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FRAMEWORK FOR MANAGING PROCESS IMPROVEMENT:

FRAMEWORK FOR MANAGING PROCESS IMPROVEMENT:

A Guide to Enterprise Integration

December 15, 1994

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THE MANAGEMENT FRAMEWORK FOR PROCESS IMPROVEMENT:

A Guide to the Methodology

SECTION 1. INTRODUCTION

1.1 The Third Industrial Revolution

American enterprise is caught up in a massive restructuring not seen in this country since the second industrial revolution, which introduced the factory system and dramatically changed all aspects of American life. This sea change is being described as a paradigm shift that requires a new context for leadership and management practice in all sectors of our economy. In his book, *The Third Wave,* published in 1980, Dr. Alvin Tofler described this new paradigm as the information age. We are just now beginning to understand the full impact of his prophetic writings.

Government in general, and the Department of Defense in particular are caught up in this phenomenon, which some authorities call *the third industrial revolution* and others call *the information age*. We cannot stop it. We cannot avoid it. We can, however, tap into the power generated by the change forces at work here and use it to transform the Department in ways that will take full advantage of the capabilities inherent in an information age economy.

The term *information age* is no more restricted to computers and data than the term *industrial age* is limited to machines and materials. The information age concept is all-encompassing and affects all facets of our culture, society, and economy. Therefore, all elements that make up the Department—our mission, vision, culture, leadership, management, human resources, products and services, processes, and systems—must be examined as we endeavor to help guide DoD into this new age.

1.2 The Paradigm Shift

The information age represents a paradigm shift in the way enterprises, especially large enterprises, are organized and how they function. Experience has shown that there is great resistance to change within organizations when they are faced with massive dislocations brought on by the forces of change. History also tells us that usually and eventually the forces of change prevail over those who resist. These are the six most important elements that have to be reckoned with:

1.2.1 Global Economy. Competition is no longer constrained by national boundaries. Every decision made by large enterprises, including governments, has profound impacts all over the world. Products, services, and ideas flow freely across national borders. Free enterprise and the discipline of markets has and is prevailing over planned economies and allocation of goods and services. The competition for skilled labor and professional skills pits non-profit and governmental organizations against for-profit and private sector concerns. Privatization and out-sourcing are increasing as the competition for talent triumphs over organizational stagnation and employee loyalty.

1.2.2 Information Highway. Information is the new capital of the information age. Those enterprises that best learn to share information, rather than control it, will succeed. The availability of information and the means to both transform it and transmit it determines how efficiently and effectively an organization can re-order its business processes to respond to changing demands for products and services in an unforgiving global marketplace.

1.2.3 Employee Empowerment. The factory model for organizing and managing employees is a *second* industrial revolution paradigm that still prevails in most modern enterprises. This model was developed in an age when education was at a premium and the supply of unskilled or semi-skilled workers was endless. Hierarchies of management did the thinking and planning while armies of workers followed the rule book and did what they were told. In the information age, educated and skilled workers organized into teams need only information and the authority to act for the enterprise to be successful. The role of the manager is shifting from giving direction and rating performance to individual coaching and team facilitation.

1.2.4 Virtual Corporation. As the walls between nations become porous, so too are the fences that separate enterprises coming down. The enterprise will no longer be a physical entity organized around structure, but an ephemeral, intangible entity loosely associated in alliances to serve customer needs. The military establishment is no stranger to this concept as armies have always been formed out of divisions and specialized battalions for a specific purpose, and then reformed as events warrant.

1.2.5 Focus on Core Competencies. The vertically integrated enterprise was well suited to insulate the second industrial revolution economy from the ravaging forces of rapid change. It was possible for a single company to control a commodity like gasoline from well-head to gas tank. The new paradigm mandates that an organization discover what few things it does well, better than anyone else, then allocate all capital and human resources to doing those few things. More and more business leaders are selling off or discontinuing businesses where they are not the leading producer or at least the second leading producer. Governmental organizations are turning more and more to out-sourcing or privatization when they cannot excel in an endeavor.

1.2.6 Demand for Quality and Service. The new consumer is an educated, discriminating buyer of goods and services and demands value in the form of high-quality, low-cost, and rapid service. Products and services must meet, if not exceed, the expectations of sophisticated customers. This rule applies also to business buyers as well as consumers of government services. The concept of a *captive* customer is bound by the old paradigm even with respect to consumers of government services.

1.2.7 The New Paradigm and the Department of Defense. All of the attributes of the information age have impact on the ability of the Department of Defense to carry out its mission. While the Department has no direct competitor in the usual meaning of the term, it does compete in the marketplace for products, services, ideas, employees, funding, and support from the citizenry and their political leaders. The Department cannot isolate itself from the transforming influences inherent in the new paradigm.

1.3 Transforming the Department of Defense

Desert Storm effectively demonstrated the capabilities of our high-technology weapons systems and proved the efficacy of our command structure resulting from the 1986 Goldwater-Nichols Act. But it also revealed a pressing need to reexamine the "tooth-to-tail" relationship between combat and support systems.[1] We have come to realize that we need to restructure the Department around a new enterprise model that will include all functional areas in the sustaining base with responsibility for all aspects of our strategic and tactical mission.

The DoD process improvement program, a part of the Corporate Information Management (CIM) initiative under the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD (C^3I)), is designed to provide the mechanism for effecting this transformation. We have already obtained significant results in the functional areas where process improvement principles have been applied. But as we gained experience with the program, we realized that we needed an overarching methodology to guide

1 *Defense for a New Era*, Les Aspin and William Dickinson, 1992, page 34.

improvement efforts on the massive scale required to achieve results consistent with our current national defense policy. This methodology is also needed to assist the Department in realigning its business and functional processes to maximize their potential and performance in the new age.

1.4 Need for a Process Improvement Methodology

The Framework for Managing Process Improvement (Framework) described in this guidebook is the response to the need for an overarching methodology. The Framework consists of a comprehensive methodology for performing process improvement projects and is applicable in all functional areas in the Department. It supports three levels of improvement efforts that we include under the definition of functional process improvement (FPI).

- *Continuous Process Improvement* (CPI) that reduces variation in the quality of output products and services and incrementally improves the flow of work within a functional activity.

- *Business Process Redesign* (BPR) that removes non-value added activities from processes, improves our cycle-time response capability, and lowers process costs.

- *Business Process Reengineering* (BRE) that radically transforms processes through the application of enabling technology to gain dramatic improvements in process efficiency, effectiveness, productivity, and quality.

The Framework was developed after an intensive period of research into the theory and practice of process improvement. The literature related to Functional Process Improvement (FPI), and material about the practice of Total Quality Management (TQM) and Total Quality Leadership (TQL), were thoroughly examined.

The findings indicated that both process improvement and TQM are concerned with the same issues and seek to achieve the same objectives, but approach the problem from different perspectives. By taking the best practices and techniques from each discipline, we developed a methodology that represents breakthrough thinking into the problem of applying quality management principles in a services organization.

Recent literature suggests that others are arriving at similar conclusions. Edward Fuchs, Director, Quest Division, AT&T Laboratories, resolves the confusion over the role of incremental improvement, a long-standing component of TQM, versus the more recently introduced notion of reengineering, by clarifying their different perspectives—one being primarily technical, the other focusing on leadership:

1. Where the performance gaps are large, reengineering is the proper approach. Where they are small, incremental improvement provides the required results.

2. Incremental improvement is an extension of past performance without the driving force of a leader. Reengineering is driven by the pull of the future, the vision of the leader, or the target to which the company is aiming.[2]

Clearly both process improvement and process reengineering concepts are being incorporated into quality management principles and practices. Any methodology developed to guide improvement efforts must be comprehensive, and must be based on best practices wherever they are found. To confirm this theory, the Framework was benchmarked in twelve private and public sector organizations known to have achieved success in process improvement. The benchmark partners included two winners of the Malcolm Baldrige National Quality Award and those who have achieved ISO 9000 certification. We found that having a unified methodology is an important component of success in process improvement efforts in large organizations.

2 "Total Quality Management from the Future: Practices and Paradigms," Eduward Fuchs, Quality Management Journal, October 1993.

1.5 Advantages of the Framework Methodology

Based on research, benchmark results, and experience to date using the Framework, the methodology has undergone three major revisions. This document describes the latest in what will be a continuing series of improvements building on Department successes with process improvement. Draft 5.0 of the methodology offers these advantages and benefits:

- The Department *owns* the methodology and therefore has complete control over its continuing development.
- The methodology is vendor-independent and as such provides a neutral resource for use by all contractors and Department employees.
- The methodology is comprehensive—it covers all phases of process improvement from mission development through deployment of improved processes.
- The methodology is consistent with the principles ordained by such authorities as Deming, Juran, Taguchi, Hammer, Davenport, and others.
- The concept of a single, Department-wide methodology supports the cross-functional training, teaming, and performance efforts needed to address complex functional processes and builds an experience base that is deployable wherever needed.
- The methodology is compatible with techniques and tools already established in the Department such as groupware, IDEF modeling, activity-based costing, functional economic analysis, and life cycle project management.

1.6 Characteristics of the Framework Methodology

The Framework describes twenty-five specific steps, organized into six phases, which guide functional users through the improvement process from mission validation to post-implementation assessment. The phases, which are fully described in this document are:

- Strategic and Business Planning
- Process Improvement
- Change Management: Organizational
- Change Management: Technical
- Enterprise Engineering
- Project Execution.

Each phase is divided into steps that clearly describe the tasks to be performed, the deliverables to be produced, and the recommended techniques and tools that can be used to produce the deliverables.

The Framework concept includes an integrated documentation, training, and support package (also described in this document), which will enable functional managers and employees to apply the methodology with confidence in their own organizational unit.

