artificial intelligence [60]." A simple example of the conceptual graph is shown in

Figure 6-3. It means that "Every cat is on a unique mat." A more complicated one would be the following:

(∃p)(process(p) ∧ descr(p,
       (∃s1)(∃e)(∃s2)(∃t1)(∃t2)
(state (s1) ∧ event(e) ∧ state(s2) ∧
succ(s1,e) ∧ succ(e,s2) ∧
time-peried(t1) ∧ time-period(t2) ∧
time(20:23:19 GMT) ∧
dur(s1,t1) ∧ ptim(e,10:23:19 GMT) ∧
dur(s2,t2) ∧
measure(t1,15sec) ∧ measure(t2,5sec))))).

This means that "There is a process p consisting of a state s1 of duration 15 seconds, followed by an event e at time 20:23:19 GMT, followed by a state s2 of duration 5 seconds [60]."

Figure 6-3: A Conceptual Graph*

*Adopted from Zachman, John A.; Sowa, John F. (1992). "Extending And Formalizing the Framework for Information Systems Architecture," *IBM Systems Journal*, 31, No.3.

CAT : ∀ → (ON) → MAT:@UNIQUE

or in ASCII: [CAT:@every]->(ON)->[MAT:@unique]
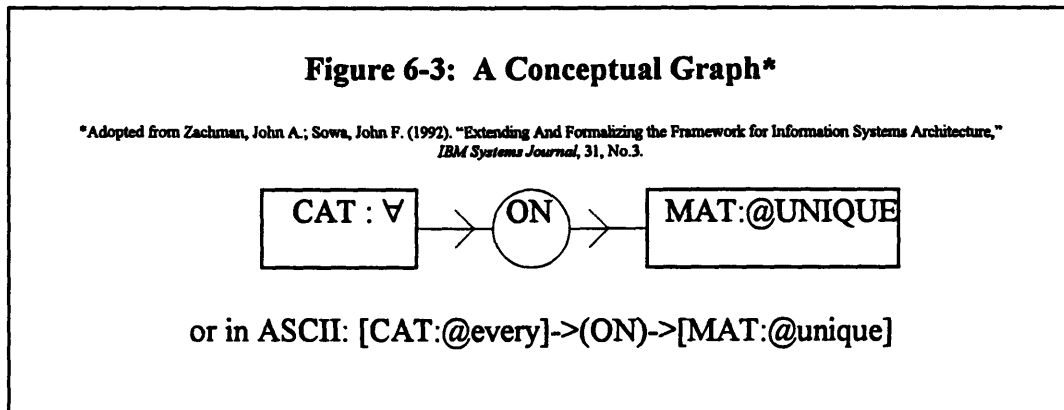
The conceptual graphs is a powerful way to describe a system. They have been chosen by the ANSI Task Group X3H4.6 as "the basis for the normative language of the IRDS conceptual schema [60]." Conceptual graphs can be used to not only describe each cell in the ISA framework, but also describe the relationships between cells. However, it would be out of the scope of this thesis to discuss the conceptual graphs and their applications in details.

6.5 Emerging Modeling Practices

6.5.1 IBM's Method to Business / Enterprise Modeling

Business / enterprise modeling has been used widely to address data and information requirements and data and information flow across processes. For example, an organization wants to have more disparate computer sites so it wants to determine whether or not distributed data processing of its applications and data would be possible [61].

Before the building of a business / enterprise model, it is necessary to understand the existing processes.

IBM organizes processes into five-tier hierarchy: (1) business functions - resources that exist to satisfy the mission, goals, and objectives of a business, (2) business systems - systems that manage each particular business function, (3) processes - support business systems, (4) subprocesses - support business systems, and (5) sub-subprocesses - support business systems. An example of seven business functions along with underlying business systems are shown below. Once the information flow is determined, future company reorganization should have minimal impact on the design [61].

A. *Production*
      Operations
      Maintenance
      Materials and Service

B. *Administration*
      Payroll
      Cashiering
      Accounts payable
      Document control

C. *Management*
      Commitments
      Quality control
      Performance

D. *Legal*
>Environment
>Licensing
>Security
>Quality assurance

E. *Personnel*

F. *Engineering*
>Modifications
>Controls
>Supplies

G. *Planning*
>Budget
>Schedule

Analyze only the processes without the data will prove to be insufficient as processes use data to produce output. Therefore, data need to be defined, qualified, and criticized. Data are defined by interviewing key corporate individuals through *data views*, which are a collection of invoices, reports, memos, conversations, computer screens, forms, and others. The data are qualified based on the following criteria: essential, copied (e.g., duplicated, rekeyed, or manually recorded), text (e.g., written, printed, or typed), computer output, graphics, drawings, microform (e.g. microfilm, slides, or photos), real time required (e.g., change rapidly and need to be kept current), and not formalized (information by telephone, word of mouth, or other informal source). Then the data are further criticized based on their quality of accessibility, clarity, accuracy, timeliness, completeness, legibility, and excessiveness / redundancy; this provides a good indication of data satisfaction and data requirements.

There has been a trend towards using computer-aided software engineering (CASE) tools for support and simulation during the building of a business/enterprise model. Based on the processes and data collected, tools are used to generate statistics reports, satisfaction index, matrix, and other reports which are essential to understand the current information system as well as to identify problems. Integrated tools are further used to simulate the

acquired information, providing valuable insights during solution formulation process. A business / enterprise model is then built upon processes, data, events, locations, and organizations.

6.5.2 Enterprise Integration Modeling

Enterprise Integration (EI) is "the task of improving the performance [in terms of efficiency, responsiveness, quality, and customization of product] of large complex processes by managing the interactions among the participants [62]." EI distinguishably concentrates on "improving the coordination among interacting organizations, individuals, and systems [62]." Since all participants of EI are to benefit from the improvement in coordination, specifically in the interaction between an enterprise with its suppliers, subcontractors, customers, and other companies, all participants should have the desire to cooperate. (See Figure 6-4) Besides acquiring perspectives from coordination theory, artificial intelligence (AI) contributes in a great extend, especially in the area of knowledge representation and knowledge sharing.

Figure 6-4: Intra- and Inter- Enterprise Integration Example
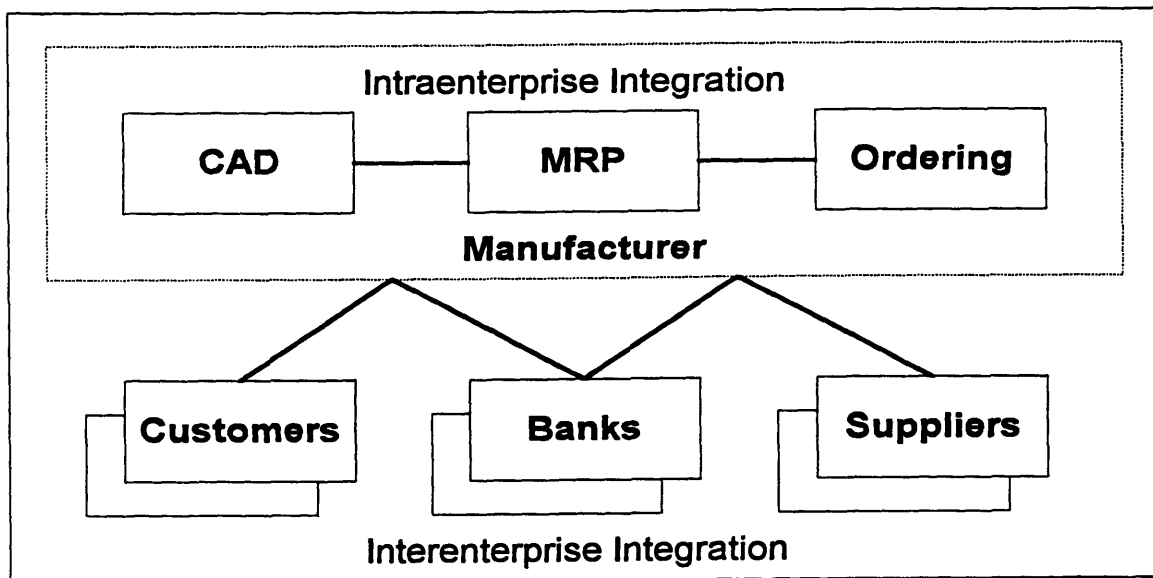
The hypothesis of the effect of EI is the creation of *virtual corporations* - "many currently huge companies may become composed of only a few hundred direct employees that 'farm out' nearly all of the companies service or manufacturing requirements to a shifting web of subcontractors and suppliers via electronic contracts and coordination mechanisms [62]."

The principle to perform enterprise (or small scale) integration is to "abstract the interactions" first, and the process of abstraction is modeling. For example, model integration should take place before application integration. Modeling is a powerful tool that filters out irrelevant details and gives us an abstraction of the reality.

A problem faced by model integrators is that two different organizations usually use different modeling tools and different syntax. Translation between them will be a challenge by itself, let alone the integration. Tenenbaum's Knowledge Interchange Format is proposed to provide a common intermediate language [63]. Another challenge is the variety of different semantics used by different organizations.

The first International Conference on Enterprise Integration Modeling Technology (ICEIMT) is the focal place that tries to consolidate frameworks in EI modeling in the US and Europe. It has divided up EI space into four domains, collectively called Integration Domain (ID): 1. Application Architecture (AA; applications), 2. Execution Environment (EE; application execution platforms), 3. Enterprise Characterization (EC; models and metamodels), and 4. Formal Mechanism (FM; a dynamic component that actively manages integration). All of these methodologies and frameworks are still maturing (some are conflicting) as it is the first international conference on the EI effort.

EI modeling takes on four distinctive perspectives: (1) might be (not formalized yet) called "traditional" *enterprise modeling* - enterprise is modeled as services, processes, applications, and others. Tools include EXPRESS, IDEF, CIMOSA, and others. (2) *Computer services* - modeling to increase access to heterogeneous computer data and services within the enterprise, instead of to change its processes and applications. Systems and tools include DAA, DCE, DME, COBRA, IRDS, CARNOT, and others. (3) *Concurrent engineering* (CE) - modeling to support distributed / simultaneous decision making in different organizations. Tools have a strong bend towards artificial intelligence and include PACT, REDUX, Galileo3 and others. (4) *Coordination* - modeling that focuses more on human factors and organizations as a whole than on computer systems. Tools include HI-TOP, UNISON, and others.

6.5.3 Winograd / Flores' Action Model

During the past 20 years, Dr. Fernando Flores has been researching in a conversational model of human actions and commitments. Flores believes that this conversational model can be apply in all domains of human behavior. The model is divided up into two categories: conversations for action and conversations for possibilities. Conversations for action is well suited for business processes modeling, according to Flores [64].

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What makes the model different is that it is based on a language / action approach, instead of the systems approach that are common in other modeling technique. The systems approach looks at human organizations in an input, process, output metaphor as well as in terms of processes and data. Understanding of users is based on creation of an abstract representation of this systems thinking. On the other hand, in the language / action approach, understanding is based on *interpretation* and people act through language.

Flores and Winograd has a different view of language. They view language interaction as a social act that is generated by the background and traditions of the people. Rather than looking at language as a carrier of information, we need to look at the acts performed through language in the conversation for action. The conversation for action is composed of assertives, directives, commissives, expressives, and declarations.

A name given to this human behavior based model is the Action model, parallel to the concept of conversation for action, and Flores started a company, named Action Technologies (ATI), that focusing on developing and deploying technology based on the model. Action model contains four phases: opening, negotiation, performance, and satisfaction (some call this assessment). (See Figure 6-5) Negotiation and commitment juggling are implicit in the way we perform our work. The model helps to capture the human interactions involved in getting work done. The condition of satisfaction is at the central of every business interaction. The model clearly depict the roles of customer and performer so that ownership is clearly defined.

Figure 6-5 show that each phase includes several possible "moves" by each partner and resulting in different "steps." This helps us to know where we are in the process easily, to measure customer satisfaction and the time it takes to complete a certain part of the process, and to detect potential bottlenecks and breakdowns.

Figure 6-5: ActionWorkflow Loop

Proposal ———————————————————————— Agreement

Customer — Conditions of Satisfaction — Performer

Satisfaction ————————————————————— Performance
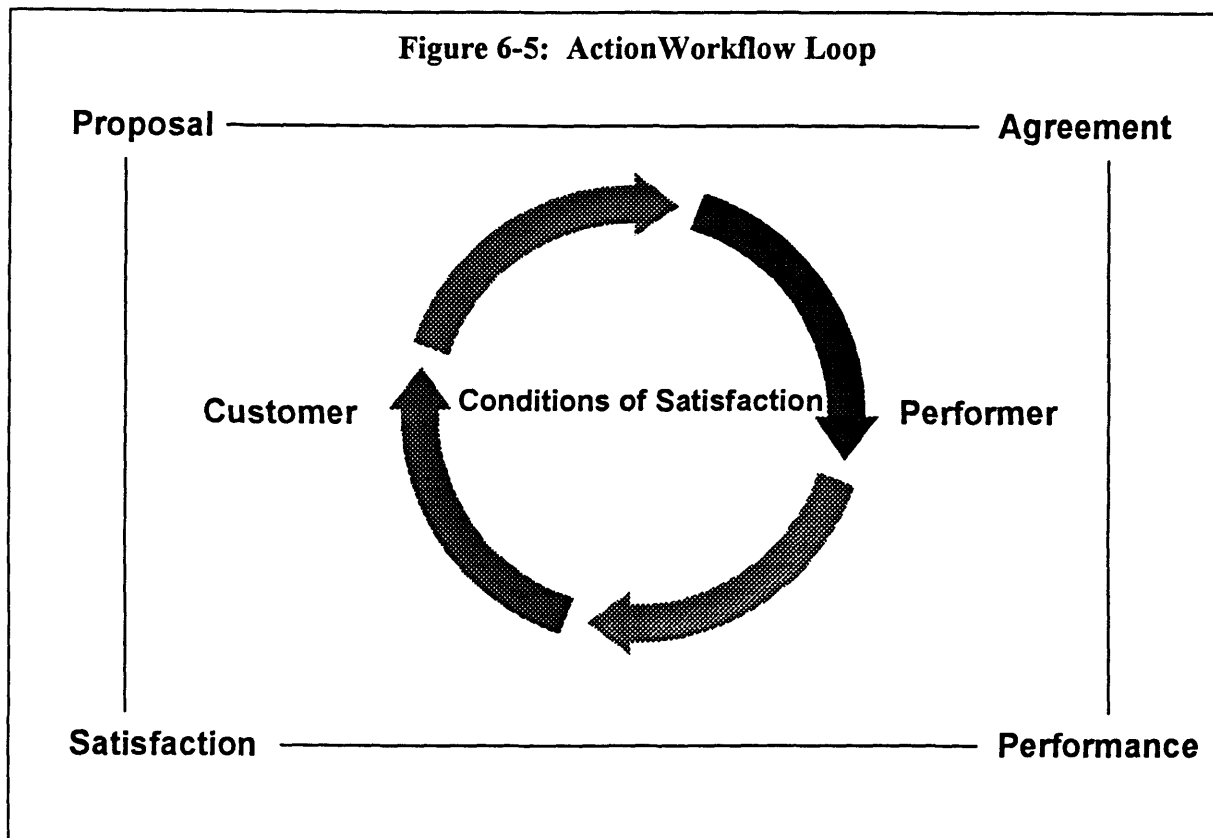
The Action model has the potential to become the de facto standard protocol for workflow applications [65]. The Action model paradigm has been embodied into a message handling system (MHS) / conversational management system (CMS). This has become widely used as the underlying protocols and infrastructure for vendors to develop applications. Some of them include IBM, Lotus (notably, the Lotus Notes), and Novell. Because Action model is well tested paradigm, it has a head start over the proposed models coming from Digital Equipment and Microsoft.