Joseph Juran, one of the pioneers in quality management and process improvement, gives three imperatives for implementing great change in an organization: unwavering commitment from senior leadership, a context for coordinating change throughout the organization, and the necessary tools to bring about the change.[3]

With a comprehensive methodology in place (Juran's second point), the Department can move more quickly and more certainly toward restructuring critical defense processes in support of our primary mission, and ensure that the Department can strengthen the relationship between tooth-to-tail systems. This in turn will also help us complete the restructuring process currently under way within the Department with less risk of compromising our readiness, capability, and security.

3 Juran on Quality by Design, J.M. Juran, The Free Press, New York, 1992.

SECTION 2. PROCESS MANAGEMENT AND IMPROVEMENT

The hierarchical (vertical) organization served the needs of industrial age enterprises well. The organization of work into like functions is suited to the needs of an uneducated work force. It simplifies employee supervision and training, maximizes managerial span of control, and has little dependence on the free flow of information.

A new model is needed for information age enterprises and is indeed enabled by the capabilities of the information age. Work can be organized and managed as an end-to-end process, rather than as the sum of disjointed functions. The process management model is well-suited to the promise of the new paradigm. Once the concept of process management is firmly rooted in the enterprise, it becomes possible to organize process improvement programs. Outside a framework of process management, process improvement programs have little chance of lasting success.

2.1 Process Management Principles

The concept of process management is not new. It has been practiced on the factory floor for years. Process management became possible in manufacturing as machines began replacing manual labor, and information and communication networks became available to control the machines. Work flow was simplified, product quality was increased, cycle time was reduced, and process costs had nowhere to go but down. Today, there are entire factories with processes so well designed that no humans are needed except for emergencies, maintenance, and enhancements. And it is possible to buy a small high-quality color television for the price of a meal for two at a better restaurant.

It is interesting to note that while the typical service corporation today is patterned after the old-style factory with its manually-intensive, functionally-based division of labor concept, the new-age service corporation is being modeled after the modern industrial corporation and its automated end-to-end processes.

2.1.1 Functions and Processes. A *process* is simply the largest unit referring to the flow of work through an enterprise beginning with external suppliers and ending with external customers. Along the way, value is added at each step through a series of transformations involving the consumption of resources within an established control (rule-based) framework. Processes may be decomposed into smaller units beginning with subprocesses and continuing to activities, tasks, and operations. The principles are the same, regardless of the level of work transformation observed.

A *function* is a specified type of work applied to a product or service moving within a process. Functions are described in the typical hierarchical organization chart, which in effect breaks down functions from the chief executive office of the enterprise through successive layers of management to the individual worker who touches the product or service, or who faces the customer. As work crosses functional boundaries, internal suppliers and internal customers are created, and responsibility for the resources and controls applied to the work changes hands.

This is illustrated in Figure 2-1, which shows a process moving through two functions. Function A sets the rules for, and controls the resources assigned to, Activity 1. Function B controls and funds Activity 2. Function B is the internal customer of Function A. Much of the challenge of process management is optimizing the transition of processes across functional boundaries.

In a functionally-driven enterprise, processes are organized around structure or functions. In a process-driven enterprise, structures and functions are organized around processes. This is the fundamental reason that meaningful process improvement cannot succeed in a hierarchical enterprise. In such organizations, processes will always be *suboptimized*—somewhat distorted—to *fit* organizational structure.

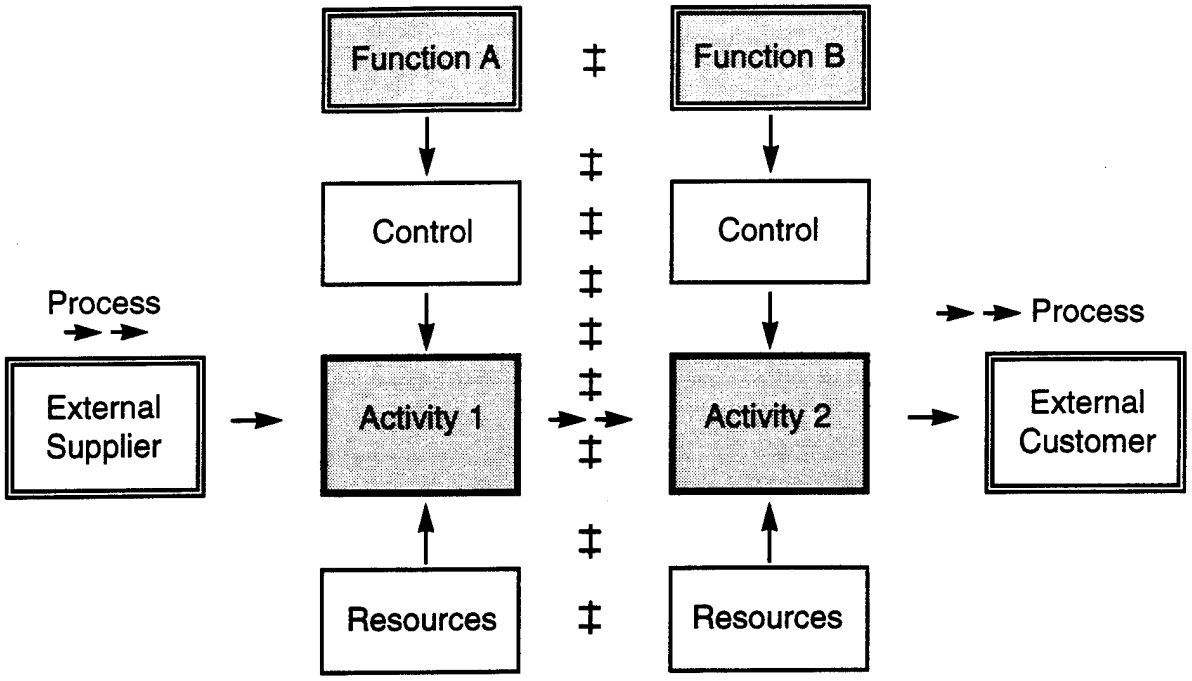

Figure 2-1. Process and Functions

When work is managed by function, managers naturally emphasize resource consumption by unit of work and the rigid application of controls or rules. Because employees are strongly motivated to follow functional rules and conserve resources, relationships with suppliers and customers are not optimal. When work is managed by process, managers emphasize working with suppliers and serving customers *within the context* of controls and resources. In this situation, employees are motivated to focus on product and service quality, customer service, and fast response to exceptional situations.

Most large organizations have from five to twenty processes. Processes are identified during business systems planning activities and mapped to the organizational structure. This forms the basis for building cross-functional teams.

Process management as a business model has positive effects on organizational dynamics including manager-employee and peer-to-peer relationships. The focus for organizational activity within a process is on serving stakeholder interests and that becomes the basis for empowerment, self-motivation, personal esteem, recognition, and rewards. Turf battles, infighting, and pettiness must decrease as the focus shifts from a preoccupation with internal concerns to one of serving those who have interests in process performance.

2.1.2 Process Stakeholders. There are four classes of *process stakeholders*—people who have a defined relationship or stake in process performance. They include customers, suppliers, higher authority, and resource providers. Each has a different interest in the process, defines process performance success differently, and benefits from process performance in different ways. Furthermore, interests, success criteria, and expected benefits vary both with the nature of the enterprise (public or private), and with the purpose of the process.

Figure 2-2 shows the stakeholder classes and the principal ways in which they relate to a single process.

- **Customers**. Customers are the recipients and users of the products and services produced by the process. In for-profit enterprises, customers buy

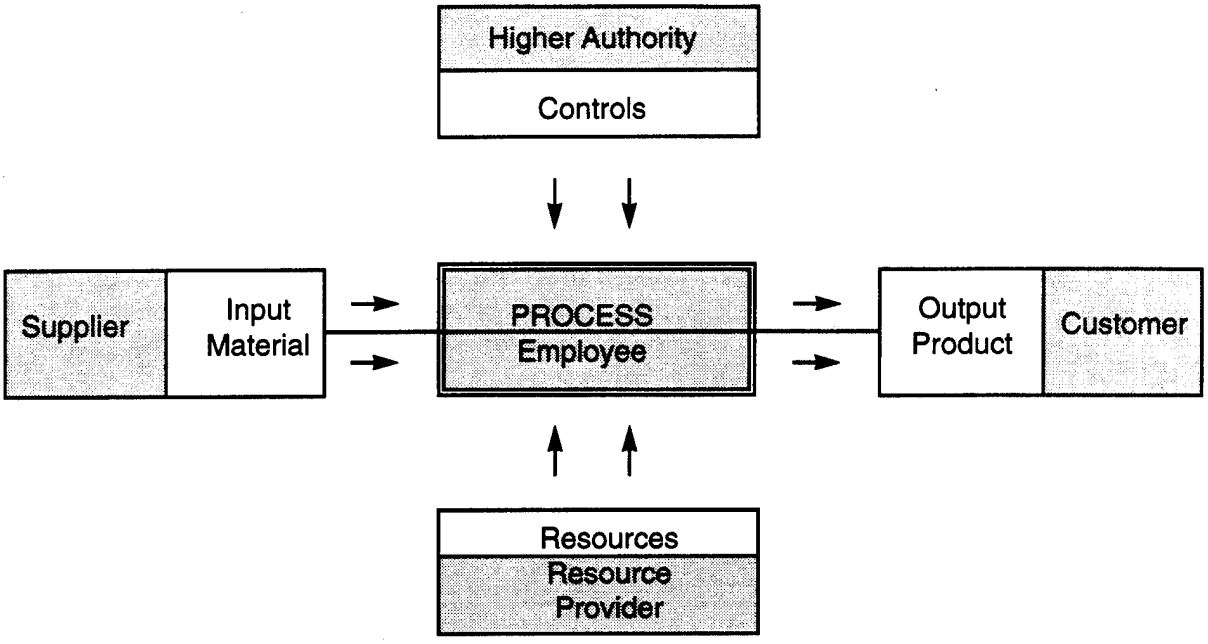

Figure 2-2. Process Stakeholders

products and services, and customer satisfaction can be measured in such terms as market share and market penetration. In government enterprises, customers receive products and services either on a fee basis or as an entitlement. Customer satisfaction must usually be measured in indirect ways such as degree of support for process owners, relocation from one jurisdiction to another, public opinion polls, or special interest group activity.

- **Suppliers**. Suppliers provide the inputs to a process, which consist of materials and data. Suppliers generally desire strong partnership relations, exclusivity, 100% acceptance of inputs, more business, and fast payment.

- **Higher Authority**. Higher authority is defined as those entities outside the process that set rules, requirements, standards, constraints, and budgets on process performance. Their interests include conformity, low-risk operations, satisfaction of functional and business objectives and goals, and process stability. Higher authority is often, but not always, the voice of functional management within the enterprise with respect to subprocesses and activities.

- **Resource Providers**. Resource providers fund process operations with facilities, equipment, machines, and labor. Everything consumed in whole or in part is considered a process resource. Resource providers are interested not only in conserving resources and return on invested assets, but also in the inherent benefits of the process itself, apart from the output product and services. Resource providers are usually citizens in government enterprises who *speak* through their elected representatives. For instance, in the case of the Department of Defense, resource providers (citizens) do not use the weapons systems and materiel produced by defense processes, but they do enjoy the benefits of peace and freedom that result from defense processes.

Process management consists in part of satisfying the diverse interests of all process stakeholders in the most optimum fashion. It also means establishing and maintaining a working environment that balances the interests of process stakeholders with those who labor within the process.

2.1.3 Performance Measures. Process management views work in terms of objectives, goals, and strategies within the context of an enterprise—its unique organization and technology. Process management relies on feedback to evaluate and improve process performance, so establishing meaningful measures is a primary consideration.

There are four all-inclusive categories of performance measures. Specific measures within these categories provide the basis for evaluating both the satisfaction of stakeholder interests and the performance of all process participants. The four categories of performance measures are conformance to standards, fitness for purpose, process cycle time, and process costs. The first two categories are effectiveness measures, the last two are efficiency measures.

- **Conformance to Standards (CTS).** Conformance to standards measures are concerned with product and process quality with respect to a norm. CTS measures the factors of customer acceptance of a product, service, or deliverable; number of rejects; adherence to procedures; test results; budget performance; compliance with public law, statutes, and regulations; and issues associated with health, safety, and security.

  There must be a well-documented or illustrated standard in place. The standard must state the requirements, the authority for the standard, and the applicability. New standards of performance should be validated before being put into service for a given process. Benchmarking is a particularly good technique to use in establishing standards of performance in this category.

  While all four process stakeholders are concerned with CTS, Higher Authority is particularly interested because it is the source for most conformance standards. Customers are also interested in CTS as it applies to output products and services.

- **Fitness for Purpose (FFP).** Fitness for purpose measures are focused on the degree to which a given interaction between a stakeholder and the process meets requirements or satisfies an objective. FFP measures such factors as how well a product or service satisfies (meets requirements) or even excites (exceeds requirements) customers. Customization, flexibility, and responsiveness are qualities that generate FFP measures.

  FFP also applies to other stakeholders. Higher Authorities need to measure the relevance of standards, rules, and regulations to the processes on which they are imposed. Suppliers are becoming more proactive in supplying processes with just enough value-added materials and data to meet process requirements with a minimum of waste. Resource providers are concerned with providing suitable facilities, equipment, and funding vehicles to maximize process performance.

- **Process Time (PTM).** Process time measures are concerned with process cycle time, throughput, and responsiveness. But process time is also a reliable surrogate measure for process cost. This is because process costs are consumed over time and, in general, the less time a process takes to complete a cycle or produce a product, the lower the cost. Many leading organizations focus on reducing process time rather than on reducing process cost. As a result, they improve cycle time while automatically reducing process cost.

Process time measures fall into three subcategories. *Operations time* is defined as the time spent within a process transforming inputs into outputs by adding value to the inputs. It is the direct application of resources or factors of production in making the transformation. *Non-value added time* is time spent in the process other than operations time or quality-related time (described next). It includes delay or wait time, meetings and report writing, supervision and oversight, compliance with unnecessary or inappropriate regulations, planning and budgeting, employee relations, acquisition and procurement, and internal paperwork. *Quality-related time* includes inspection, rework, error prevention, problem determination, problem solving, quality-related maintenance, and training.

- **Process Cost (C$T).** Process cost measures are concerned with the consumption of resources allocated to the process of producing output products and services . Variable costs include supplies that are used up in producing outputs as well as the factors of production, which include labor, machine hours, and facilities integral to process operation.

  There are also fixed process costs not directly associated with process operation that must be measured, managed, and controlled directly. These include cost of excessive benefits and perquisites, cost of facilities not directly related to work processes, and cost of non-productive (non-income producing) assets.

2.1.4 Critical Success Factors (CSFs). Critical success factors are those primary process performance measures that most closely define and track how the process must perform to be considered successful. CSFs are directly related to strategic and business plan objectives and goals. For each critical success factor there must be an associated *key indicator* that provides the measure, and a standard of performance or allowable variance from planned performance. The most effective key indicators are those designed into the process in such a way as to provide a readily available or continuous reading of performance. Many of the instruments on a car dashboard can be considered examples of key indicators.

CSFs provide one means of assessing the need for process improvement actions or projects. This is especially true when the key indicator relates directly to stakeholder interests. For instance, if customer satisfaction survey results are a key indicator for a process and the standard of performance is set at 90%, any reading below 90% suggests the need for corrective action.

2.1.5 Total Systems Management (TSM). Total Systems Management is a means of implementing process management principles. In TSM, every process is continuously evaluated in terms of satisfying stakeholder interests.

The TSM model is shown in Figure 2-3. In this model, the horizontal flow is called the *value-chain* and suggests the need for each component of a process to add value to the work product moving through the process. The vertical flow is called the *control-chain* and suggests the need for the process to conform to functional objectives, goals, and strategies. In many ways, these two chains are in dynamic tension. One of the responsibilities of a process manager is to achieve the appropriate balance between value-chain objectives and control-chain objectives.

The four quadrants refer to areas of process management and improvement where stakeholders' interests intersect. For instance, effectiveness goals for a process must be balanced with efficiency, synchronization, and standardization goals. Quadrant 1 (Q1) measures require a balancing of Customer interests with Higher Authority interests. Quadrant 2 (Q2) measures require a balancing of Customer interests with Resource Provider interests. Likewise, Supplier interests must be balanced with the interests of both Resource Providers and Higher Authority in Q3 and Q4 respectively.

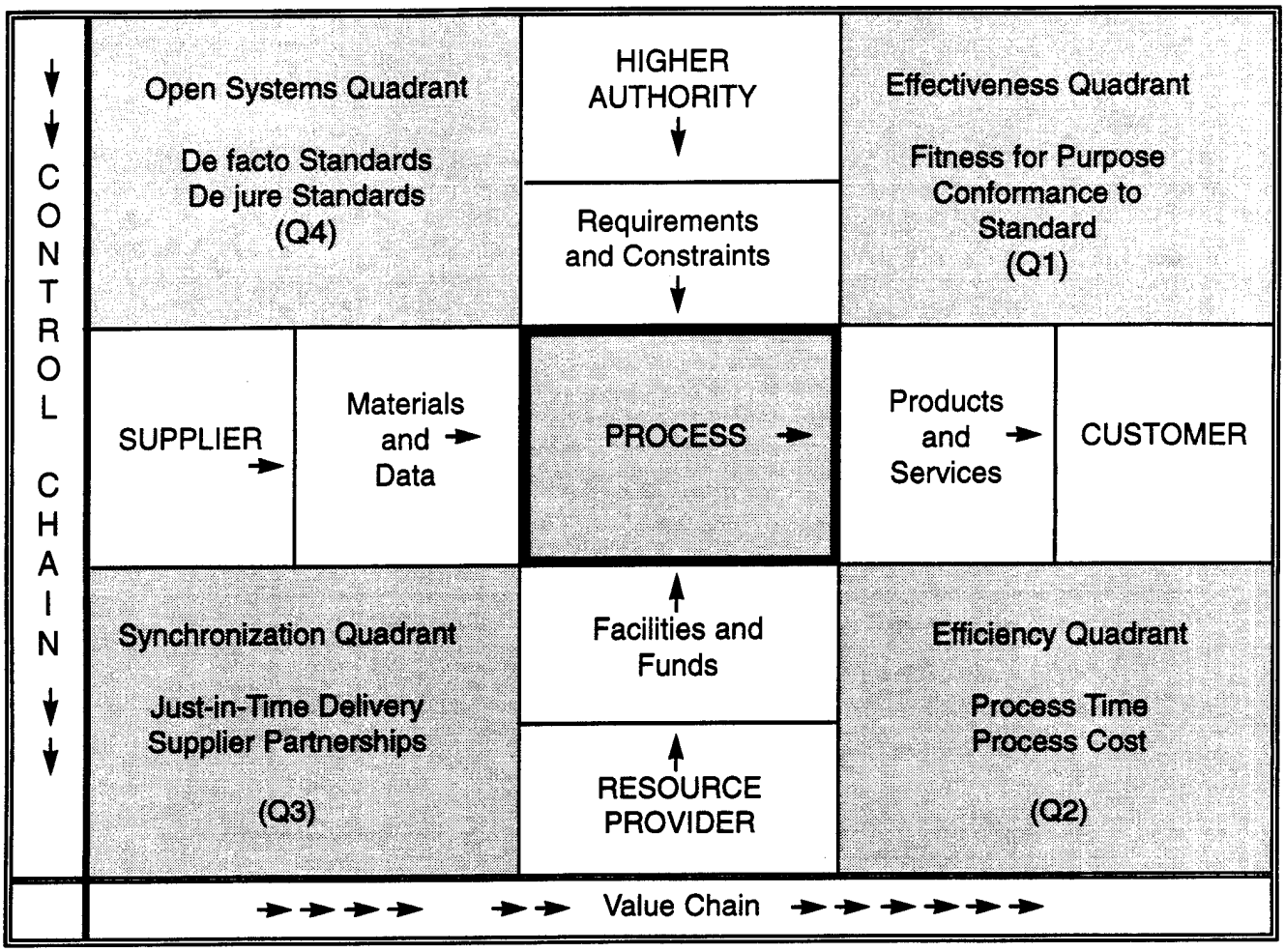

Figure 2-3 Total Systems Management

As an example of competing and conflicting interests, assume an environmental process. Resource Providers (citizens) want clean air. Higher Authority (Congress) mandates production of electric (zero-emission) automobiles by 1998. Suppliers (auto manufacturers) say they can't meet the standards on time. Customers (auto buyers) won't buy an electric vehicle that doesn't perform as well as a gasoline-powered vehicle. These issues are associated with all four quadrants in the TSM model, and all have to be addressed concurrently if progress is to be made.