In order to gain a better understanding of how the workflow loop is applied, an example of candidate review process is shown in Figure 6-6. The benefits of having the workflow map include it "(1) notifies users about the actions that need completion, (2) provides users with the specific tools and information to complete a task, in a ready-to-hand way associated with identifying it, (3) manages reminders, alerts, follow-ups, etc. to keep

processes moving along, (4) gives users an overview of where their tasks fit into the overall processes, both dynamically and through maintaining records of workflow history and providing structured access to them, (5) gives managers an overview of the status of workflow in the organization, both on demand and through generating regular reports and measures based on workflow structure, and (6) automates standard procedures and individualized responses, on the basis of the action workflow structure [65]."

Figure 6-6: A Candidate Review Process*

*Adopted from Medina-Mora, Raul; Windograd, Terry; Flores, Rodrigo; Flores, Fernando. "The Action Workflow Approach to Workflow Management Technology," *CSCW'92 Proceedings*, November 1992.

1 Skill set & position

2 Interviewers by when + 1

3 Interview date, time, and interviewers

4 Evaluation form   5 Decision: Active file, no match, reschedule
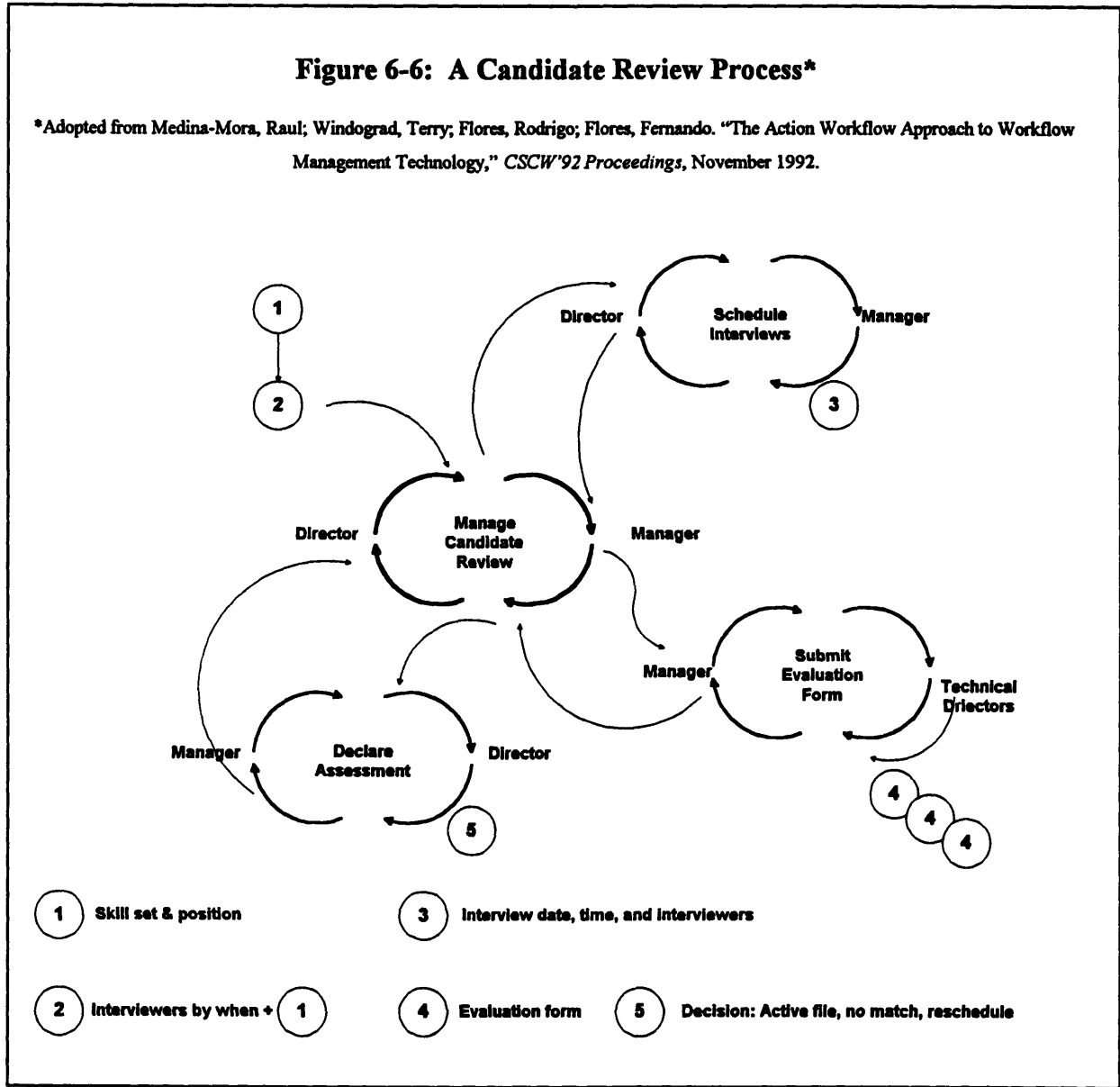
6.5.4 Andersen Consulting's ETVX

I was introduced to Andersen Consulting's ETVX paradigm while working at Giant Corporation's Desktop Technology Group [66]. ETVX stands for Entry criteria, Tasks, Validation, and eXit (See Figure 6-7). The core of each ETVX box is tasks that need to be performed. Before undertaking these tasks, some entry criteria need to be satisfied first. The tasks are not completed until the validation for accuracy and completeness of these tasks is performed. Before exiting the ETVX box, certain exit criteria need to be satisfied. ETVX ensures that a sequence to tasks are performed in proper order as the following tasks will not be performed until different criteria are satisfied.

Figure 6-7: ETVX Paradigm
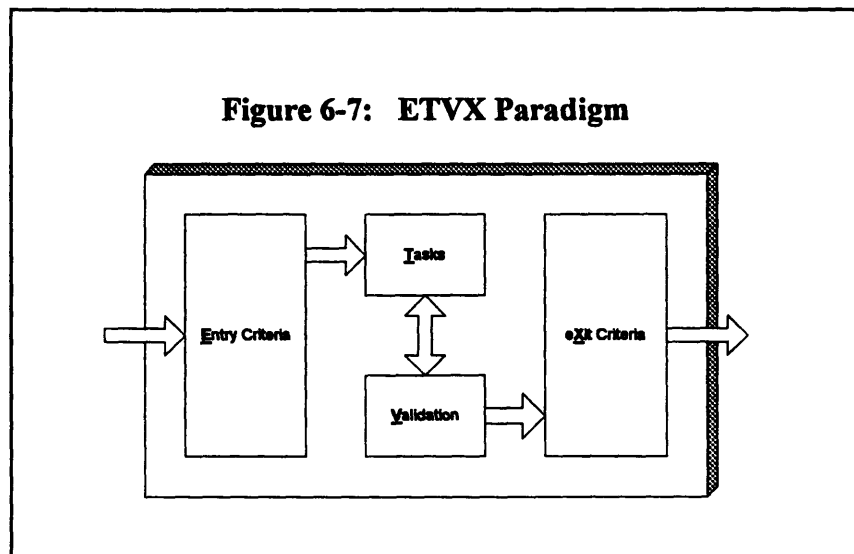
6.5.5 Organizational Workflow Model^{sm} by American Management Systems

In order to compensate the shortcomings, especially in the area of organizational design, of IDEF0 process modeling technique, the Organizational Workflow Model^{sm} is invented by American Management Systems (AMS) [67]. Organizational design issues include workflows, accountability, and authority among groups. Organizational Workflow Model^{sm} (OWM) "provides an effective mechanism for communicating the process, a platform for evaluating an organizational structure, a design tool for creating new

organizational structures to support the reengineered process, and a framework for developing implementation products [67]."

Figure 6-8 is a template of Organizational Workflow Model[sm]. At the top of the chart is a list of organizations. As the process is placed under each organization, the accountability of each process is clearly delineated. When a process is performed by more than one organization, it is placed under those organizations while surrounded by the dotted line. At the same time, putting in the time element, going from top to bottom, provides the insight to flow of information and workflow implementation. Products, that are produced by each process, and skill sets, that are needed to perform each process, are shown at the bottom of the chart; this recommends different organizational structures, either based on products or allocation of skills. In sum, OWM is helpful during many different phases of reengineering, including communication, analysis and design, and implementation.

Figure 6-8: Organizational Workflow Model Template

Concept adopted from Bjorkelo, Kenneth A.; Burk, Karen B.; Chalmers, Jennifer L.. "Integrating IDEF Modeling with Organizational Workflow Analysis," American Management Systems, Inc. Proprietary Material. Permission given by Leif Ulstrup, Senior Principal of American Management Systems, Inc.

Organizations	Org	Org	Org	Org	Org
Time	Process		Process		
			Process	Process	
		Process			
					Process
Products	≡≡≡	≡≡≡	≡≡≡	≡≡≡	≡≡≡
Skills	≡≡≡	≡≡≡	≡≡≡	≡≡≡	≡≡≡
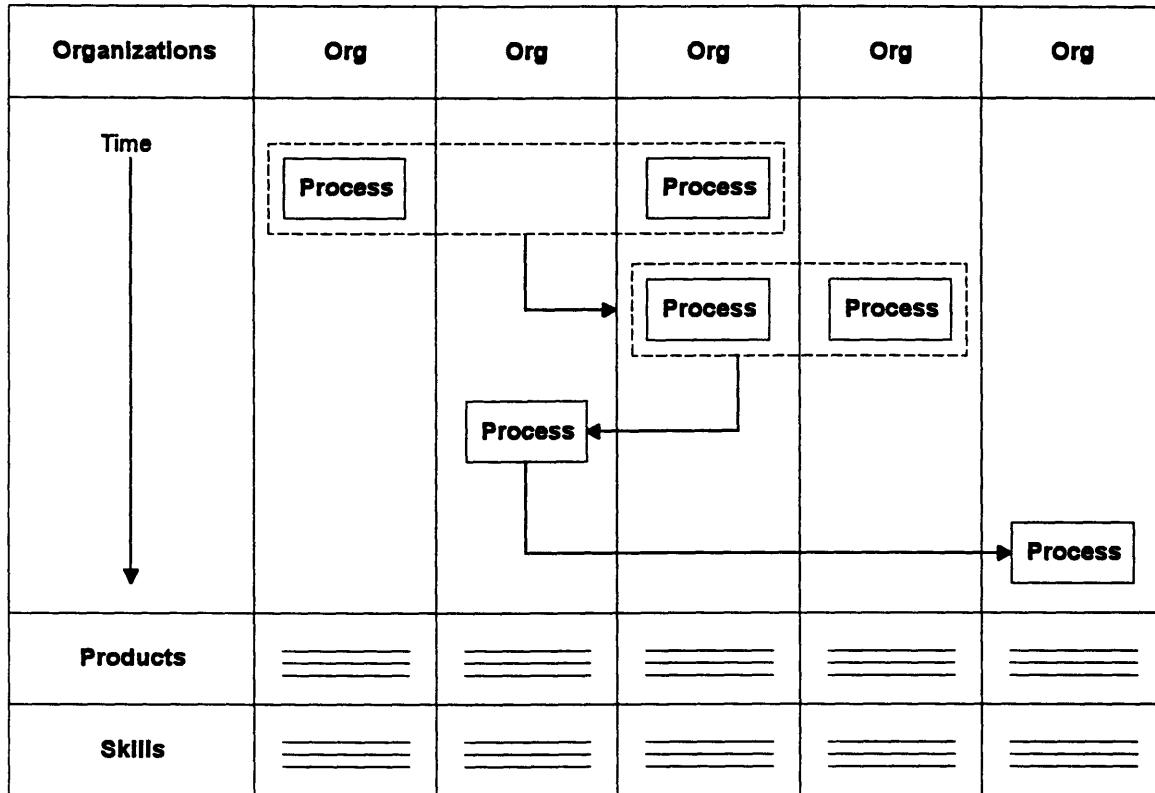
6.5.6 Data Modeling

Data Modeling is also applied to understand and document business. Chris Bird, President of Model Systems Consultants, Inc., warns that people often produce meaningless data models [68]. The relationships between entities are the most important things in modeling a business; however, the relationships are often treated as entities themselves. Only when relationships between entities are created, value to the business is created. For example, "A file of business prospects is costly to maintain, but when one of the prospects becomes a customer by an establishment of the "Buys" relationship, that value is created [68]." A

pitfall of SQL tables is that the notion of relationship disappears in favor of reference. Dr. Peter Chen's Entity-Relationship model is a better way to model business.

CASE tools are often used to manipulate models, and it is important that the results of data modeling be applied to the project level quickly in order for people to understand its value.

Chapter 7

7. Information Technology (IT)

We are moving into the information age. In fact, often it's not that we are not receiving enough information; we are inundated with too much information that important ones are not get the attention they need.