2.2 Process Improvement Principles

Process improvement can only take place in an enterprise that has adopted a process management philosophy. While there are many reasons for this, the primary reason is that process improvement is both enabled and constrained by existing processes, organizational structures, and the installed technology base. If these assets are managed functionally, they cannot be effectively redeployed around a value-chain concept, which is the essence of process improvement. In other words, it is too difficult to surmount functional barriers and jurisdictional disputes. For process improvement to be effective, the focus of improvement must be on the customer, not higher authority or functional management.

2.2.1 Elements of Process Improvement. An enterprise exists to fulfill a defined mission. If there is no mission, there is no need for the enterprise. The mission is fulfilled by processes that are purposefully designed around mission. If there are

no processes, there is no way to fulfill the mission. A process is defined as a series of work activities that produce output products and services. Activities take place through the interactions of people and technology. Without people and technology, there is no mechanism to operate the activity.

Process management is overseeing the way work activities, people, and technology combine to produce useful outputs. Performance measures are used to evaluate process management success with respect to standards of performance. Performance standards are derived from strategic and business (or functional) objectives and goals. Objectives and goals are based on the mission, enhanced by knowledge gained, in part, through research, benchmarking, and analysis.

Process improvement actions and programs are required when one or more of four conditions occur:

- The mission of the organization changes or is enhanced.
- Customer needs, requirements, or desires change in substantial ways.
- Performance measures indicate that process performance is consistently below current standards of performance.
- Performance standards aresignificantly raised to improve one or more of the four categories of measures: conformance to standards, fitness for purpose, process cycle time, or process cost.

Process improvement actions and programs are therefore not to be undertaken without cause or without consideration for all performance elements process, people, and technology. Furthermore, process improvement will affect not only existing processes, but also the existing organizational and technological infrastructure. In any process improvement program, all three elements must be the object of a carefully designed and skillfully executed change management program.

2.2.2 Levels of Process Improvement. There are three distinct levels of process improvement, each with its own considerations and organizational impacts. In the descriptions below, as throughout this guidebook, the terms *business* and *functional* are interchangeable. The term *process improvement* is used in this guidebook to encompass all three levels, unless otherwise indicated.

- Continuous Process Improvement
- Business Process Redesign
- Business Process Reengineering.

2.2.2.1 Continuous process improvement (CPI). Continuous process improvement is most closely associated with the Total Quality Management (TQM) discipline. The traditional approach is to empower self-managed teams to make task-level improvements in quality, cycle time, and cost. Improvements are incremental and sustained. They are creative responses to the constant need to get the job done in changing circumstances. CPI actions typically are wholly contained within one functional activity, although cross-functional teams can be organized to deal with chronic or pervasive situations. To use an analogy, the objective of a CPI team is to tend to one or two trees in the forest.

2.2.2.2 Business process redesign (BPR). Process redesign is the next level of improvement. BPR actions are undertaken in a project context with planned or specific improvement objectives. The focus is on streamlining processes by detecting and eliminating non-value added process time and costs, and incorporating best practices in whole or in part. Moderate improvement in quality with respect to output products and services is usually one of the objectives of BPR. Processes generally remain intact with respect to other related processes, and there is little to moderate impact on existing supporting information systems.

Cross-functional teams work together to model and analyze processes (AS-IS condition), and design a TO-BE condition that maximizes process operations within the context of the established organizational and technological infrastructure. There is a strong reliance on capturing the experience base of project participants through brainstorming and other groupware techniques as the basis for generating improvement ideas. While

these techniques often produce significant improvement ideas, the ideas are limited because of the *insider* perspective of members of the improvement team. To continue the analogy, the forest is managed in spite of all the trees.

2.2.2.3 Business process reengineering (BRE). Process reengineering is often undertaken in response to dramatic changes in the external environment (a paradigm shift, for instance) that apply considerable pressure on the ability of the organization to fulfill its mission, improve its competitive positioning, or to even survive as an entity. BRE actions are radical and transforming. The focus is on the end-to-end process or a considerable subset of that process. Virtually all functions within the organization are affected by BRE actions. The existing organizational and technological infrastructures are subject to major dislocations, and pressure is applied to the very culture of the organization.

BRE actions are initiated and guided by senior leadership. Cross-functional teams are organized and directed under the auspices of a high-level manager. Because mission fulfillment in a changing external environment is the objective, the organization's strategic and business plans are, or should be, the driving force behind BRE actions. The focus of technology shifts from its role as support for current processes to enabler of future (reengineered) processes. The organization must recreate itself around reengineered processes.

All process stakeholders (especially process participants) are affected by BRE projects. New performance measures must be developed to reflect these changes. Assuming that the objective of BRE is to produce quantum leaps in quality, cycle time, and cost efficiency; baseline measurements and data will be of little use (and may inhibit) the search for new, more meaningful measures. To complete the analogy, the objective of the BRE team is to create a new forest with sturdier and more valuable trees.

Three organizational elements or components involved in process improvement at all three levels are process, people, and technology. At the CPI level, *people* and how they perform their jobs is the focus. At the BPR level, *process* is the focus of improvement efforts. At the BRE level, *technology* assumes primary importance. But all three components are always part of every improvement effort. The differences are only of degree, importance, and priority. We can also make the case that each level of improvement emphasizes different categories of measures. CPI deals, to great extent, with quality measures; BPR with cost measures; while BRE seeks to employ technology to achieve significant breakthroughs in process cycle time.

2.2.3 Barriers to Process Improvement. Process improvement actions and programs face obstacles that must be identified, understood, and overcome. In general, the barriers fall into one of three categories:

- Organizational
- Cultural
- Regulatory.

2.2.3.1 Organizational. These barriers are related to the hierarchical structure of the enterprise in which employees focus more on serving management than on providing superlative customer quality and service. Also included are the barriers inherent in functional rather than process management.

- *Senior leadership commitment and buy-in*: Business process reengineering is a top-down initiative and depends upon strong leadership to meet and overcome obstacles to success.

- *Mismatch between authority and responsibilities:* Process improvement includes the concepts of team-based performance and worker empowerment, both of which challenge traditional management and organizational wisdom.

- *Functional and technical stovepipes:* The concept of process crosses established organizational boundaries and requires new methods of managing work products.

- *Funding:* Current funding practices support the status quo and inhibit management's ability to apply scarce resources to activities that produce products and services most needed by internal and external customers.

2.2.3.2 Cultural. These barriers are related to work practices developed over time that militate against decentralized decision making and worker empowerment—both requisites for high performance in an information age economy.

- *Becoming customer-centered:* Managers and employees must shift from a rule-based to a customer-based mode of operation and establish performance measures that focus on process outcomes rather than process inputs such as budget.

- *Aversion to job elimination, risk, and change:* The very essence of process improvement is the elimination of non-value added activities, radical change, and adoption of high-technology solutions all of which challenge the organizational status quo.

2.2.3.3 Regulatory. These barriers prevent the redesign of workflow commensurate with process management, effective utilization of work teams, and innovative changes in the recognition and reward systems that promote effective teamwork.

- *Focus on current operations:* Process improvement disrupts established procedure and challenges existing regulations and directives. Management must successfully guide employees through the transition period from existing process to reengineered process.

- *Inconsistent rules, methods, and techniques underlying management processes:* Much of the non-value added activities associated with processes undergoing improvement can be traced back to obsolete or inappropriate rules, regulations, methods, and techniques whose worth must be reevaluated.

- *Policies on job descriptions, training, and reassignment:* Process improvement calls for a radical reengineering of personnel policies that currently limit the authority of management to develop a flexible, customer-centered work force with appropriate rewards and recognition for team-centered performance and individual skill development.

2.2.4 Approach to Process Improvement. The methodology for conducting process improvement projects is described in detail beginning in Section 4 of this guidebook. This is the general approach for conducting a process improvement effort:

1. Understand the business and functional requirements for the process under study with respect to mission.

2. Assess the current status of all process elements (process, people and technology) with respect to meeting requirements and enabling change.

3. Establish the baseline (AS-IS models) with respect to process, data, organization, and technology.

4. Identify and quantify stakeholder interests in the process, establish new standards of performance, and design measures and key indicators.

5. Conduct an improvement analysis program to identify potential improvement initiatives that will raise process performance to the desired level.

6. Design a change management program that will address organizational and technical issues to align improvements in these elements with potential or planned process improvement.

7. Develop a process vision and construct TO-BE models of process, data, organization, and technology based on the vision and improvement initiatives. Identify alternative means of achieving the desired future state.

8. Perform economic and risk analysis on all alternatives, and select and document a recommended course of action.

9. Perform enterprise engineering to construct an organizational and technological platform suitable for the improved, redesigned, or reengineered process consistent with the DoD Enterprise Model and established standards.

10. Test (prototype or pilot), implement, deploy, operate, and maintain the improved process and supporting systems.

11. Evaluate progress, update baseline models, and prepare for the next cycle of improvements.

Process improvement projects are conducted by cross-functional work teams according to established project management principles with the support of project management software. Various techniques are applied throughout the methodology to gather and analyze process related performance data; and to display and evaluate potential changes and improvements. It is important to establish a *process owner* to charter the improvement effort and to review, validate, and approve project deliverables and recommendations.

2.2.5 Functional Integration. Unless they are very limited, processes frequently cross functional boundaries. At each functional boundary there is a different organizational and perhaps different technological infrastructure. Process improvement projects must take into account functional differences in the design of improved or reengineered processes. There are three principle approaches to accomplishing functional integration of improvement projects:

1. Simplify cross-functional organizational issues by consolidating functions or remapping processes to functions to reduce the number of functional areas involved.

2. Identify all functional interests in a proposed improvement project, ensure functional leadership commitment to the improvement project, and staff improvement teams with representatives from all involved functional units.

3. Formalize the boundaries between functions by establishing a supplier/ customer relationship at each junction. Treat these internal suppliers and customers with the same deference as would be given external suppliers and customers.

Organizational change management issues are paramount in projects that cross functional boundaries. The more visibility the improvement project has in the organization with respect to level of functional management, the more formidable the change management issues. The interests of the higher authority stakeholders (internal and external) *must* be recognized and addressed in major improvement projects.

Technology issues are also demanding in projects that cross functional boundaries where existing technologies may be incompatible. Technology acts as both an enabler of, and inhibitor to, change—especially where the installed technology base was acquired or developed at great time and expense.

In general, reengineering a major business process or subprocess is a non-trivial exercise involving high-risk, long time-frames, significant investment, project team member turnover, and endless problems and issues that have to be identified and resolved. Success depends on the presence of a forceful, experienced project manager with a written charter and sufficient authority to execute.

2.2.6 Migration and Transition Issues. The installed information systems in an organization are termed *legacy systems* because they are carried forward from previous projects. In large organizations there will be many legacy systems performing essentially the same functions because

they were developed independently to support the needs of a single functional unit.

Usually a process redesign or reengineering project will involve one or more legacy systems. When this happens, one (or two) of these legacy systems will be designated as a *migration system.* This means that all reasonable efforts will be made to transition all systems support from other legacy systems to the designated migration system. The old legacy systems will be allowed to live out their useful life and be retired. The migration system will be enhanced to the extent possible to support continuing process improvement requirements. Eventually, a completely new information system, utilizing advanced technology, may be authorized to replace the migration system. Radical process reengineering normally requires completely new information systems that will support technologies not present in, or not adaptable to, migration systems.

Once cross-functional improvement projects reach the transition phase, organizational and technological pressures peak as the infrastructure strains to sustain both the existing process while making the transition to the new. In general, there must be an organizational and technological change management plan in place for both the transition and the deployment period.

2.2.7 Information Systems Architectures. The purpose of having architectures is to document complex, structural artifacts associated with the following enterprise elements:

- *Information Architecture* defines business processes and shows their relationship to organizational structure.
- *Functional Architecture* shows how information systems support business process needs, or defines new information systems needs.
- *Data Architecture* identifies and defines the data entities that are created or used by business processes.
- *Geotechnical Architecture* maps how information systems components are deployed to support business process needs.

Architectures are developed or updated using the Business Systems Planning (BSP) technique, which is performed following the strategic planning process.

Three levels of architectures represent different states of existence:

- *Current baseline* represents the present state with respect to all four architectures.
- *Current target* documents an approved set of improvements or changes.
- *Objective* documents the desired future state of the architectures following a program of changes and improvement.

Architectures can help process improvement teams understand the baseline condition of the artifacts involved in the process under study. Much time and wasted effort can be saved if these resources are available and used.

2.3 Department of Defense Initiatives

Functional managers in the Department of Defense are the driving force in the effort to improve all major DoD business (functional) processes. The concept of "improved functional process" includes any or all of the following actions:

- Realigning processes with changed missions
- Improving customer service
- Lowering costs of providing services
- Moving to a "fee-for-service" mode of operation
- Adapting to changing technology and information systems
- Adjusting processes in response to reduced budgets.

Managers face many challenges associated with the downsizing of the Department of Defense.

Many different but related programs, initiatives, and directives are in place or being developed to help DoD managers achieve their objectives. These include the following:

- Defense Management Review Decisions (DMRDs)
- Corporate Information Management (CIM) Initiative
- Management Control Program
- Total Quality Management (Leadership)
- Functional Process Improvement Program (FPIP)
- Life Cycle Management of Information Systems (LCMIS)
- Planning, Programming, Budgeting System (PPBS).

One of the purposes of this Framework is to give the functional manager a step-by-step approach (methodology) that consolidates the principles, concepts, techniques, and requirements expressed in the programs listed above.

The Office of the Secretary of Defense (OSD) has expanded the focus of the Corporate Information Management (CIM) Initiative and Defense Management Review Decisions (DMRDs) to include not only information systems but all functional processes found within DoD. The following subsections briefly review some of the principles relevant to the process improvement program.

2.3.1 Executive Level Group (ELG) Principles

- Simplify functional processes before (re)designing related information systems.
- Apply economic analysis and benchmarking to functional processes.
- Require process (activity) models and data models for all functional processes as the basis for information system implementation.
- Provide common information systems for identical functions.
- Develop information systems in accordance with a common methodology.
- Provide a shared communications and computing infrastructure.
- Mandate common data definitions and standards.
- Exercise central control over security.

2.3.2 Corporate Information Management (CIM) Principles. CIM may be defined as "strategic business approach to managing information resources."

- The functional manager defines systems requirements, manages implementation, and measures results. The Information Technology (IT) organization is a fee-for-service provider.
- The functional process must be simplified before it is automated. Effectiveness is gained and cost is reduced by changing how people work. Technology should be applied only after it is certain that organizations can implement the changes.
- Progress is increased and risk is reduced when organizations proceed by evolutionary migration rather than radical change.

2.3.3 Information Management Principles

- Information will be managed through centralized control and decentralized execution.
- Simplification of processes by elimination and integration is preferred

over automation or performed before automation.

- Existing and proposed processes will be subject to cost/benefit analysis that includes benchmarking against the best public and private sector achievements.

- Information systems performing the same functions must be common unless specific analysis determines that they should be unique.

- Functional managers shall be held accountable for all benefits and all directly controllable costs of developing and operating their information systems.

- Information systems shall be developed and enhanced according to a Department-wide methodology.

- Information systems shall be developed and enhanced in the context of process (activity) models and data models that document functional processes.

- The technical infrastructure shall be transparent to the information systems that rely on it (open systems and standards.)

- Common definitions and standards for data shall exist DoD-wide.
- Data must be entered only once at the point of creation (source).

- Information must be safeguarded against unintentional or unauthorized alteration, destruction, or disclosure.

- All information systems shall include a "friendly" and consistent user interface.

2.3.4 DoD Enterprise Model. The DoD Enterprise Model (described in detail in other documents) provides a framework or context for assuring that unrelated process improvement projects produce results that are consistent with the *corporate view* of processes and data entities. The Enterprise Model itself is derived from the DoD mission statement. Project improvement teams should validate all proposed process improvements against the Enterprise Model to ensure that all efforts are mission enhancing and consistent with strategic and business plans derived from mission.

The Enterprise Model identifies thirteen functional processes that cross all organizational boundaries (mission areas) within DoD. These thirteen processes are organized into four macro functional processes:

- **Establish Direction**
  - — Establish Policy
  - — Determine Requirements
  - — Develop Plans
  - — Allocate Resources

- **Acquire Assets**
  - — Manage Acquisition
  - — Engineer (Design Assets)
  - — Produce Assets

- **Provide Capabilities**
  - — Manage Assets
  - — Develop Capabilities
  - — Use Capabilities

- **Employ Forces** (Warfighting Missions) -or- **Serve Customers** (Support Missions)
  - — Constitute Forces
  - — Provide Operational Intelligence
  - — Conduct Operations

There are eight mission areas that together fulfill all mission requirements in the Department:

- National Security
- Warfighting Plans
- Command and Control
- Intelligence
- Personnel
- Logistics
- Finance
- Medical

The collections of data (entities and subject data bases) that support the processes and mission areas are comprised of the following:

- Concepts
  - — World Situation
  - — Guidance
  - — Agreements
  - — Plans
  - — Organizations
  - — Capabilities
  - — Location

- Assets
  - — People
  - — Materiel
  - — Facilities
  - — Funds
  - — Real Estate

A process improvement project will be associated with one or more mission areas, macro processes, and data entities documented in the Enterprise Model. Eventually, automated information systems will be developed to operate on open-systems platforms, have appropriate access to a DoD-wide corporate data base, and support all DoD process requirements. All process improvement projects within DoD should include this vision in the statement of principles that guide improvement efforts.

The Enterprise Model will be contained within the *Defense Data Repository System* (DDRS), which will be available to all process improvement teams to help guide process improvement efforts.

2.4 Guidance and Directives

The process improvement program is authorized by the following DoD official documents:

- DoD 8000.1 Directive: Defense Information Management Program
- DoD 8020.1 Instruction: Functional Process Improvement
- DoD 8020.1-M Procedure: Interim Management Guidance on Functional Process Improvement.

2.5 Roles and Responsibilities

The specific duties and responsibilities of DoD elements with respect to process improvement are contained within the documents listed in the subsection above. The following highlights are intended to summarize those concepts.

2.5.1 Principal Staff Assistant (PSA)

- Exercise final Department-wide responsibility, authority, and accountability for all process improvements within the functional area
- Ensure that Defense Information Management program requirements for functional process improvement are implemented and executed and that they comply with relevant standards
- Assign functional managers to perform process improvement activities on their behalf
- Establish internal procedures supporting the process improvement methodology
- Review and approve process improvement deliverables
- Develop PPBS requirements for process improvement and information systems development
- Act as the functional proponent for all information systems within the functional area and comply with LCMIS requirements.

2.5.2 Functional Information Manager (FIM)

- Guide development of the DoD Enterprise Model to provide the managerial framework necessary for determining the relationships among functional areas and activities.