Here are some important issues that designers and implementors of IT systems need to keep in mind: (1) Most important of all, the system needs to be easy to use for the end users. Electronic mail has become popular very quickly because of its simplicity. This means that graphical user interface (GUI) should be used. (2) The system should have a development environment that is friendly to developers. The preferred development toolsets include C, C++, SQL Forms, and Visual Basic, instead of proprietary tools that takes third-party developers six months to come up to speed. Object-oriented development environment would be preferred as it enables developers to change and enhance an application quickly, and it "plug-and-play" new hardware and software technology modules rapidly. (3) Adapt open systems standards including user interface, network, communication, storage systems, databases, file formats, and others. Investment in hardware and software are not only better protected, the training, maintenance, and support costs for them are lower. (4) The system needs to be scaleable, in terms of meeting the demands due to expanding number of users and disperse geographic locations. NetBIOS, for example, is a non-scaleable transport protocols that is not well suited for a WAN environment. In order to meet the need of a enterprise workflow application that can link up the tasks into a complete process, distributed databases using ANSI standard SQL transactions would be ideal and scaleable. In sum, transport protocols, network operating systems and services, and databases are some areas that scalability is critical.

Even system house Digital Equipment Corporation concurs that the key benefit of reengineering, whether it is system reengineering or business process reengineering, "comes not from the technology per se, but from the new business process [70]." It's important to remember that technology should not be applied for technology's sake.

A question to ask is what are the driving forces that affect Information Technology Infrastructure.

Today, companies usually combine and integrate products from different vendors to build its technology infrastructure. As a result, technology evaluation is becoming more complex and involved. In order to avoid a workgroup to evaluate a technology that has already been evaluated by another workgroup in the enterprise, IT organization needs to have a central site that keeps track of all the evaluation processes. Evaluation criteria need to be set to ensure that proper benchmarking and evaluation take place.

The need to have IT professionals to build workflow tools that cross functional boundaries and build databases that capture enterprise-wide data presents a challenge and demands the IT professionals to understand the business world.

If Forrest Research's prediction on the upcoming *social computing* paradigm [71] were true, IT better be in place to build a technology infrastructure so the enterprise can take advantage of the technology effectively as soon as possible. According to Forrest Research, on-line information services will become an integral part of selling and marketing products. IT professionals (MIS) need to (1) get involved early, especially in strategic planning; (2) begin prototyping products, like email and calendaring systems, on-line bulletin boards, and others; (3) look for transitional technologies and introduce relevant technologies to employees; and (4) plan on giving PC mutants away to "cement customer loyalty, provide clear differentiation, and increase sales [71]."

In another Forrester report, it classifies the next five years as "mobile interregnum" during which mobile computers proliferate [72]. MIS needs to be ready to support these new additions as well as to manage the increase demand in network bandwidth.

IT has the capability to impact (1) the business strategically and operationally, (2) the organization and its people, and (3) organizational and human factors. Strategically, it changes the *role* of the organization. Operationally, it changes the organization's *impact* on marketplace by improving its cost, speed, quality, and service structure. IT flattens organization and empower the employees. It makes people more effective and efficient and change the way people perform their works.

John Rockart of the MIT Sloan School list out 7 IT imperatives:
- Ensure *Strategic Alignment*
- Develop effective *Line Partnerships*
- Select and implement *New Technology*
- Select and implement *New Systems Development* process
- *Reskill* the organization
- Manage hybrid (centralized/decentralized) IT organization structure
- Build appropriate *Vendor Partnerships*

Clearly today's IT organization is no longer simply a supplier (data center, network management, application construction, application maintenance, and workstation lifecyle); an IT organization needs to (1) define, design, and build for internal customers (process innovation consulting and training and company strategy support), (2) manage outsourcing, (3) decide how to and who to outsource, and (4) manage itself. By performing well on these four areas, an IT organization in effect will achieve quality, timely systems delivery and sound infrastructure, with transparent hardware and software, skilled IT people, and effective line management and users.

7.1 IT with Reengineering

To make reengineering possible, it's important to build a sound IT infrastructure and strategy. Forrester Research report expresses that "'dynamic computing'- a new model for IS that fosters and facilitates change - is needed [73]." Four initiatives suggested in order to support dynamic computing were to (1) adopt a pragmatic approach to technology, (2) accelerate investment in networking and communications, (3) develop a new mind-set on corporate data, and (4) shift to a new "Four-way" MIS management model that is consists of early outsourcers, late outsourcers, line MIS, and central MIS (See Figure 7-1).

Figure 7-1: The Division of Responsibilities In Four-Way MIS*

Adopted from Bluestein, William M.; Hill, Neal (1993). "Reengineering And MIS," Forrester Research, May, 1993.

Central MIS
Network / Communication Infrastructure
Specialized Technology Support
Standards Oversight

Line MIS | **Line MIS** | **Line MIS**
Application development
Front-end technology support

Early Outsourcers
Technology pilots
Skills transfer

Late Outsourcers
Operational systems
Maintain older technology
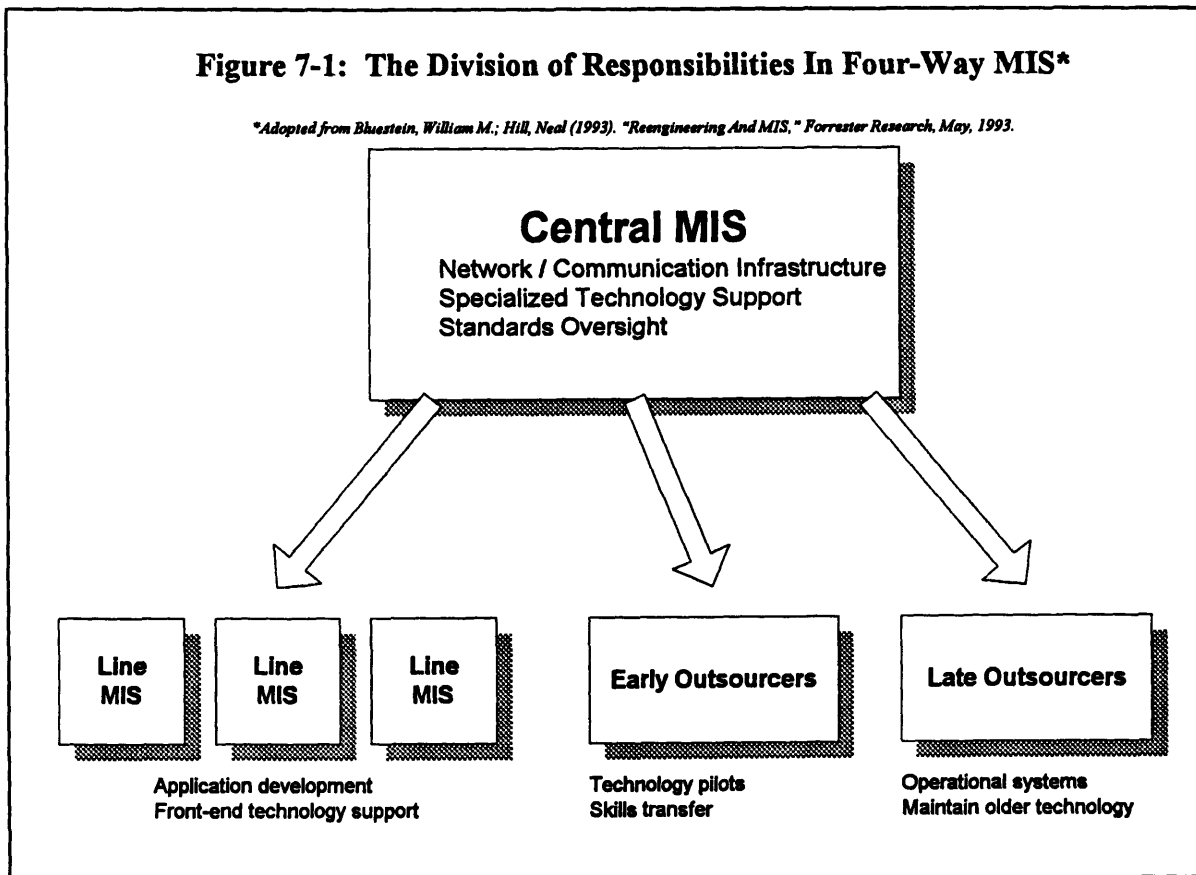
In the same Forrester Research report, 67% of the fifty surveyed companies believe that IS is part of the reengineering team, 21% feel that IS is a consultant to the reengineering team, and 12% use IS to merely implement the technology [73]. It is not made clear to me what the survey mean by IS being a consultant in the reengineering team. However, from the context of the survey, the term consultant implies to me that IS performs the facilitating function during the reengineering process and is not "part" of the reengineering team. As delineated before, IS needs to be involved in the reengineering team at all time. IS is an essential part of the reengineering team.

In the same survey, 36% of the companies found that reengineering accelerates learning and acquiring new technologies, 23% found that it helps MIS to focus on business issues, 11% found that it freezes old systems development, 11% reduces MIS staff, and 19% feel no impact on MIS. I believe all of above, except reducing MIS staff and having no impact

on MIS, are results of reengineering. Reducing MIS staff as a result of reengineering does not seem likely. The support and training infrastructure, in fact, need to be expanded in most cases. It is apparent that the 19% of the companies that feel no impact on MIS from reengineering are not really reengineering; reengineering not only has great impact on MIS but also the whole organization.

In 1992 - 1994, Forrester sees client/server as the driving force that facilitate reengineering efforts. During 1994 -1997, widespread workflow will enable complex reengineering as different information technology tools mature. Social computing will then drive radical transformation from 1996 to the year 2000.

IT needs to be used creatively or inductively. They are not merely automation tools in reengineering.

7.2   Database

Today's database is designed to implement the collection, interpretation, and presentation of information regardless of their origin and format. It is more of an "intelligent database" that is composed of traditional database technology, object orientation, hypertext/hypermedia, text retrieval system, and expert systems [74]. Database is at the central of most information technology systems because by definition, it is where all the information is accumulated, shared, and distributed.

Today, database is no longer just a repository of information / data. We not only need to let the users know that the information exist in the system, where it is, and how to locate it, but also provide understandable and trustworthy information. Navigation capability is greatly enhanced by combining unstructured document databases with content-based retrieval.

As company moves all of its knowledge and information into an 'intelligent database."
The responsibility of the systems administrator multiplies. Not only it's important to
ensure that the system is operating properly and a backup system is available to take over
during unforeseen down time, knowledge and data of high security need to be well
protected.

7.3 Client/Server

Forrester Research survey in September, 1993, states that 'sixteen of the nineteen senior
technologists interviewed say client/server architectures are critical to achieving their
vision [75]." An *InformationWeek* survey found that 97 out of 100 IS executives
surveyed are engaged in some form of client/server projects and the proportion of
client/server spending is increasing [76].

The world has been moving from mainframe technology to client/server technology; we
call this downsizing [17] (See Figure 7-2). Client /server ties up users' desktop computers
into one giant enterprise network and allow people to send, retrieve, and share
information. Some of the benefits of implementing client/server technology compare to
that of mainframe include (1) faster, easier, and cheaper application development, (2)
better communication linkage and information sharing among users, (3) cheaper to
maintain and support, and (4) more interoperable, meaning that it's an open systems
standards so there is much more flexibility to mix and match hardware and software
products.

Upsizing
quickly to hosts
3%

Upsizing
slowing to hosts
9%

Downsizing
quickly to PCs
46%

Downsizing
slowly to PCs
42%

Figure 7-2: Business Research Group Survey (100 major corporations)
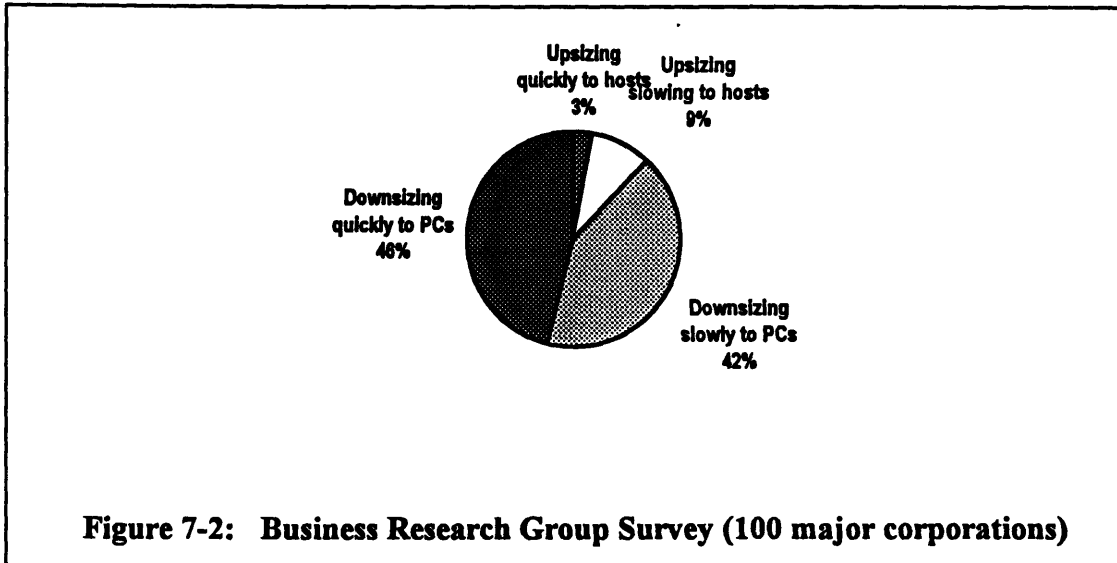
According to Digital, there are three approaches to downsizing [70]: (1) "Re-hosting"-Gain cost reductions or functional improvement by moving the existing application to a new platform. (2) "Re-architecting" - Gain ease of use, a better cost structures, and enhanced productivity by changing the application itself as well as moving to a cost-effective technology platform. (3) "Reengineering" - Gain competitive advantage and enhanced productivity by fundamentally redesigning core business processes. In a sense, these are three different degrees of approach to downsizing, resulting in different subsequent outcome: In re-hosting, users are not going to see any change; in re-architecting, users will need to change the way they use the application; and in reengineering, not only the way the users interact with the application is changed, but also the tasks themselves have been transformed.

The best migration strategy for client/server technology is one that "includes decisions about overall infrastructure, pilot projects vs. enterprise wide migration, training, product evaluation, and the system's applicability to the business mission [77]." However, some companies have found that business pressures have made it impossible for them to institute pilot projects. People are often taking the migration slowly as many IT professionals are learning as they progress. Some of the reason are that building distributed applications are

not simple (see dist. app), the IS culture is evolving, applications development tools are immature, network connections are not in place, and most importantly training developers and end users need to take place. A Forrest Research poll show that two most common problems cited were retraining IS (80%) and training end users (60%) [77].