- Facilitate coordination of data requirements across functional areas of the Department
- Support PSAs and functional managers in the development of goals and objectives and facilitate resolution of cross-functional issues
- Receive and review corporate Information Management (IM) central fund requirements developed by functional managers
- Chair working groups related to cross-functional and implementation issues
- Provide the linkage between PSAs and the support services available from the Defense Information Systems Agency (DISA)
- Maintain current information related to public, private, and academic sector achievements in process improvement to facilitate benchmarking and best practices studies.

2.5.3 Technical Integration Manager (TIM)

- Advocate Information Management (IM) migration solutions related to functional process improvement actions
- Prototype and test information system components related to process improvement
- Perform configuration management functions
- Assist in the development of Technical Management Plans (TMPs) which are incorporated into Functional Economic Analyses (FEAs)
- Review TMPs for conformance to standard architectures
- Provide transition strategies for migrating from baseline and migration systems to an open systems environment
- Assist functional managers in the preparation of an appropriate information system strategy that supports functional objectives.

2.5.4 Functional Data Administrator (FDAd)

- Develop the data management and information system strategy for each functional activity
- Serve as the advisor and reviewer of data models developed by or for the functional manger to ensure conformance to established standards and architectures
- Integrate data models across functional activities and assist in reconciling activity models with integrated data models
- Use approved data models as a primary source for standard data
- Support functional managers in the development of Data Management Plans (DMPs) which are included in the FEAs.

2.5.5 Functional Manager

- Execute the Defense Information Management functional management process within the functional activity or activities specified by the PSA
- Program budget and execution funds required to implement the Defense Information Management program within their functional activity
- Manage the implementation of process, data, and information system changes approved by the PSA
- Participate in working groups associated with process improvement.

2.5.6 Process Manager

- Act as the representative for all functional managers involved in a process management or process improvement action or project
- Establish objectives, goals, and strategies for process improvement projects
- Establish critical success factors, performance measures, and key indicators for process management and process improvement actions and projects
- Assist in staffing cross-functional process improvement teams and providing access to functional and process subject matter experts
- Review and approve all improvement project in-process deliverables
- Assume a lead role in organizational change management issues and recommendations.

2.5.7 Project Manager

- Assume responsibility for planning and executing project improvement projects
- Establish and track project schedules, milestones, and budgets
- Ensure that process improvement projects are conducted in accordance with all policy and guidance according to the process improvement methodology
- Identify and resolve project related problems and issues
- Lead process improvement workshops, interviews, surveys, and benchmarking activities
- Prepare and submit all process improvement in-process deliverables
- Ensure open communications among all interested parties with respect to project performance
- Prepare and submit regular project status reports.

SECTION 3. FRAMEWORK FOR MANAGING PROCESS IMPROVEMENT

Business process improvement (especially process reengineering) is a complex undertaking that demands leadership from the highest levels of the Department of Defense and participation from virtually all executives, managers, and professional employees. Davenport[4] posits five elements that together provide the techniques and tools to support the concept of process reengineering:

1. Total Quality Management (TQM) principles and practices ensure high-quality products and services to both internal and external customers of business processes.

2. Industrial engineering provides process measures, controls on process efficiency and effectiveness, and standardized procedures.

3. Workflow design that incorporates the concurrent management of technological and human change.

4. Process redesign incorporates innovations and eliminates non-value added time and costs from processes.

5. The introduction of competitive (aggressive) information technology enables superlative customer quality and service.

The concept of an end-to-end process improvement model with a supporting methodology seems to be the most expeditious way to implement Davenport's principles. Such a methodology would:

- Begin with a statement of mission, vision, objectives, goals, and strategies

- Produce a reengineered business process to support the stated organizational mission and related strategic and business plans

- Continue through information systems design, deployment, and operations consistent with the Enterprise Model

- Employ process management principles to ensure that process improvement gains are held

- Focus on cultural and organizational change management issues and structural barriers to change that represent the most risk-prone component of process improvement efforts.

The Framework for Managing Process Improvement (Framework or F/MPI) is designed to enable process improvement efforts within the Department of Defense consistent with the established body of expertise for process improvement and best practices analysis.

3.1 Process Improvement Model

Figure 3-1 illustrates the process improvement model supported by the Framework. The model shows that process improvement proceeds from an understanding of the current situation represented by these blocks in the figure:

- The current environment (A) is external to processes under consideration and represents all factors outside of the direct control of processes that can influence or constrain process improvement efforts.

- The current organizational infrastructure (B) supports the existing process. The relationship of the process to the existing organizational structure must be well-understood so that appropriate organizational changes can be made in light of planned process improvements.

4 *Process Innovation*, Thomas H. Davenport, HBS Press, 1993.

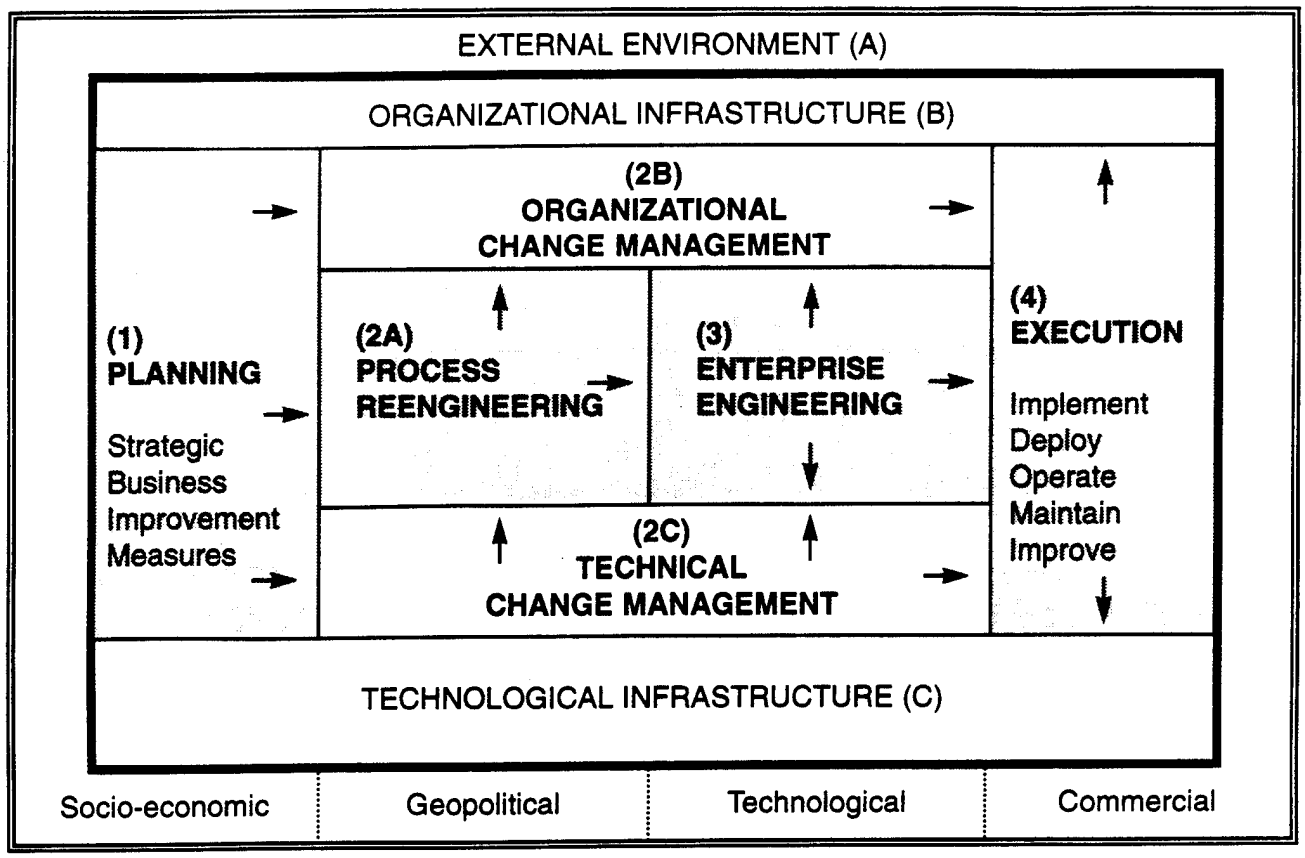

Figure 3-1. Framework for Managing Process Improvement

- The current technological infrastructure (C) provides a platform of information management and communications services for existing processes. The relationship of processes to platforms must be well-understood so that appropriate technological changes can be made in light of planned process improvements without unduly affecting existing information systems.

Blocks numbered 1 through 4 show the major phases performed in the process improvement methodology. These activities lead to a reengineered process and the necessary changes in the organizational and technological infrastructure needed to support the reengineered process.

3.1.1 Planning Phase (1). Planning activities analyze the current process baseline with respect to the external environment and the organizational and technological infrastructure to develop a vision for a future state that defines where the organization wants to be and how to get there. This vision is expressed in a series of models and architectures that define the organization, processes, information resources, and technology enablers and is consistent with the DoD Enterprise Model.

3.1.2 Process Reengineering Phase (2A). Process reengineering activities consider planning outputs, technology enablers, and stakeholder requirements to design improved processes that advance the organization toward its planned future state. Reengineering seeks to make processes dramatically more effective and efficient. These activities also provide inputs to the change management program, which conditions the organization for the coming enhanced processes.

3.1.3 Organizational Change Management Phase (2B). Organizational change management program activities define a series of cultural, organizational, and personnel-related changes necessary to remove barriers to change and maximize the potential of improved or reengineered processes.

3.1.4 Technical Change Management Phase (2C). Technical change management program activities ensure that the technology changes needed to support reengineered processes are consistent with the DoD-wide technology platform and the DoD Enterprise Model. Technology improvement program activities are also concerned with such issues as legacy systems, migration systems, and systems integration.

3.1.5 Enterprise Engineering Phase (3). Enterprise engineering activities provide the hardware, communications, software, and data base structures needed to support the reengineered process. These activities also provide inputs to both change management phases (2B and 2C) to help ensure that all elements of process improvement—process, people, and technology—are designed to be mutually supporting. Enterprise engineering activities conclude with pilot implementation or prototyping services for the redesigned process.