It's important to be aware that often many IT professionals are thrown into the combat mode without proper precedent training; moreover, this combat mode inhibits them to find the time and opportunity to have the desperately needed training.

7.4   Groupware

Groupware are communications-enabled systems that allow people transfer, communicate, and share information. Some of the systems include electronic mail, imaging, conferencing, electronic meeting systems, workflow software, and databases. Major groupware products include Lotus cc:Mail, Lotus Notes, Microsoft Windows for Workgroups, Microsoft Mail, Keyfile, and others.

Some call that workflow is process oriented as groupware is people oriented. Groupware has been widely used to capture knowledge, but the success of such a system often requires a culture of sharing, besides extensive management of the bulletin board system. In fact, a research on Lotus Notes conducted by Wanda Orlikowski of the MIT Sloan School has indicated that in the absence of mental models that stressed its collaborative nature, groupware is often used as a stand-alone, personal technology [105]. Groupware technology will not work until incentive and reward systems promote collaboration and until people's cognition begin to recognize that groupware is for collaboration.

7.5   Technology Informates, not Automates

The key proponent of "technology informates, not automates" is Shoshana Zuboff, a professor at Harvard Business School. Automating makes people redundant while informating makes people even more valuable.

In an interview, Zuboff states that "with technology that informates, you start to have masses and masses of data that hold all the riches, all the opportunities to learn something about the business that never could have been learned before. The business and its various dynamics become transparent, and this transparency is the new source of wealth of the company....Informating represents the changing distribution of knowledge, authority, and power [78]."

7.6 Outsourcing IT

Despite the advancement in rapid software prototyping and development techniques, information technologists are finding a hard time to keep up with the fast pace of technological change. Development of software systems cannot be done overnight, and disappointing internal IT development results, like exceeding budget and not meeting deadlines, are ubiquitous. Competitive pressure from the industry to cut cost, and past disappointing IT results, often contribute to an organization's decision to outsource its IT.

IT outsourcing means that IT expenditure becomes a variable cost instead of a fix cost (somewhat depending on the way the contract is written). This means that outsourcing is expensive in good economic time during which an organization operates at full capacity; on the other hand, outsourcing is desirable during economic downturn. In good time, an organization earns enough to cover the expense; in bad time, the expense can be avoided. Ups and downs trends and cycles of certain businesses makes IT outsourcing more attractive to them.

Many organizations, like banks, have often regarded their IT as a back-end office, not a revenue generating center; in fact, in banking industry, IT technologists are considered "second class citizens." These back offices usually don't have enough IT people to undertake a major corporate project, but have too many people to do daily maintenance work. Because IT has not been linked with strategy (and even when IT is strategic, it is often quickly copied by competitors) and technologists often do not understand business, IT investment has delivered disappointing results. Management often simply does not have much trust in its IT and the IT people. Given this prevailing culture in many organizations, the quest for competitive advantage also served as a force leading to an organization's IT outsourcing decision.

At the very same time, outsourcing can reduce an organization's debt and increase its financial leverage. Customization and complexity of IT applications and systems mean that the redeployability of IT assets is limited. A high-debt organization can reduce its non-redeployable assets through outsourcing IT; hence, IT outsourcing could seem even more attractive.

People associate information with power. IT outsourcing does not necessary mean that the organization is giving up control of IT; however, it does mean that the organization needs to ensure that a strong partnership with external IT vendors is established. As I agreed with MIT Professor John Rockart's saying that today's organization has four key tools / assets -- people, machine, money, and IT, I feel any organization that outsource all of its IT operation is taking on a great risk (outsource some parts of IT is okay, and it is in fact wise to do so). I believe that at times it is better to make than buy; outsourcing the complete IT means that an organization has decided to give up its capacity to make. Complete outsourcing of IT could deliver promising result in the short run, but only time can tell whether a long term success is feasible when a key organizational asset is outsourced.

7.7 Managing IT Software and Systems Development

Managing development of a large-scale software product has always been a difficult challenge. Brooks feels that software development is hard to manage because of its complexity, conformity, changeability, and invisibility [111]. He believes that people have been able to solve some of the *accidents*, but not the *essence*, of software development problems through high-level programming language, time-sharing, unified programming environment, object-oriented programming, artificial intelligence/expert systems, automatic programming, and others. Software development is not only a technical problem, but also a management problem as it is difficult to conceptualize the product as well as the process to complete the project. Brooks does not think there is a hope for finding a silver bullet to solve problems in essence of software, at least not today and in the near future.

Kemerer and Sosa believes that information systems cannot deliver values and cannot be successfully implemented unless several prerequisites are satisfied [112]. Above all, technology strategy needs to be defined and be aligned to business strategy in order to solve key business problems. Many barriers in different stages of systems development, including definition, implementation, and maintenance, need to be addressed. The conception of the technological idea requires teamwork and can only survive in a conducive and appropriate environment or culture. MIS and business people need to work together in synergy to make the development possible. The software needs to have a market, and the development needs to be customer-oriented. Beyond technical issues, human issues are just as important, if not more. Complexity of the system, reliance on multiple vendors, lack of people with dual disciplines (technical and business), human resistance to change, and autonomous organizations having no desire to work together are just some of the issues to worry about in the implementation stage. In maintenance stage, people need to anticipate increases in system demand, to maintain cost function, to develop detailed plans, and to understand risk factors. Management needs to be aware of and avoid all the potential pitfalls that can prevent a system from achieving its success.

This requires extensive knowledge and experiences, and Kemerer and Sosa's risk matrix provides a good guideline to start.

As a strategic technology is copied by the competitors, the technology no longer provides strategic advantage for the organization; it becomes strategic necessities. Organizations need to continuously reinnovate themselves in order to stay ahead of its competition. This requires a management that is willing and eager to embrace change. However, change is often a difficult challenge. A strategic technological change is no longer simply a change in technological infrastructure of an organization; it needs to be accompanied by process, organizational, role, responsibility, and incentive system changes. Management of technology is a science and an art and requires the cooperative work of technical and managerial people.

7.8 IT Cases

Followings are several interesting cases of use of information technology by various organizations to help them achieve competitive advantage in their respective industries. Many lessons can be learned from their approach and experience.

7.8.1 McGraw-Hill's Electronic Database Publishing System

With the emerging concern in distribution cost, increasing popularity and availability of used books, accelerating desire of professors to have customized course material, and intensifying spread of illegal copying at photo duplication services like Kinko's, Vice President Robert Lynch of McGraw-Hill pushed for the development of *Primis* [107]. *Primis* is an electronic database publishing system which allows instructors to create a customized textbook for their course needs through selection of chapters and sections from existing textbooks, case studies, journals, and others. This innovative approach to

publishing inevitably create much changes in the organization as well as the industry as a whole.

Fortunately, McGraw-Hill has an "IS-friendly" environment where the CEO was previously the head of IS and hence, supported the development of *Primis*. Through outsourced partnerships with Kodak as the software provider and Donnelley as the manufacturing agent, McGraw-Hill was able create a lean *Primis* venture. With *Primis*, production process of the textbook is faster, perceived value by consumers increases, a strong relationship with customer is created, and to my surprise, the cost of production decreases. Mass customization gives the impression that the process will be expensive as there is less economic of scale. However, digital imaging technology has made the production of books without stopping for set-ups, eliminating the inherent benefit of economic-of-scale. In addition, one key reason Primis has succeeded is that it is a multi-publisher system; the database includes not only McGraw-Hill material but other publishers' -- Clearly, Lynch recognizes that we have electronic markets today. McGraw-Hill has a new business in licensing Primis to others. Lynch has successfully redesigned the old "assembly line" process of publishing into a process that is of quality, flexibility, integration, timeliness, diversity, service, value, and copyright integrity.

McGraw-Hill is clearly capitalizing on the competitive advantage it has created through Primis by building relationships with universities around the States. It is developing a distributed printing environment. For example, the university printing center can do the printing, instead of using Donnelley. This helps to eliminate the shipment costs as well as publishers' inventory costs. As *Primis* database continues to expand and customization through electronic publishing become widespread, authors of books need to write more modular chapters because instructors are likely to select specific chapters out of the books and out of sequence. At the same time, companies in the publishing industry are changing their roles. Donnelley, instead of being a producer of physical products, becomes a service center that prepares electronic material for book publishers. Publishers become creators and exploiters of copyrights and use all type of media for distribution of

information, including printing, on-line, film, interactive laser discs, CD-ROM, and others. Establishment of technological standards, value-adding partnerships and strategic alliances are key issues important to McGraw-Hill's future. In order to survive in the information age with the advent of information superhighway and other channels, publishers need to learn how to play the electronic service game; otherwise, they run the danger of being replaced by IBM, Microsoft, Intel, and other key vendors who know the game well.

7.8.2 Frito-Lay's Hand-Held Computers

Frito-Lay wants to move from a centralized structure to a hybrid organization that "leverages the benefits of both centralized and decentralized decision-making and control systems [108]." As time is Frito-Lay's key success factor, hand-held computers (HHCs) have been deployed to the sales force and first-line managers supervising them in order to reduce business cycles.

Information from HHCs are used to provide a set of weekly reports, the Hand-held Data Analysis (HDA) reports and the Customer Inquiry System (CIS) reports. These reports are used by the managers to track how first-line managers are doing in terms of stores serviced, the days serviced, detailed sales information on cash and charge accounts - in a sense, information systems are put ahead of the accounting systems; they are used by first-line managers to know how the salespeople are doing in terms of sales, stales, and service to customer; and they are used by salespeople to know what they do and why, base on inventory, pricing, and promotion information. Also, the sales reports have helped salespeople to build rapport with store managers. Promotions, product location changes, "rolled" products (switch products from one store to another for faster sales rate), and other strategies are deployed based on the information provided by the HHCs. As they are paid on commissions, HHCs help to find out how much people should be paid. The availability of these information has changed the way people do and manage business at different levels of the organization. However, it seems like there is no need to have a layer

of managers and a layer of first-line managers, unless there are other functions they perform that are not mentioned in the case.

The HCC information are basis for the new management control system. HHC has made managing field salespeople an explicit and real-time process. The new process includes weekly one-on-one meetings between the first-line managers and their salespeople. This new addition, I feel, is recommendable as it has made the managing process more interactive and more human. First-line managers and salespeople are now exchanging ideas, solving problems, setting goals, and developing strategies together. They are working as a team to increase their commissions.

HHCs have transferred some of the decision making and authority to the field, and at the same time the management has gain more control and understanding of the field. Given information from HCCs, salespeople are responsible for their own performance; they make decisions for increasing sales and reducing stales. One important thing is that the information have helped the salespeople to work better with the store managers. They are responsive to stales, shortage, and excess of products. They also serve to relocate products. However, the management system has been used primary to improve intrafuctional efficiency and effectiveness. The system needs to be extended to enhance interfunctional efficiency and effectiveness. Much further integration of information and processes need to be done.

7.8.3 Phillip 66's Executive Information System & Decision Rights Movement

Executive Information System (EIS) is deployed throughout Phillips 66 company in order to transfer decision rights without losing control of the overall business [109]. As the critical daily decision areas are pricing, inventory, and supply, moving the decision rights to the right location provides significant time value, especially under its debt pressure.

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Phillips 66's EIS are used throughout all layers of management, including President Wallace (who made EIS a reality), division executives, regional executives, and terminal managers. Managers are able to combine local and global information (pricing data, inventory data, and supply data) for decision-making. Points of action, reaction, and control are analyzed carefully. Pricing decisions are decentralized while inventory information have helped operating managers to reduce inventory. With EIS, managers are more responsive to customer needs and changing market conditions, and executives are able to monitor the business and detect potential problems. In addition, new managers have found the EIS helpful in educating them about the business quickly; EIS has served as an effective training tool. All of these benefits have helped Phillips 66 to increase its bottom-line profitability.

Accompanying the EIS deployment, there were role changes (from active controller to monitor and teacher), organizational restructuring (elimination of senior vice-presidents, reduction in number of division and regional vice-presidents, and others), and changes in the way people work (managers now begin their days with EISs, they hold meetings using EISs, they communicate with each other through EISs, managers have better relationship with IS people, and other process improvement). With these changes and availability of information, people are faced with increased responsibilities. Knowledge workers like to be challenged and feel important. Providing people the authority and trust to make decision is gratifying and increases work morale. An added benefits is that managers who are sick at home or just simply traveling can still be in touch the business and remote EIS.

EIS has been customized for specific needs of each executive manager. A wide range of available services are available: News, Quotes, and Highlights allows executives to have timely information, even before they appear in papers; Weekly Operating data provide critical operation information. Other information include financial data, president information, forecasts and trends, administration, file control, responsibility statements, monthly letters, and conference room meetings. Information have made the people to be more effective and efficient. EIS has become part of every manager's ability.

The experience of EIS has also created much opportunities for Phillips 66. This experience is extremely valuable (1) for future growth of Phillips 66 as there is a new breed of MIS people who understand both business and technology, (2) for the benefit of Phillips Petroleum, the parent company of 66, as the scope expands, and (3) for a potential new market as Phillips 66's EIS can now be sold as a commercial package EIS has delivered much value to both the organization and to the individuals within it.

7.8.4 USAA's IT Infrastructure

USAA has been successful in using information technology as strategic weapons because its CEO is fully behind the effort, and in fact, he is the champion who portraits the vision of "the paperless environment" in the 1970s and "USAA single company image" in the 1980s [110]. Clearly, information technology was deployed with a good understanding of the corporation's strategy and critical success factors - quality and timely service.

Before 1980's, USAA's IS department had much conflict with different business units. The CEO stepped in to resolve the conflict and established partnerships between the IS department and the business units. Long Range Systems Plan (LRSP) was in placed to ensure a systematic approach to systems development for the benefit the business units. ISD planning was put in place to build relationships with various user groups and provided a framework for ensuring mutual commitment, cooperation, trust, confidence, and respect. The IS department and the business units no longer use the terms "you" and "we," but "us." They recognized their interdependencies.

To maintain leadership in technology and sustain its competitive advantage, the IS division was committed to R&D, experimentation, and assimilation. It was also in charge of building a strong technical infrastructure to facilitate future growth. All of these activities often produce limited visible result up-front; they are long term investment. Communication infrastructure was first put in place to ensure that people understand this

IS investment approach. Constant communication was made possible with the establishment of different councils, review boards, committees, workgroups, and other coordinating mechanisms. Again, strong CEO backing was available as some of these coordinating councils were headed by the CEO. Communication had eliminated misunderstanding and fostered trust among the users and IS people.