3.1.6 Project Execution Phase (4). Project execution activities bring together the planned process, organizational, and technology changes under a project management concept to provide a coherent and manageable means of incorporating all design changes into the existing internal environment (organization, technology and process). Project execution activities include implementation, deployment, operations, maintenance, and continuing process improvement.

All of the activities in the four mainline phases (planning, process reengineering, enterprise engineering, and project execution) and the supporting phases (organizational change management and technology improvement) ultimately result in a new level of performance for the organization.

It is important to note that the successful implementation of all the six phases of the process improvement methodology requires leadership and active participation from executives, managers, and professional employees serving in the process; effective coordination by the designated process and project manager; and access to support services provided under the CIM program.

3.2 The Business Engineering Management Model

Figure 3-2 reorganizes the Framework methodology into a format that illustrates the management processes supporting the methodology. This format emphases how management decisions flow from phase to phase as the inputs shown on the left of the process box are transformed into the outputs displayed on the right.

Change management is shown in the center of the model to reinforce its critical importance in the success of the other phases. Ultimately, nothing can happen until and unless the organization, its managers, and its employees understand and support improvement efforts. The arrows emphasize the reiterative nature of process improvement efforts and the interactions that take place between the phases.

Each of the inputs to the model is transformed dramatically, often radically, by the improvement process.

Current business processes are improved incrementally, redesigned to maximize efficiency, or reengineered to achieved maximum effectiveness. Funding is eventually transformed from a constraint (negative presumption) on process performance into an enabler (positive presumption) of superior organizational performance. What is meant by this is that waste and non-value added activities are reduced along with the debilitating effects they have on process performance and employee satisfaction.

Existing technology is modernized into effective enablers of further process improvement performance in pursuit of information age values. Underutilized assets are redeployed to processes that demonstrate superior customer-centered performance. The organizational structure itself, and associated management and employee practices, are transformed into effective resources in support of process management principles. Teamwork, empowerment, enriched job responsibilities, skill-based recognition and reward systems, continual training, and employee

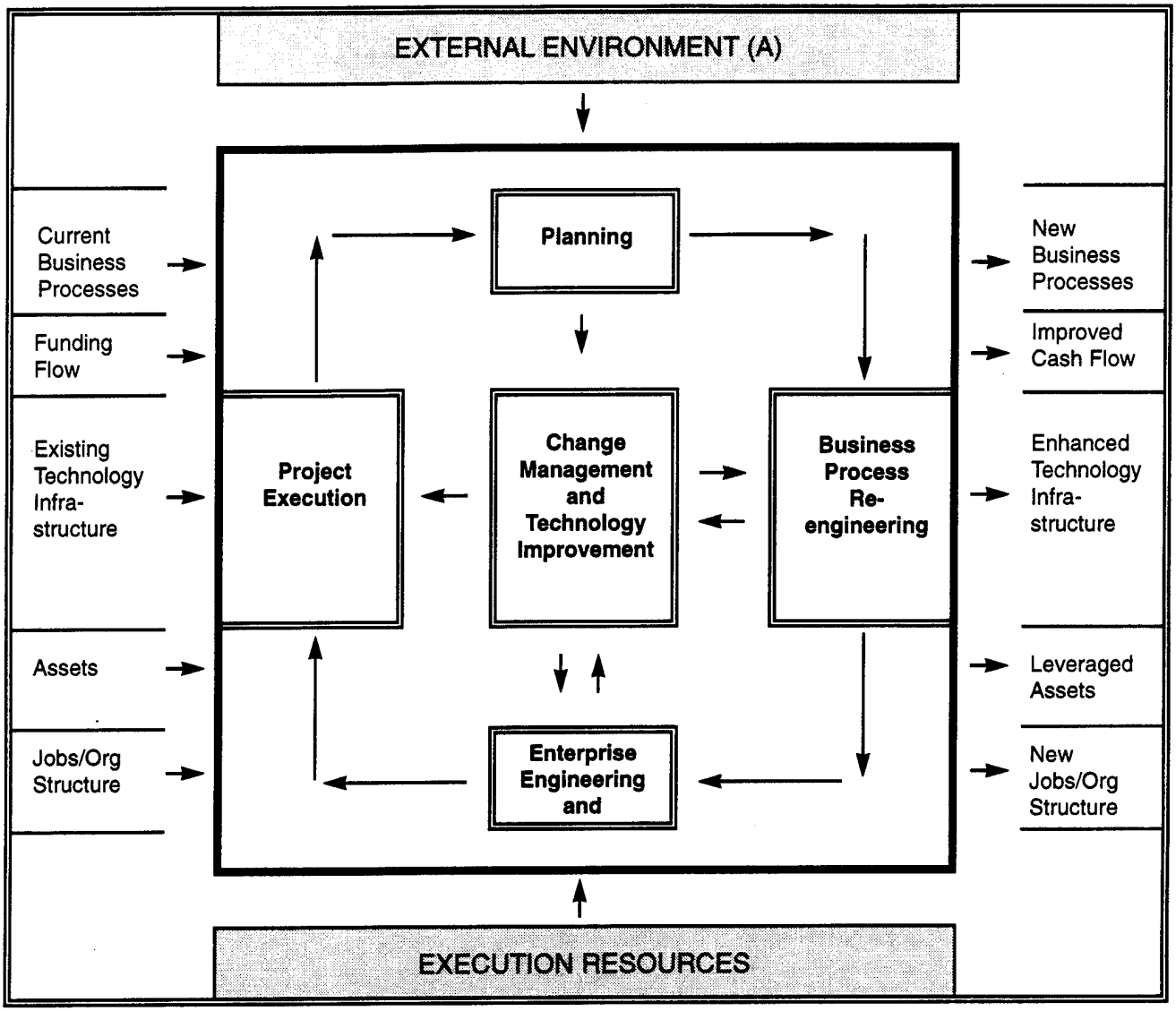

Figure 3-2. Business Engineering Management Process

resourcefulness are the eventual outcomes that produce a high-performance, satisfying work place.

3.3 The Framework Support Matrix

Figure 3-3 illustrates the framework support concept that shows the resources provided by the methodology to support process improvement efforts. The *performance* line indicates that the methodology consists of a series of phases, steps, and tasks that produce one or more deliverables. There are a total of six phases and 25 steps in the methodology. Each step consists of several tasks that produce the required deliverables. The *support matrix* shows the materials and services that are provided to enable all actions in the performance line.

- **Project Management Guidebook and Software Support System.** Materials suitable for organizing and managing a process improvement project include pro forma work breakdown structures, schedules, milestones, and resource allocation matrices in machine-readable form.
- **Framework Methodology Guidebook** (this guidebook).

	PHASE →	STEP →	TASK →	Deliverables
Planning	Project Management Guidebook and Software Support System			
Process Reengineering	Framework Methodology Guidebook			
	General Briefing Documents and Presentation Aids			
Organizational Change Mgmt	Briefingss	Abstracts		Templates
	Assessments	Checklists		
Technical Change	Tutorials			
Technical Change Mgmt	Evaluations			
		Techniques and Tools		
Enterprise Engineering	Workshops			
	Training Courses			
Project Execution		Guidebooks		
	References - Case Studies - Hotline - Consulting - Facilitation			

Figure 3-3. Framework Methodology Support Matrix

- **General Briefing Documents and Presentation Aids**. A series of briefing packages and presentation aids suitable for making presentations about process improvement and the methodology for process improvement.

- **Phase-level Briefings**. A series of six briefing packages, one for each phase of the methodology, suitable for use with process and functional managers and process improvement teams.

- **Step-level Abstracts**. A series of 25 one-page summaries relating to all activities, techniques, deliverables, and support services for each step in the methodology, which can be used as a quick reference for all step requirements.

- **Deliverable Templates**. Templates illustrating the requirements for each deliverable produced in the conduct of process improvement projects.

- **Phase-level Assessments**. A series of six assessment instruments that evaluate the organization's readiness for process improvement in terms of process, people, and technology prior to the commencement of each phase.

- **Checklists**. A series of checklists related to the activities that must be completed for each step and task in the methodology as well as the minimum requirements for each deliverable produced by the methodology.

- **Phase-level Tutorials**. A series of six tutorials, one for each methodology phase, that review the principles and concepts of each phase.

- **Phase-level Evaluations**. A series of six evaluation forms used to rate the degree of success achieved at the completion of each phase.

- **Techniques and Tools**. A series of primers on each of the techniques and tools used in process improvement projects showing their purpose, how and when to use them, and the results that can be expected.

- **Workshops**. A series of structured workshops supporting process improvement project efforts at points in the methodology that benefit most from interactive group activity.
- **Training Courses**. A curricula of process improvement-related training courses.
- **Guidebooks**. A series of documents related to major improvement deliverables.
- **Support Aids and Services**. Resources for process improvement teams.

SECTION 4. PHASE 1: STRATEGIC AND BUSINESS PLANNING

Process improvement begins with planning. Planning provides the context for developing a process vision, which is the fundamental driver of all improvement efforts. The more radical the improvement objective, the more important it is to associate process improvement efforts with strategic and business objectives and goals. Planning also determines the measures and critical success factors that will be used to evaluate the success of improvement projects. Planning defines the destination, while the process improvement project provides the vehicle. There is much truth in the aphorism that if you don't know where you are going, any road will get you there.

> Process innovation is meaningful only if it improves a business in ways that are consistent with its strategy. In fact, process innovation is impossible—or at least only accidental—unless the lens of process analysis is focused on a particularly strategic part of the business, with particular strategic objectives in mind.[5]

There are two levels of planning: strategic and business (or annual) planning. Strategic planning looks outward to establish the context in which the organization or business unit will operate with respect to its defined mission, and to set the vision for a desired future state. Business planning looks inward to marshal available resources in pursuit of the vision. Both levels of planning rely on definitive objectives and quantitative measures of performance to guide and monitor progress.