A clear vision followed by careful planning, thorough execution (using pilot study, outsourcing to 3M, Arthur Andersen, and IBM, establishing standards, recruiting talents, redefining roles and training requirements, and others), and clear communication has helped USAA to succeed in the IT deployment and infrastructure building efforts. However, there seems to be a potential fault in USAA's IS strategy as it moves into the re-engineering world of the 1990s. The IS department aligns its services to parallel the business entities, with a vice president in charge of its own development and maintenance. This creates the danger of what Hammer calls the functional stove pipe IS deployment; as these different divisions began to develop their own systems and buy their own machines, there will be islands of information and integration will be much problem in the future (if process-orientation / re-engineering is proven to be the desired trend). It is also unclear that whether processes were redesigned first before automation and streamlining of works. It is recommended that we don't automate the past, but create the future; otherwise, it's like "paving over the cow path" or "pouring sour wine in a new bottle." Nonetheless, USAA seems to have mastered much of the challenge in IT deployment.

Chapter 8

8. Change

Some call managing change is like "fixing the engine of a car while the car is running;" some call it "putting on new athletic shoes and tie them while running in a marathon [79]." The reason for such analogy is that while making changes we need to ensure that work continues to get done.

Analysis of business processes or reengineering is only a small fraction of creating an adaptive, lean, profitable organization. Reengineering only creates excellence in operations and execution. Other needs include building a positive culture, establish strategic direction, and organizational restructuring.

Leonard A. Schlesing of the Harvard Business School states that "with the possible exceptions of death and taxes, the only thing entirely predictable is that things will change [80]."

Many people have expressed that the biggest obstacle to reengineering is resistance to change [17]. Considering that Michael Hammer has a strong technical background, getting his SB in math, SM in electrical engineering, and PH D. in computer science at MIT, he echoed his revised belief that change management is the most difficult task:

"My revised belief is that the soft stuff is the hard stuff. I used to really believe that, in organizational change, issues of structure such as human resources were fluffy and insubstantial. The only things that mattered were technology and hard design. I've increasingly learned that what I considered hard is, in fact, the easy stuff. The technology issues are the easiest to deal with and don't usually make the most difference. It took some doing for me to get over that belief [81]."

Reengineering in the end is to change the way people work. As a result, culture is important. Change will not happen just because management wills it; it's a whole new challenge that need every employee to buy in.

The rewards systems need to be changed. In the past, rewards have been tied to function rather than process or product. In addition, recognition of team effort needs to take place.

Joseph Movizzo, head of IBM Consulting Group's Business Transformation Consulting practice, says that the most in-demand aspect of the Business Transformation unit is identifying the "behavioral changes required to really transform the business [31]."

As technology transforms the way we work, skill requirement for the tasks change and significant retraining is needed. However, it's important to remember that technology can not make people change. Only uppermanagement with a good understanding of change management can succeed in it. We need to work with people so they are both able and willing to use all of the new resources that technology has brought available to them.

"You can survive the old way. You can survive the new way. It's the goddamn transition that'll kill you, " stated Agway's Bruce Ruppert, "When the once clean sheet of paper is covered with boxes, lines, and arrows, the true test of leadership begins [12]."

Business transformation inevitably produces chaos. Chaos should not be standing in the way of wanting transformation.

In order to initiate a change in culture through layers of management with as little distortion as possible, "all middle managers in that organization must be enlisted as *agents* of *change*," according to Andy Grove, the CEO of Intel Corporation [82]. Middle managers can introduce changes in their immediate environment that is smaller in scope and will happen more quickly. Upper management will need to ensure that this culture

change is happening by meeting with the middle managers and observe these changes firsthand. It is a laborious, long process.

Gemini Consulting believes that there are two major methods to deal with cultural changes that come from reengineering: (1) top-down approach - "Strategy changes are made at the executive level and filter down the organization." and (2) bottom-up approach - "stresses changes in information technology to make fast change possible [83]." Both approach do take time and there is a change gap. Steve Patterson, a VP of Gemini Consulting, claims that "we have to position clients to manage change on a long term basis."

People often don't really know how to change. In an effort to pin point problems, meetings increased in frequency and length, but the ideas generated for improvements often go nowhere. People are unable to translate ideas into action and implement the solution. This requires leadership and guidance.

Employees involvement is important during change. By involving them, they are able to more quickly get away from the distractions accompanying change. Change must be explicitly managed.

8.1 Changes In A Growing Company

Changes are especially accelerating in a growing entrepreneurial company. I am inclined to say that tomorrow's organizations need to stay nimble, flexible, and entrepreneurial in order to survive. Therefore, it is important for us to analyze the different phases of evolution of a growing company. Many lessons can be learned from the following two tables (Table 8.1 and 8.2).

Table 8.1: Larry Greiner's Five Phases of Organizational Growth.*

Category	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Management focus	Make and sell	Efficiency of operations	Expansion of Market	Consolidation of organization	Problem solving and innovation
Organization structure	Informal	Centralized and functional	Decentralized and geographic	Line-staff and product groups	Matrix of teams
Top management style	Individualistic and entrepreneurial	Directive	Delegative	Watchdog	Participative
Control system	Market results	Standards and cost centers	Reports and profit centers	Plans and investment centers	Mutual goal setting
Management reward emphasis	Ownership	Salary and merit increases	Individual bonus	Profit sharing and stock options	Team bonus

Table 8.2: Three Stages of Organizational Development

Company Characteristics	Stage I	Stage II	Stage III
The Business:			
1. Product	Single product or single line	Single product line	Multiple product lines
2. Distribution	One channel or set of channels	One set of channels	Multiple channels
3. R&D	Not institutionalized - oriented by owner-manager	Increasingly institutionalized search for product or process developments	Institutionalized search for new products as well as for improvements
4. Strategic choices	Needs of owner vs. needs of firm	Degree of integration. Market share objective. Breadth of product line.	Entry and exit from industries. Allocation of resources by industry. Rate of growth.
The Organization:			
1. Organization structure	Little or no formal structure - "one man show"	Specialization based on function	Specialization based on product / market relationship
2. Product / service transactions	Not available	Integrated pattern of transactions: A→B→C→Market	Specialization based on product / market relationship. Not integrated: A B C ↓ ↓ ↓ Market
3. Performance measurement	By personal contact and subjective criteria	Increasingly impersonal, using technical and /or cost criteria	Increasingly impersonal, using market criteria (return on investment and market share)
4. Rewards	Unsystematic and often paternalistic	Increasingly systematic with emphasis on stability and service	Increasingly systematic, with variability related to performance
5. Control System	Personal control of	Personal control of	Delegation of

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	both strategic and operating decisions	strategic decisions, with increasing delegation of operating decisions based on control by policies	product/market decisions within existing businesses, with indirect control based on analysis of "results"

8.2 The Change Masters

Rosabeth Moss Kanter defines the *Change Masters* as "those people and organizations adept at the art of anticipating the need for, and of leading, productive change [84]." As the world evolves, it has become apparent that to make a corporation successful, the people, not the system, are the most important assets because it's the people who generate new ideas to solve problems and push for changes. By fostering innovation, entrepreneur spirit, and participatory management, Kanter believes that companies can then stay ahead of changing markets and technologies. In the Change Masters series of books that Kanter has written, innovation and change go hand-in-hand.

A Change Master can be from any level in the organization as innovation can come from anyone. There are several key characteristics of Change Masters [85]: (1) They tune into the environment, both internal and external. Especially, they spend time outside of their specialties with people who are likely to challenge their thinking. (2) They have "kaleidoscope thinking," the ability to take unconnected fragments and merge them together to form a new pattern. (3) They communicate a clear vision and share idea. (4) They know how to build coalition to support and push for their ideas. This is especially true for middle management without authority. (5) They work through teams by making their idea to that of the team's and acquiring ownership from all participants. They make everyone feel involved. (6) They are persistent and persevering. "Everything looks like a failure in the middle, " stated Kanter. It's important to persistent in overcoming all

obstacles. (7) They make everyone a hero by sharing the success together. This makes the next change much easier to be accomplished.

To systematically encourage people to embrace change, Kanter says that organizations need to (1) be result oriented instead of procedure oriented; it is hard to change if people are told to follow order, (2) give broad job assignment which empowers people to carry out new ideas, (3) organize people into team with full responsibility for a product or service, and (4) build a culture of pride that values people and encourages mutual respect. Telling people that they have future and they will stretch further to achieve more. Give abundant of recognition and praise.

People need "power tools," including information, support, and resources, to help them become innovative. Information makes people knowledgeable, and effective sharing of information needs open communication. Collaboration across organizational boundaries requires support, and support encourages networking. Resources, in terms of equipment, time, and money, give people the opportunity to be innovative. A long term vision is needed to provide guidance [85].

Kanter is somewhat self-contradictory in saying that Change Master needs to be tune to the external world and be with people who are likely to challenge their thinking; and on the other hand, she believes that asking departments to challenge and criticize each other will stifle innovation. Intel believes in "constructive confrontation." It is one way to have open communication that ensure no one feels uninformed and inhibited. Kanter is afraid that encouraging this type of mutual criticism will discourage future collaboration between departments. Also, express criticism freely will instill job insecurity. However, I hope to differ. People are known to perform best in fear and anxiety. With a cultural understanding that the intention for criticism is for the common goal of making the corporation successful, "constructive confrontation" seems attractive. However, it is important to be aware of the differences between gender communication. Women focus

on relationship (rapport) as men focus on facts (report). As a result, a "constructive confrontation" environment could stifle the participation by female managers.

Also, Kantor believes that controlling and counting every detail as often as possible will stifles innovation. She believes that extra resource (time, money, and equipment) should be made available to people so innovation would be possible. It somewhat contradicts to the common belief that we should "stick to our knitting" and pay attention to the nuts and bolds. To be competitive, today's corporation needs to utilize all its resources in the most effective way and allocating such "extra" resource might severely hamper its operation. This comes down to the question that whether a corporation should really trust the mass or empower the elite to make decisions. In the past, the lower level workers have no access to information so decision making is a privilege of the elite. As information technology has made information accessible to the mass, the notion of empowerment has been cherished to an extreme. It is important to separate technology innovation from that of social and organizational innovation. Technology innovation has often come from the mass, and they have always been recognized. However, I believe that social and organizational innovation should continue to be the privilege of the elite as they are the ones who set the vision and direction and have greater access to the external environment. It is then the elite's responsibilities to ensure that their followers buy-in and operate as intended.

In order to implement the right systems that will benefit business processes, technology people now need to understand users and the business processes. It used to be that programmers could sit in their little cubical and crank out a program based on the specification given, even though it is not recommended but it was feasible. Now, it is no longer possible. Understanding of how the technology is going to enhance the business processes is very critical. Customized tools and systems integration / migration are often necessary.

We are redefining not only the processes, but also the organization, the workforce, the marketplace, and the information systems. We are empowering the employee, change the reward system to motivate employee, downsizing the workforce (no more managers and deep hierarchical structure).

8.3 Behavioral Change

David Gleicher describe behavioral change concept into a formula [79]:

$$Change = (Dissatisfaction \times Vision \times Process) > Cost\ of\ change$$

Dissatisfaction creates motivation for people to change. The ways to increase dissatisfaction include (1) using customer data to indicate the needs for performance improvement, (2) using direct but supportive, nonpunitive feedback on how the performance falls short, (3) create educational programs to broaden perspectives and teach new skills, (4) introduce them to how other people are doing things in better ways, and (5) create an exciting vision of the future state where satisfaction is greater.

Vision gives a clear view of the new, desired behavior and conditions. It needs to be "futuristic but vivid enough so the targets of change can understand and be excited about it [79]." People being dissatisfied with present state and excited about the future state want to know the process of moving from one state to the other. If they lack the knowledge on how to get to the future state, frustration increases and cynicism sets in. Hence, the importance of process.

The process of formulating the transition process is delineated by Allan Cohen as follow [79]: First, identify the stakeholders. Then determine each stakeholder's stakes, needs/desires, and resources (information, allies, funds, and supplies) in relation to the issue. In addition, understand how each of them will be affected by the change in terms of

finances, status, relationships with others, and reputation, and decide whether it is necessary to have the stakeholders' cooperation.

The next step is to prioritize the stakeholders base on how critical each is to the success of the transition. The focus is on what we have to offer in return for what we need from each stakeholder. A good transition manager understand all possible implications for all stakeholders, anticipate the stakeholders' reactions, and prepare to deal with them.

Because transition creates uncertainty which people fear, the ways to reduce the uncertainty will be to (1) show them a clear, accurate information about the transition plan, progress, and problems, and (2) increase the amount of control in the hands of the stakeholders.

Understanding of Allan Cohen's R factor also help to identify the needed behavioral changes. The "R" is made up of situation, personality, and results. Human behavior is influenced by either the situation / environment or personality. Situation Rs are roles, relationships, rewards, and rites. Personality Rs are recall, reach, reasoning, repetition, and reconciliation of self. Situation Rs are easier to deal with than personality Rs, and therefore, should be well leveraged. The results that a manager look for are employee productivity, growth/learning, satisfaction, commitment, and competitive capability.

From Gleicher's equation above, it can be interpreted that change will only take place when dissatisfaction of the present state, clear vision of future state, and the transition process altogether create a force that is greater than the cost of change. We can immediately see that to make change happen, we can either make the left side, (dissatisfaction x vision x process), bigger or make the right side, cost of change, smaller. Therefore, it will be the manager's job to ensure that he or she spend equal attention in each of the three elements - dissatisfaction, vision, and process. At the same time, by reducing uncertainty, encouraging participation, and having a temporary management

structure that ease the overload during change transition, we can reduce the cost of change.

Paradigm Shift

Kuhn, a premiere philosopher introduce the concept of paradigm in his *Structure of Scientific Revolution*. The reason that people resist change is because in everyone's mind there is a paradigm; this paradigm is a set of rule and regulation that establish boundaries within which we operate. The paradigm within us is so strong that it filters away data that do not match our expectation or distorts the data so they will fit our paradigm. As a result, we become blinded to new opportunity and lost our creativity.

Joel Arthur Barker carried the concept further and stated that when there is a paradigm shift, everyone goes back to zero; past success guarantees nothing [86]. For example, Switzerland was blinded by its past success and failed to recognize electronic quartz as the next paradigm shift in watch making. In ten years, Switzerland lost its worldwide domination of the watch making to Japan.

Barker warns us on the danger of being blinded by our past success, a paradigm paralysis disease. To better equip ourselves to anticipate, accept, and welcome change, we need to have the courage to defy the old paradigm and choose to see the world anew. What is impossible today might be tomorrow's norm [86].

This same paradigm concept is seen in Stephen Covey's *The 7 Habits of Highly Effective People* [87].

Context Creation

Similar to the concept of paradigm shift, Gross, Pascale, and Athos advocates that "to reinvent itself, an organization must first uncover its hidden context [21]." Present context that shapes our thinking and perception often blurs the vision of executives. Executives often fail to recognize the need to shift the context; instead, they found comfort in changing the little objects under an archaic context.

To "manage the present from the future [21]," Gross, Pascale, and Athos proposed that we need to (1) assemble a critical mass of key stakeholders, especially the key employees, (2) perform a organizational audit to understand the current organization's context, (3) create urgency and discuss the undiscussable, (4) harness contention as conflict generates creativity, and (5) engineer organizational breakdowns that provide opportunities to operate from the new context.

8.6 Jeanie Duck's Balancing Change

Managing change is difficult, "it's like the company is undergoing five medical procedures at the same time. One person's in charge of the root-canal job, someone else is setting the broken foot, another person is working on the displaced shoulder, and still another is getting rid of the gallstone. Each operation is a success, but the patient dies of shock [88]."

The key concept in managing change that Jeanie Duck stresses is that we are managing the dynamic of change, not the pieces. From Taylorism, we break change into small manageable pieces and then try to resolve each piece in isolation, and this is the wrong approach. The right approach is to connect and balance all the pieces. "In managing change, the critical task is understanding how pieces balance off one another, how changing one element changes the rest, how sequencing and pace affect the whole structure [88]."

Like most change management experts, Duck believes that Transition Management Team (TMT) is the key to have a successful corporate change effort and provide the needed balance to the pieces of change. TMT is composed of company leaders who report directly to the CEO. They need to be talented and credible individuals. The eight responsibilities of TMT are to (1) establish context for change and provide guidance, (2) stimulate conversation, (3) provide appropriate resources, (4) Coordinate and align projects, (5) ensure congruence of messages, activities, policies, and behaviors, (6) provide opportunities for joint creation, (7) anticipate, identify, and address people problems, and finally (8) prepare the critical mass so replication and scale-up would be possible. The team members commit all their time and energy to the change effort and the team will only disband when the change process is stabilized.

Because of past failure in different managerial programs, most people in today's organization are cynical as well as skeptical about any managerial programs, especially a program that entails radical change. The first change in behavior should begin with that of the top executives. By changing their own behaviors, the executives send a clear message of commitment in change to their employees.

It is through values that organizations connect with their people. Underneath the values are feelings and emotions. By understanding the values of the employees, the behavior of these individuals become predictable. By addressing their feelings and emotions, we can then change their values, resulting in the change in behavior we desire.

Trust becomes an issue during change because on one hand, employees are encouraged and empowered to take on responsibility and on the other hand, they are not guaranteed with job security. The trust can be enhanced if executives can give direction and rules that provide *predictability* and identify needed *capabilities* to accomplish the tasks at hands [88].

"Managing change means managing the conversation between the people leading the change effort and those who are expected to implement the new strategies, managing the organizational context in which change can occur, and managing the emotional connections that are essential for any transformation [88]."

8.7 Self-examination

Roger Martin, a director of Monitor Company, believes that the key to a successful change process is self-examination [89]. Instead of blaming and finger pointing, company should look at what it did right. It will be much easier to achieve change in an atmosphere of positive reminiscence. In self-examination, managers need to distinguish the difference and recognize the conflict between the strategy *espoused* and strategy *enacted*. Strategy espoused is the vision and the steering mechanisms of the organization. Strategy enacted is the actual behavior with customers and competitors.

8.8 Empowerment

Empowerment has become a prevailing concept. Today's organizations need to discover ways to tap the creativity and initiative inherent in employees. "Traditional organizations needed employees to just do their jobs without asking questions; today's workplace calls for employees to make decisions, find and implement solutions, take initiative and be accountable for results [102]." At Giant Corporation, employee empowerment or involvement refers to employees being chartered to make important decisions and participate in key business decisions. Empowerment is based on the principle that employees know their job best [103].

Rosabetth Moss Kanter, editor of *Harvard Business Review*, describes four principles of empowerment: (1) Give people important work to do on critical issues. (2) Give people

discretion and autonomy over their tasks and resources. (3) Give visibility to others and provide recognition for their efforts. (4) Build relationships for others, connecting them with powerful people, and finding them sponsors and mentors [102].

Duck forewarns that empowerment, however, does not mean abandonment [88]. It is useless to empower someone who is either unprepared, unwilling, or incapable to take on the responsibility. The person needs to feel strong, capable, and committed. It all begins by understanding what the employees do and finding out what they do not know. An ongoing dialogue is essential to make empowerment provide benefits. When people feel empowered, they are more likely to use their energies to achieve and generate unprecedented results.

For large corporations to survive, Bob Palmer, CEO of DEC, believes that decentralization to empower employees to become agile in smaller units is the solution [90].

8.9 Chaos

Because of rapid change, it does not seem like we will ever reach a static state of perfection. In fact, we live a dynamic state of permanent chaos.

When Gross, Pascale, and Athos mentioned about the need to engineer organizational breakdowns [21], they recognize the need to create intentional chaos. In order to reinvent an organization, carefully designed breakdowns help to achieve a shift in paradigm.

Edward McCracken, the CEO of Silicon Graphics, Inc., believes that "the key to achieve competitive advantage isn't reacting to chaos; it's producing that chaos. And the key to being a chaos producer is being an innovation leader [20]."

8.10 Change in Data Accountability

Accountability of data accuracy, completeness, and timeliness are becoming more and more critical as we move into the Information Age. Larry P. English advocates the need for *data stewardship* in information / data resource management [92]. A data steward is a custodian or coordinator who manages data for someone else. Three different types data stewards are knowledge workers, operational data stewards, and tactical data stewards. Data are used by knowledge workers to perform tasks. Since these "knowledge workers can do their jobs only as effectively as the quality of their data [92]," they depend on the producers of the data to provide accurate, complete, and timely data. The producers of data are the operational data stewards who "capture or create data in the process of carrying out their business functions [92]." The operation data stewards in terms depend on the tactical data steward to provide clear and precise definition and data meaning for the enterprise. "The tactical data steward is accountable for this 'metadata' integrity; that is, the quality of the data definition for clear communications and understanding throughout the enterprise [92]." Table 8.3 shows the functions of the data stewards as well as their counterparts in information systems.

Table 8.3: Data Stewardship Business And Information Systems Roles

Business	Information Systems
◊ Knowledge Worker (Data Consumer) • Requires data to perform business functions • Accountable for integrity of data usage	◊ Applications Developer • Builds applications to support the business functions • Accountable for integrity of application functions
◊ Operational Data Steward (Data Producer) • Creates data in the performance of job functions • Accountable for integrity of data created	◊ Database Administrator • Builds production databases • Accountable for integrity of the physical data structures
◊ Tactical Data Steward (Data Definer) • Defines the data requirements for carrying out the mission of the enterprise • Accountable for the integrity of data definition	◊ Data Administrator • Creates enterprise data models • Accountable for integrity of the enterprise data model

Data definers (tactical data stewards) of the enterprise needs to be given authority as well as have enterprise wide data knowledge to work together as a council to establish standards, policies, and definitions. Data producers (operational data stewards) are managers in the enterprise as they create and maintain data when carrying out their tasks. Since they are the people who are closest to the point of data origin, they are able to provide the highest degree of data quality [92]. The managers need to understand the importance of the quality of the data they provide.

Today's data are captured from the enterprise perspective, owned by the enterprise, and shared by individual departments and individuals. As a result, the data stewards are held accountable not to functional data but to enterprise-wide data. This needs the creation of a rewards system that accolade and motivate people to deliver quality enterprise data. The organization needs to *entrust* data stewards with data on which others depend; this

eliminates redundancy of data as people are willing to trust data provided by others instead of creating their own. As data are business resources, managers, the operational data stewards or data producers, need to make accountability for data part of their job descriptions [92]. In sum, with data stewardship in place, we improve the quality of data, reduce data redundancy, and increase data sharability. All of these are essential to an Information-Age enterprise.

8.11 Changes Associated with Reengineering

We have so far discussed many change issues, especially on how to change, but what are the changes that take place as a result of reengineering?

Here are several key changes: (1) Jobs are reintegrated and the number of handoffs have disappear; this means that tasks have become multi-dimensional, and past sequential works are performed in parallel. At the same time, these multi-dimensional works require employees to learn new skills. (2) Workers become responsible for the process and are empowered to perform; their role is changing. In order for these workers to take on new responsibility, the incentive and reward system needs to change. (3) Information technology replaces control bureaucracies and geography constraint disappears. The middle-management layer gets thinner and the organization is flatter. (4) Finally, there is the formulation of interfunctional process teams.

As we can see from the list of different changes listed above, reengineering is about a fundamental rethinking of the way we work and radical change is often the result. John Rockart of MIT Sloan School has proposed the following model shown in Figure 8-1 to depict all the major changes that need to take place when we induced a technological change, like reengineering which leverages information technology to induce changes. The model is called a balancing act because it implies that we cannot change one element (strategy, role, process, structure, or information technology) without changing the other

elements. If we only change one element, we will lose our balance; we need to take all five elements into consideration during reengineering. In addition, the model calls for the integration of strategy and information technology. What has been adjusted by John Rockart to the original Leavitt's Balancing Act is the process element. As reengineering becomes the new, prevailing concept, Rockart puts process into the center of the balancing act.

Figure 8-1: A Balanced Change in Reengineering

Leavitt's Balancing Act (Adjusted by John Rockart)

Organization Structure & Culture

Strategy

Processes

Technology

Roles
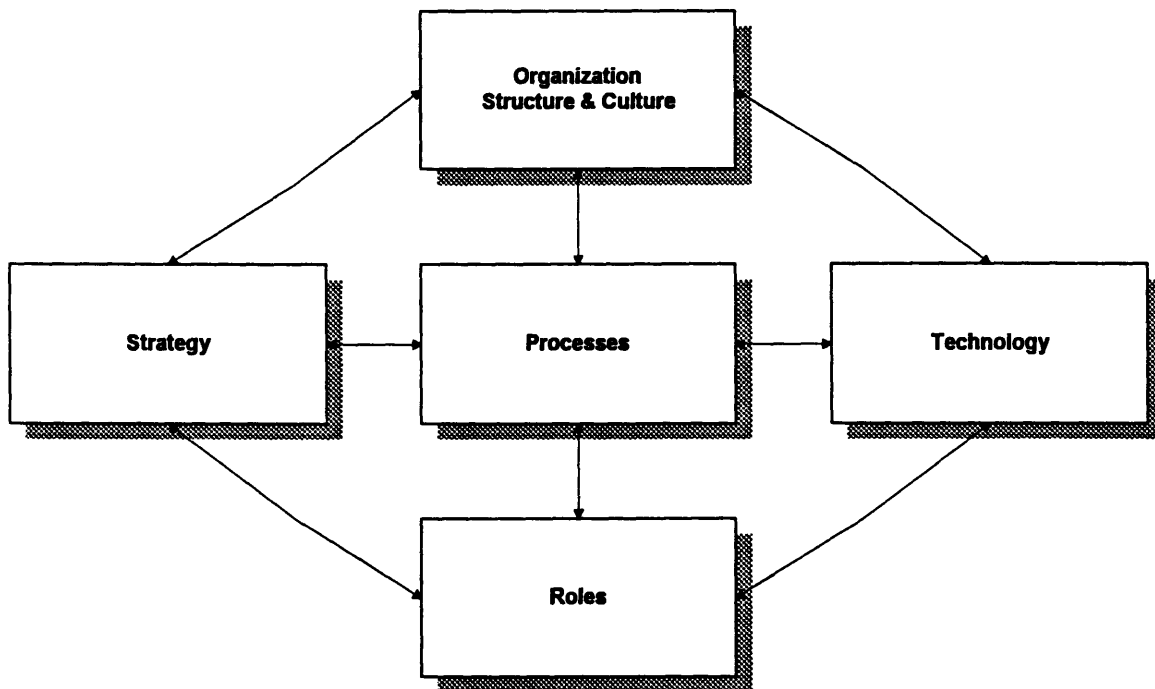
Chapter 9

9. Other Key Issues

9.1 Strategy Alignment

A company need to have a vision and a clear strategic direction. Reengineering is one of the many tools that can help a company to achieve the goals arising from its vision.

Total Quality Management (TQM) focuses on quality of the product and customer orientation; we want to make sure *what* we are producing is of high quality. Reengineering has its proclivity in business processes; the emphasis is *how* we get the work done; in fact, it encourages organizations to *start over* or *start again* from a white sheet of paper. Strategy alignment ensures that we truly know *why* we are doing what we are doing and it is indeed what we want to do as corporate objectives and goals would be satisfied.

A framework for strategy formulation that's been widely accepted contain the following elements: "(1) the *task*, including the environment and concept of the business, its definition, mission, competitive position, and functional goals and efforts; (2) available *resources* including leadership, human, financial, technological, customer franchise, stakeholder relationships, and working environment; and (3) the *structure* including organization, controls, systems, standards, rewards, policies, processes, and values [69]."

9.2 Vision

Bob Palmer, CEO of DEC, believes that "vision doesn't come from a single individual in a complex organization of this type [like DEC]...chief executive prefers to get the input

from all the leaders of the company, and from many people lower down in the organization [90].

"A manager who lacks integrity, fairness, or a sense of commitment quickly creates confusion and cynicism in the organization [80]."

As depicted in the change management section, having a vision or a sense of the future is one of the key element. Without a vision, people do not know where they are going, feel lost, and do not have a sense of direction. A vision is like a magnet that attracts us to move towards it. Peter Senge calls the gap between current state and the vision a natural tension [113]. The vision of what might be provides the natural energy for changing reality. Without the vision, there is no natural tension. On the other hand, without a good understanding of current state or reality, cynicism will foster.

9.3 Culture

Leonard Schlesinger believes that managers can change the work environment by establishing (1) goals and performance standards, (2) values for the organizations, and (3) business and people concepts that are consistent with their goals and values [80].

Culture is the "unspoken assumptions about proper behavior...reflects a combination of the organization's founders(s), current leadership, key crises and events in the history, size, and particular industry of the organization [79]."

A pre-publication work by Peter Senge talks about three key areas of cultural dysfunction [115]. These cultural problems that form our current business paradigm are fragmentation, competition, and reactiveness. The article is a call for deep reflection and testing. As organizational challenge has become systemic, we should stop fragmenting

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problems into pieces. Linear thinking should gives way to integrated thinking. This is exactly parallel to the integrated thinking concept behind reengineering.

Competition has made us lost our desire and ability to cooperate. "The development of a new culture may be more like gardening than a military campaign; the process of developing leaders may be more like parenting than competing [115]." Our overemphasis on competition has made us focus primary on short-term measurable results and go for quick-fixes. At the same time, real learning is about "aspiration, imagination, and experimentation [115]," instead of reaction to outside forces. Most people are willing to change only in times of crisis; however, crises produce changes but little learning.

Senge eloquently states that "we are so focused on our security that we don't see the price we pay: living in bureaucratic organizations where the wonder and joy of learning have no place. Thus we are losing the spaces to dance with ever-changing patterns of life. We are losing ourselves as fields of dreams [115]." To build learning organizations, the culture needs to shift.

9.4 Human Resources Issues

In today's organization that is composed of knowledge workers, human resource management is increasingly important. Employees are the most important resource of an organization.

According to Abraham Maslow, people have physiological and psychological needs: Physiological needs are oxygen, water, food, rest, constant body temperature, and reproduction; Psychological needs include security / self-control, social relationships, self-esteem, status / recognition, achievement / challenge, power, creativity, and self-actualization.

Once the business processes are redesigned, employees need to have the incentive to use these new processes. Compensation and evaluation systems need to be in place to create the incentive for them to perform.

9.5 Organizational Structure

How do you manage a process oriented, instead of function oriented, company?
As process are crossing functional boundaries, it means that the CIO needs to think beyond technology as the CFO needs to think beyond numbers and budgets.

Bureaucracy has been thought as the sum of non-value adding activities and must be eliminating. Some social scientists call these large, bureaucratic, nonadaptive organizations *bureaucratic dry rot* [80]. These organizations are "insensitive to employees' needs, ignore consumers' desires, and refuse to accept their social responsibilities [80]."

Management guru Peter Drucker feels that the best example of a large and successful information-based organization has no middle management at all [116]. An example he gave was the British civil administration in India; its organization structure was totally flat. The success factor of this system is that "it was designed to ensure that each of its members had the information he needed to do his job [116]." As middle management is sharply cut in this new breed of organizations, top executives will have to come by hiring people away from smaller companies; the management process that includes preparation, testing, and succession will become even more problematic. Tomorrow's information-based organization will be an organization of knowledge specialists.

To analyze a company, it's important to see it holistically. Envision all its parts and how the parts interact with one another. Without a holistic view of a company, we run the danger of focusing on treating symptoms rather than curing diseases.

James O. McKinsey, the prominent management consultant, believes that there are twelve requisites for good organizational structure [93]:

1. "In every organization there should be centralized control. This means the organization as a whole as well as each division of the organization should have an executive head who has final authority over the activities under his jurisdiction [94]."

2. "Good organization necessitates that definite responsibility be fixed for making all decisions which can be anticipated, ... not only should responsibility be fixed for the making of decisions but equally responsibility should be fixed for their enforcement [93]."

3. "Final responsibility for executing decisions should be placed in an individual and not in a group [93]. "

4. "A proper procedure for handling unusual problems should be established [93]."

5. Authority should accompany responsibility [93]." For example, a branch manager who is held responsible for his unit must be given formal authority over those who assist him.

6. "The number of subordinate executives reporting to each executive should be limited. The president or chief executive should usually have not more than five or six executives reporting to him [93]."

7. "Provision for specialization should be made." Specialization promotes efficiency and hence should be encouraged. At the same time it tends to divide the organization and complicate problems of coordination. McKinsey suggested using committees and budgetary control to help ensure coordination [93].

8. "A system of promotion should be provided from within. Such a system will help motivate individuals by ensuring that efficient performance is rewarded [93]."

9. "Organizational structure represents a balance between the organization as an abstraction and the abilities and limitations of individuals. The structure should reflect the interests and capacities of the individuals who are members of the organization [93]." "Usually it is not possible to set up an ideal organization and then secure the men needed to fill the various positions in the organization [95]."

10. "Line control should be distinguished from functional control: 'Generally speaking, an executive has line control over activities when he is responsible for the performance of these activities, and he has functional control over the activities when he is responsible for prescribing the method by which these activities are performed or has the authority of approving the method by which they are performed....The authority of the personnel manager and of the controller is largely functional.' Furthermore, line authority should be distinguished from staff authority: 'A staff man is one who exercises no authority to prescribe how activities are to be performed. He is simply one who studies, carries on research, analyzes problems and presents the results of his studies with his recommendations, to a line man who may or may not accept these recommendations [93].'"

11. "In most instances, an organization chart should be drawn up. In the process, all the activities that need to be performed will be ascertained and classified on some logical basis. 'An organization chart is merely an administrative device which enables an executive to see the men who are responsible for performing the activities of the company [93].'"

12. "Maintaining an organization chart is a continuing process. Conditions change and the formal structure of the organization should reflect such changes. Moreover, 'there is no one kind of organization chart that is right.... Every business has to work out its own organization in terms of its particular problems and personnel [93].'"

Clearly, McKinsey believes that an organization need to be dynamic, continuously tailored to the changing environment. He already recognizes the problem of coordination and integration when the organizational structure is division of labor and specialization (See requisites #7 above). McKinsey believes that top management needs to "develop a mental set for viewing a firm and approach each business setting with a framework and reference point for gathering and interpreting data [93]."

The danger in having a matrix organization is that accountability is difficult to pin point. Bob Palmer, the CEO of Digital Equipment Corporation, stated that "We have a highly matrix company, we do business in 100 countries and we have many overlaps in a

company this complex. But we had such a confusion of business units and responsibilities it was very difficult to know who was really responsible to accomplish a given task or even what the task was [90]."

Some people say that organizational structure has been changing from hierarchical model, to matrix model, and to networked model.

9.5.1 Management

McKinsey's believes management process involves organizing, directing, and controlling [93]. Organizing is a process of planning and establishment of different major policies. Organizing as a process implies directing; directing is to deal with the formal structure of the organization and to decide and communicate how the policies will be performed. Controlling is to ensure that the organized and directed policies are performed accordingly. Figure 9.1 shows a three dimensional framework which McKinsey uses to analyze management.

Figure 9-1: McKinsey's Analytical Framework for Understanding Management

Adopted from Wolf, William B. (1978). *Management And Consulting: An Introduction to James O. McKinsey.* ILR Publications, Ithaca, New York.

FUNCTIONAL AREAS OF MANAGEMENT

```
                    Marketing
                   Purchasing
                     Traffic
  Major Policies     Production
  and Goals**        Personnel
                     Finance
                   Standards and Records*

   External          O        D        C
  Environment        R        I        O
                     G        R        N
   Internal          A        E        T
  Environment        N        C        R
                     I        T        O
  DETERMINING        Z        I        L
  FORCES             I        N        L
                     N        G        I
                     G                 N
                                       G
```

MANAGERIAL PROCESSES
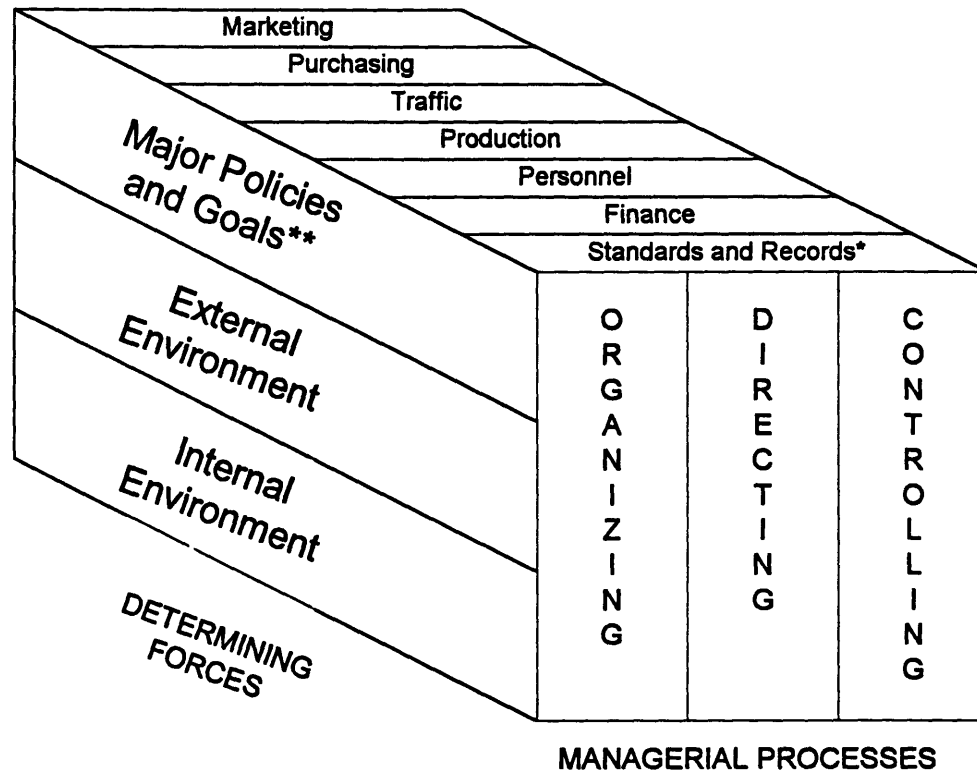
*In his early writings, McKinsey treated standards and records as a functional area of management. In later years he treated these as a managerial process of controlling.

**McKinsey's discussion of policies can be confusing. He was not consistent in differentiating major polices, such as products and markets, from operating policies. Operating policies are management processes, whereas major policies are determining forces.

9.5.2 Diagnose an Organization

McKinsey's General Survey Outline is a guide to thinking that can be useful in analyzing an organization [93]. There are three major steps:

1. "Understand the general nature of the business. A review of its history for at least the last ten years provides a perspective on the total enterprise in terms of company strategy and the forces impinging upon it [93]."

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2. "Evaluate the general environment in which the company operates. This starts with the broader economic and political setting and narrows to an outlook for the industry and the company's position in the industry [93]."

3. "Evaluate the company in three broad areas: (a.) the organization structure, technology, facilities, and staffing; (b.) policies in the functional areas of management such as sales, production, purchasing, finances, and personnel; and (c.) finances and financial requirements. The facts gathered in this broad and detailed analysis should enable the [management] to determine the current problems facing a company, to explain those problems, and to suggest some solutions [93]."

William Wolf summarized McKinsey's ideas into twelve guidelines that serve as "percepts and caveats for management [93]." In the guidelines, McKinsey recommends empowerment: "Delegate responsibility and authority but centralize control. Formal authority and responsibility should be delegated as far down the organization as possible [93]." He believes that the best way of communicating about the organization is by means of organization charts and manuals, but at the same time organization charts should be recognized as merely an administrative device and need to be continuously changed as the organization is changing continuously.

9.5.3 High Reliability Organizations (HRO)

Three researchers at University of California at Berkeley have been studying High Reliability Organizations (HRO), like nuclear-powered aircraft carriers, air traffic control systems, nuclear power plant, and others [96]. A mistake in these organizations often results in deaths. From this research, they have identified common HRO qualities: "1) intensive training and rehearsals; 2)easy communications from the top down as well as from the bottom up; 3) a strong, clear sense of mission and goals; 4) an ethic of dedication and loyalty to the group [96]." With these traits that foster a culture of reliability, an organization can improve the stability of its business.

One observation that defies common sense is that you should NOT meet crisis with *strong* leadership. During a dangerous circumstance, the HRO instantly transform itself and pushes decision-making responsibilities to the lowest level people that can deal with problems first head. This is the approach because problems need to be quickly corrected and a rigid hierarchy is often fatal. If the leader waits too long to let go, the organization is in real trouble. The researchers call the collapsing of the hierarchical pyramid a "pyramid inversion [96]."

To create the culture of reliability, organization needs to work against the notion that "we punish errors." Having such notion makes people refuse to discover and recognize errors that ultimately result in disaster. On the other hand, spotting a problem and taking immediate responsibility to resolve that problem should be praised. Motorola motto says, "We celebrate noble failure." "We never punish failure. We only punish sloppy execution and the failure to recognize reality [7]."

Sacrificing product and service quality and reliability for short-term business efficiencies will result in long-term pain. Also, organizations need to spend time in developing its human resourcing function, in terms of attracting and retaining talents and establishing well performance evaluation and reward system.

9.5.4 Value-Adding Partnership

In a *Harvard Business Review* article, Johnston & Lawrence (J&L) points out the death of vertical integration and predicts the rise of value-adding partnership [106]. J&L points out numerous successful value-adding partnership (VAP) stories: McKesson was able to cut costs and add value to customers by creating new services, and the textile industry of central Italy is now made up of small cooperative companies governed by an *impanatore*, a facilitator that ensure the cooperation of all parties. J&L believe that vertical integration will give away to VAP [106].

Under J&L's theory of VAP, each player in the value-added chain has a stake in the others' success; to succeed, each will need and want the others to succeed. J&L state that vertical integration is not a good solution because functional organizations within an enterprise often need different cultures and values. Cost cutting practice that works in factory hampers innovation in R&D and marketing. Also, the key in VAP is focus; each small operating company focuses on only a small step of the value-added chain, and on the contrary, large size often creates complexity that inhibits communication, innovation, and flexibility.

I feel that while J&L's VAP concept has much merits, there are some pitfall in their reasoning. VAP goes against today's concept of re-engineering. Having small operating companies where each focuses on design, manufacturing, packaging, or distribution is exactly like stove-pipe functional organizations within a large enterprise. The optimization of each of these operating companies could come at the expense of the complete value-chain. Because the value-chain is made up of many companies, no one is in charge of guaranteeing the quality and speediness of the product or service through this complete process. In a vertical integrated organization, the management can create cross-functional teams to monitor the complete process and ensure the functional organizations work together in synergy. While in the world of VAP, no one is ultimately responsible to the customers; it relies much on the cooperative nature of many small companies.

Furthermore, companies have the desire to gain bargaining power by weakening their suppliers and customers. Who is the police that ensure everyone cooperate and no one compete unfairly? It also seems difficult to build the "right" value-chain partnership: A company only wants to have few VAP relationships so close relationships can develop, but at the same time, a company does not want to limit the number of VAP relationships, potentially alienating other suppliers and customers. At the same time, partners might become overdependent on one another, and the failure of one value-chain player trigger the failure of others. Also, today's companies might need to be value-chain partners in

one industry, but they are competitors in another industry; this will reduce their willingness and ability to share information freely and cooperate with trust.

While new technological tools does make VAP attractive, the ground rules for VAP do not exist yet. J&L says that lesson learned from "prisoner's dilemma" can teach us how to approach VAP; if this is true, this means that VAP companies have lost much control of their own fate...I sense danger in this type of organizations.

9.6 A Learning Organization

An organization's capacity for learning is undoubtedly the key to success. The ability of the organization's ability to adapt to change can ensure long term success as today's excellent productivity only deliver short term success.

As the U.S. government undergoes reengineering, it realizes that most of its federal employees don't have the skill sets needed to use information technology. IT training on strategic planning, reengineering, electronic mail, video conferencing, and imaging will be provided to non-technical managers and presidential appointees [97].

Andersen spent nearly $7,500 per employee a year on training and average nearly 1,000 hours in advanced education [93]. McKinsey believes in training the employee, especially in creating a desire in them for the rewards offer by the company [93].

As empowering employee has become a necessity, building a learning organization has become a necessity. This is because empowerment is a two way streets. In order to empower the employees, the employees must be willing to assume responsibility as well as the risk involved in making decisions. Proper training is needed to ensure that the employee truly understand the vision and direction of the organization so that not only the

employees feel more comfortable in making decisions but also the decisions they make will be in line with the organization's goals.

Result of training needs to be measured as well. It is not the shear number of courses offered that makes the employees become educated. The training courses themselves need to be benchmarked and evaluated, and the courses themselves need to be result oriented.

Because of the fast changing world, organizations that flourish or survive are ones that can learn faster than their competitors. Training need to take place to educate people on data stewardship. People need to understand that if I create the data, I am accountable for it [92].

In the information age, the need for speedy adaptation to the marketplace has moved the decision making responsibilities from the top of the bureaucracies to the self-directed workforces. It is becoming important that employees of all levels understand how their actions and decision making impact the organization's goals and objectives.

Peter Senge, the management guru behind the concept of building learning organizations, states that the old model of "the top thinks and the local acts" is over as the new "integrating thinking and acting at all levels" is taking hold [113]. A learning organization needs to be *generative*, instead of simply *adaptive*. *Adaptive* learning is about coping as *generative* learning is about creating, expanding our capability. With a leap of imagination, we look beyond what a customer wants and see what the customer *might* want. The new leadership roles including being (1) a designer, (2) a teacher, and (3) a steward. A leader needs to have three key skills, including (1) building shared vision, (2) surfacing and challenging mental models, and (3) engaging in systems thinking [114].

9.7 Productivity

Nobel laureate Robert M. Solow once said, "we see computers everywhere but in the productivity statistics...The fundamental blame rests with organizations, Information technology holds great potential, but companies have failed to provide structures and processes that facilitate the use of information technology in ways that create significant net value [99]."

We often hear consulting firms reporting that their clients have productivity gains of 25 %, or 200% after reengineering, but they never tell you how it's measured. Ambiguity is everywhere and people have to become more clear on what they are referring to.

Reengineering requires that evaluation of productivity be shifted from task orientation to result orientation, which translates to the level of customer satisfaction. Team performance should be measured, instead of solely individual performance. Some say that productivity should be measured in terms of quality rather than volume if long term success is desired.

Another area that has often been overlooked in productivity measurement is information integrity. Part of the reason for overlooking this aspect of information is that it is difficult to measure. Information integrity represents an important issue, especially in upper management's decision making process. The consequences of poor quality data and/or unreliable information can result in catastrophe. Standard software solutions have helped a great deal in achieving information integrity within and between applications.

Productivity improvement in using imaging systems are often difficult to measure. There is shifting of workers from back-end processing, that of paper-based document collection, handling, copying, filing, and distribution, to the front end of scanning and indexing documents [100]. It is difficult to measure improved customer service when sales representative can quickly retrieve a document while customer is waiting on the phone.

The easier measurement of the gain in productivity is found in knowledge workers who no longer have to dig through piles of document to look for information that they need to perform their tasks. Another measurable area is in reducing lost or misfiled documents. According to BP Exploration, they lost only 12 invoices after the installation of an imaging/workflow system, comparing to prior years' several hundred to 1,000 invoices [100].

One method of evaluating performance improvement is EBIT, change in earnings before interest and taxes. Another one is in terms of reduction in total business unit costs. People have claim that quality is the key to long term success and growth in revenues. Keeping track of defects can be applied to on production line while asking customers feedback on their level of satisfaction can be applied to control the quality of service. Sampling is needed for measurement. However, quality of information is difficult to measure.

Depending on the critical success factors (CSF) of an organization, the right measure of productivity should be taken. Table 9.1 , adopted from IBM's approach to business transformation, shows the different measures for different CSFs [104].

Table 9.1: Goals, Programs, and Measures According to Critical Success Factors

	Goals	Programs	Measures
Productivity	Cost reduction Capacity increases Organizational downsizing	Automation Process simplification	Units per person Peak output level Cost per unit Cost per activity Revenue per employee Headcount
Quality	Yields Cost reduction Customer satisfaction	Total quality management Statistical quality control	Defect rates Yields Standards and tolerances Variance Life-cycle costs
Velocity	Cycle time Asset turnover Response time	Just-in-time Time-based competition Electronic data interchange	Inventory and sales Throughput -Activities and processes -Transactions Time to market Response ratios
Customer Service	Retention Enhancement Customer satisfaction	Focus groups Market research	Retention Revenue per customer Repeat purchase Brand loyalty Customer acquisition cost Referral rate
Business Precision	Marketing sophistication	Mass customization Microsegmentation	Cost of variety Number of new products

	Flexible business systems	Activity-based costing	Number of product, service, and delivery configurations Customer self-design and self-pricing flexibility
Enhancement	Business augmentation	Embedded information technology Turbocharging Enhanced products and services	Number of features, functions, and services Information flow to customer Product and service revenue ratio Customer performance Secondary revenue streams
Extension	Broader market scope New customer acquisition	Channel development Market expansion Alliances	Customer diversity Number of new customers Channel diversity New revenue sources Broader product and market scope
New Business Development	Market value Start-up activity	Business development Entrepreneurship Spin-off units	Market value New lines of business Percent of revenue from new units and services

I believe that the key here is that performance measurement is important but more importantly, the measurement needs to be in line to the organization's strategic goals. It would be fruitless to measure areas, which leads to stronger emphasis on those areas, that don't lead to *true* strategic benefits.

Performance measurement is a way to ensure that we are customer oriented and we focus on results. As mentioned in the strategy alignment section, we need to make sure that strategic planning accounts for result oriented benchmarking. Process performance data collection is a demanding and time-consuming task and needs to be taken seriously. The collected data should be able to contribute to further process improvement. A method to enhance process measurement is to attach customer-satisfaction indicators.

9.8 Benchmarking

A circular 5 stage benchmarking approach has been proposed by premier benchmarking companies: 1. Determine what to benchmark, 2. form a benchmarking team, 3. identify benchmark partners, 4. collect and analyze benchmarking information, and 5. take action [101].

Benchmarking is a way to learn from our competition. By investigating and understanding how our toughest competitors and other superior performers, both inside and outside our industry, achieve their success, we can uncover ways to improve ourselves and potentially leapfrog the competition.

Benchmarking is a data-driven, rigorous, and systematic comparison. It is not an event, but a journey; it is a recurring process to help us continuous improve. Good benchmarking entails a commitment to change, a goal-oriented change. Benchmarking process needs to be integrated into a reengineering effort as it is not useful functioning as a stand-alone tool. A successful benchmarking study must have full management support and address issues that are crucial to the business organization.

Giant organization has a nine steps approach to results: (1) Determine what to benchmark, (2) Identify performance measures, (3) Identify benchmarking partners, (4) Determine data collection plan, (5) Measure ourselves, (6) Measure our benchmarking

partners, (7) Analyze gap, (8) Project future performance levels, and finally (9) Communicate results [117]. After acquiring the results, each organization will feed the data back into the appropriate system to plan, implement, and monitor the recommended improvements.

Concluding Note

Through my research work conducted at Giant Corporation's Desktop Technology Group (DTG), I have helped DTG to define existing business processes, redesign them, and implement several changes. The assessing of different key lessons learned from the experience has also helped DTG's future strategy formulation, project planning and deployment, team building, transition effort, and reengineering institutionalization. The first section of the thesis is documented with the experience that has been beneficial to DTG, and it hopefully will also contribute much knowledge to other organizations.

As reengineering is still a very young discipline, literature available on the subject are often scattered journal articles and research papers. These diverse articles and papers result in different opinions and foster misconceptual understanding of reengineering. The thesis has consolidated a repertoire of these opinions and points out the knowledge and lessons to be learned from each. By including other related issues on reengineering, the thesis also provides an integrated, holistic thinking to reengineering.

Information engineering or IE (like James Martin's information modeling, Yourdan, Demarco, McMenamin, and Palmer's structured systems analysis and design, John Zachman's Information Systems Architecture, and others) has been a discipline with systematic, structured approach to business modeling, but using technological tools to solve business problems has produced limited results. The granularity of IE model representation, with precise execution semantics that are essential for computer automation, has made it lost its attractiveness to be a business solution. They cannot be easily understood, and communication on existing and redesigned new processes is a problem. On the other hand, management discipline (like activity-based costing, total quality management, systems dynamics, value-chain analysis, Porter's five forces, and others) has provided good strategic tools with limited implementation values, especially in the implementation of information technology which is often at the core of reengineering.

The thesis calls for the consolidation of information engineering and these management discipline in order to succeed in a reengineering effort. It is imperative that technologists and management people work together in synergy and understand as well as appreciate what each has to offer.

While the thesis has helped to clarify and answer many different issues of (and related to) reengineering, the research has inadvertently raised even more issues. Is there an economic of scale with information technology? What is the future organization going to look like? Should we outsourced certain key technologies? How do we measure data/information quality, improvement in quality service, and other soft productivity gains? Centralization versus decentralization of information technology (or shift in decision rights), pilot versus full deployment, control versus empowerment, and others are just some of other concerns.

Appendices

AIM Process Maps Overview

DTG - AIM Program (Business Partner / Customer Driven)

AIM Process Map
DA MGMT   pg. 17

AIMINFO Process Map
WA   pg. 18

AIMINFO Process Flow
WA   pg. 26-28

AIMSUPPORT Process Map
TS   pg. 19

AAA Proc. Flow
WA   pg. 29

A. Rng. Proc. Flow
WA   pg. 30-31
TA
TS   BP
TD   IT

A. Impl. Proc. Flow
WA   pg. 32-33
TA
TS   BP
TD   IT

DTG - AIM Program (Internal)

Librarian Proc. Map
DA MGMT
pg. 20
Librarian Proc. Flow

Workflow Proc. Map
WA
pg. 21
Workflow Proc. Flow

Tech Supp Proc. Map
TS
pg. 22
Tech Supp Proc. Flow

AIM Dev. Proc. Map
TD
pg. 23
AIM Dev. Proc. Flow

Trainers Proc. Map
TA
pg. 24
Trainers Proc. Flow

Docs&P Map
TA
pg. 25
Docs&P Flow

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AIT Process Flow

```
        ┌─────────────────────────────┐
        │  AIM Implementation Process │
        │           START             │
        └─────────────────────────────┘
                      │
                      ▼
      ┌───────────────────────────────────────┐
      │         During Each Phase:            │
      │ Promote Business Partner Participation│
      │   Stimulate Business Partner Interests│
      └───────────────────────────────────────┘
```

Standard AIM

Snap-on
Application
Required

Standard AIM

WA | DA
Business Partner
IT*

Formulate
Training
Material

WA | TA
Business Partner
IT*

Build
Prototype in
AIM Lab
rapid
prototyping
step-wise
refinement

Build
Workflow
Prototype

AIM BP
Aptitude
Checklist

WA | TA
Business Partner
IT*

WA | TD
Business Partner
IT*

No

Train SysAdm,
Team Leader,
BP Developer,
& BP Trainer*

WA | TA
Business Partner
IT*

WA | TD
Business Partner
IT*

No

Meet BP's
Expectation?

No

Meet
BP's
Expectation?

No

Certified?

WA | TA
Business Partner
IT*

Yes

Yes

Yes

Schedule Users
Training

WA | TA
Business Partner
IT*

○

△ 1

```
                          ┌─────────┐
                          │    1    │
                          └────┬────┘
                               │
                               ▼
              ╱──────────────────────────────╲            ┌─────────────┐
             ╱   Certify  BP HW / SW           ╲          │  WA  │  TS   │
             ╲        Configuration            ╱      Business Partners
              ╲──────────────────────────────╱            │  IT*         │
                               │                          └─────────────┘
                               ▼
              ┌──────────────────────────────┐            ┌─────────────┐
              │      Install SW/HW for        │          │  WA  │  TS   │
              │      Business Partners        │      Business Partners
              └──────────────┬───────────────┘            │  IT*         │
                             │                            └─────────────┘
                             ▼  ◄──────────────────┐
              ┌──────────────────────────────┐     │      ┌─────────────┐
              │   Certify Users' Workstation  │     │     │  WA  │  TS   │
              │          Environment          │     │  Business Partners
              └──────────────┬───────────────┘     │      │  IT*         │
                             │                      │      └─────────────┘
                             ▼                      │
                    ╱────────────────╲    No        │      ┌─────────────┐
                   ╱     Users'        ╲────────────┘     │  WA  │  TS   │
                   ╲   Environment     ╱              Business Partners
                    ╲   Certified?   ╱                    │  IT*         │
                     ╲──────────────╱                     └─────────────┘
                  Yes ╱          ╲ Yes
```

BP Sys. Adm. Setup
Desktop Environment
& BP Builds Workflow
Prototype & BP
Developer Builds
Customized Tools

Train Users
(could be by TA,
Customer's own
trainers, or others)

WA	TA
Business Partners
IT*

WA	TA
Business Partners
IT*

Production
Environment
Certified?

No

Yes

WA	TS
Business Partners
IT*

AIM Implementation Process
END

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