There are five steps in the planning phase:

- Develop or validate the strategic plan
- Develop or validate the business systems plan
- Develop or validate the annual business plan
- Construct performance cells (performance measures) for processes
- Establish the process improvement project.

At the completion of the planning phase, a process improvement project is in place that is consistent with the strategic objectives of the enterprise, supported by sufficient resources, guided by a well-conceived process vision, and bounded by clearly defined objectives. The objectives are related to quantified goals that define the success factors for the project, and keyed to performance measures that monitor the attainment of project objectives.

The principal benefit of the planning phase is that improvement teams begin their work with a clear understanding of their mission and an idea of what successful performance will look like. Their efforts are properly focused on how they will achieve the process vision and performance objectives set in place by senior management, not wasted on trying to determine what their objectives should be.

The planning phase of the Framework for Managing Process Improvement is supported, in part, by the following resources:

- F/MPI Management Briefing on Planning
- F/MPI Planning Assessment
- F/MPI Planning Tutorial
- F/MPI Performance Cell Tutorial
- F/MPI Planning Evaluation Worksheet
- Process Improvement Scoping Workshop
- Preparing For and Initiating Functional Process Improvement (FPI) Programs Guidebook.

The techniques (described in Section 10) most useful in this phase include the following:

5 Davenport, page 117.

- Brainstorming
- Nominal Group Technique
- Performance Cell Technique
- Strategic Benchmarking
- Quality Function Deployment
- SWOT Analysis
- Hoshin Planning
- Process Flow/Process Deployment Diagraming.

4.1 Step 1: Develop/Validate the Strategic Plan

While not every organizational unit (business unit) is required to develop a strategic plan, every unit is governed by a strategic plan. Subordinate strategic plans should always be a subset of higher authority strategic plans. In general, the lowest organizational level requiring a strategic plan is the business unit or functional area. Below this point, annual business planning is sufficient.

The strategic plan defines what an organization is all about (mission and vision), whom it will serve (customers and other stakeholders), what needs it will fulfill (products and services), how well it will perform (objectives and goals), and under what terms it will operate (values and beliefs). Strategic planning establishes the external boundaries of the enterprise with respect to the environment in which it operates. The external environment is comprised of several factors as shown in Figure 4-1:

- Socio-economic
- Geopolitical
- Technological
- Markets and Competition.

The strategic plan is developed by considering the interrelationships of mission, customer base requirements, and environment with respect to potential organizational performance. When there is a gap between present and potential performance, an improvement effort may be required to close the gap. The requirements of the improvement effort are expressed in terms of breakthrough objectives. The strategic plan indicates the dimensions of the improvement project, not the means.

Most strategic planning requirements call for a minimum planning horizon of three to five years, although ten years is not uncommon. Considering that radical reengineering projects may take two to three years to complete, and the life cycle of the improved process is five to seven years, it is clear

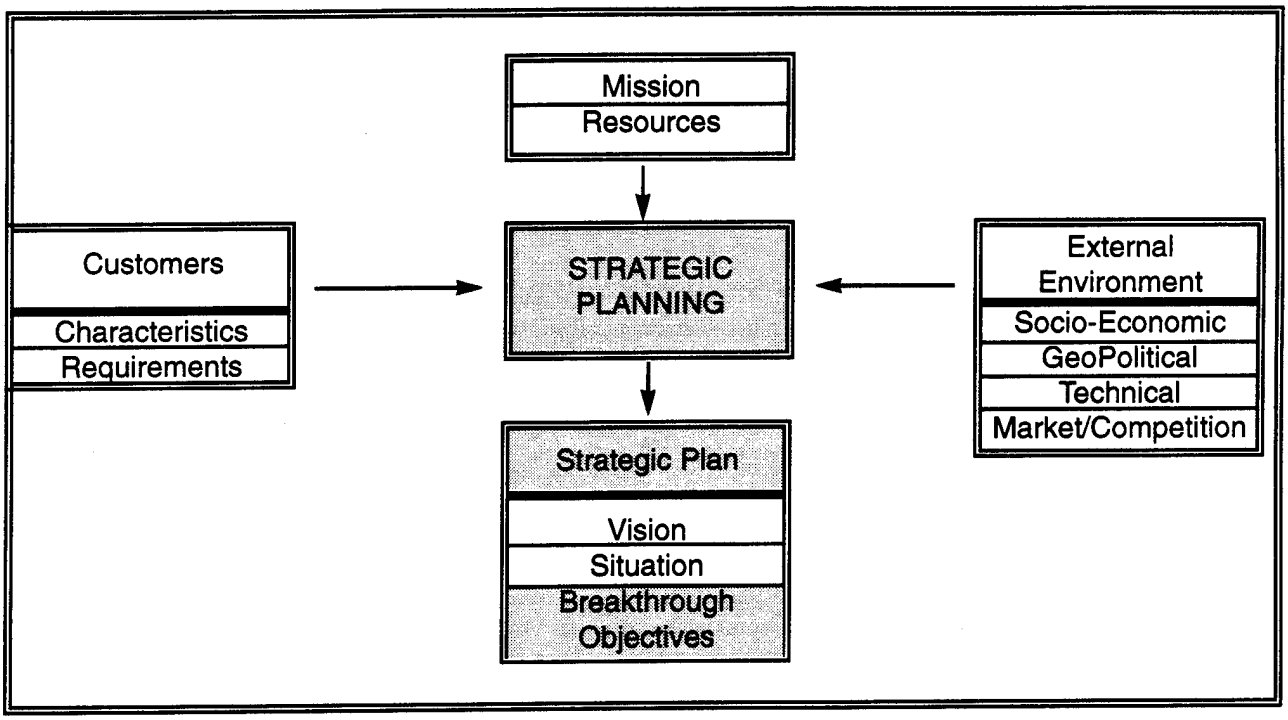

Figure 4-1. The Strategic Planning Environment

that the strategic plan should be long-range in nature. Of course, strategic plans must be revisited and updated every year to capture changes in mission, customer requirements, and the external environment.

The principal deliverable in the strategic planning step is the strategic plan itself. This step is considered complete once the strategic plan has been reviewed and approved by higher authority. The F/MPI Abstract for Step 1 provides a complete overview of the characteristics of the step in the methodology. The F/MPI Planning Tutorial contains a complete description of the contents of the strategic plan.

The following tasks are performed in the strategic planning step:

- Develop/validate the organizational articles of faith.
- Identify major customer groupings and general customer requirements.
- Conduct strategic benchmarking to establish performance targets.
- Conduct SWOT analysis
- Identify core competencies.
- Determine high-level customer service requirements.
- Prepare breakthrough objectives.
- Identify performance measures.
- Document the strategic plan.
- Review and approve the strategic plan.

4.1.1 Develop/Validate Mission, Vision Statement, Values, and Beliefs. Every organizational unit must be guided by a mission statement that defines why the organization exists, and what it must do to justify its existence. Everyone must understand the mission because it is the basis for decision making within the organization.

Every organization should have a vision statement. Vision is the framework that guides those choices that determine the nature and direction of an organization. It is what an organization *wants to be*.[6] Every decision and every action taken in the organization supports either the mission or the vision, or they are irrelevant.

Mission and vision are organizational attributes. An organization must also have a written statement of values and beliefs that are cultural attributes. Values and beliefs govern conduct. They establish the ethical and moral basis for all decision making within the organization. They define the lines that managers and employees will not cross in times of adversity. Caution: do not articulate values and beliefs that cannot or will not stand in the face of adversity.

Along with the process vision and improvement objectives (to be discussed later), this task establishes a foundation for all process improvement efforts. Process improvement efforts must support mission, be guided by vision, and sustain values and beliefs.

This task is usually performed in a facilitated workshop setting by senior level executives using brainstorming and nominal group techniques. The final deliverable should be expressed in one page of text—at most, two. Every process improvement workshop and activity thereafter should begin with a reaffirmation of these principles.

4.1.2 Identify Major Customer Groupings. The next task is to identify and categorize the customer groupings that the organizational unit serves or intends to serve. While the interests of all stakeholders in the organization must be accounted for, the starting point is to determine who the customers are. Without a clear understanding of customers and their general needs, no other stakeholder interests can be served.

Like mission and vision, a knowledge of customers is fundamental to decision making within the organization. Every decision either serves customer interests in some way, directly or indirectly, or it is irrelevant. Customer identification is also the starting point for process improvement efforts. Without a customer focus, process improvement efforts are destined to be futile.

6 *Vision in Action*, Benjamin B. Tregoe, et al., Simon & Schuster, 1989.

The more that is known about customers, individually or as groups, the more effective will be the organization's strategic planning and, eventually, process improvement efforts. In private-sector enterprises, technology is making it possible to evaluate and understand individual customer needs, and customize services to fit those individual needs. In public-sector enterprises, this level of precision is neither practical nor necessary.

This task is usually performed in a workshop setting by functional managers who are supported by research, surveys, questionnaires, and interview results. The specific data collected on customer groups depends heavily on the mission of the organizational unit and the nature of the products and services it produces. However, there should be a defined purpose for every item of data collected.

4.1.3 Conduct Strategic Benchmarking. Strategic benchmarking is now a fundamental component of strategic planning and is absolutely necessary for the task of constructing a process vision. Strategic benchmarking is the basis for setting performance targets for processes based on discovering what other organizations with like processes, products or services, and similar customer constituencies have done.

Strategic benchmarking provides a breath of fresh air to counteract the stagnation of only looking within the organization for process improvement ideas and performance targets. It is quite possible that the results of strategic benchmarking may indicate a need to revisit the organization's vision statement, which may look puny when compared to what others are accomplishing at present.

The technique of strategic benchmarking is well documented in the literature. A complete and rewarding strategic benchmarking program will take from three to six months to complete, although it can be done in parallel with other methodology tasks and steps. Strategic benchmarking is usually done on a peer-to-peer basis meaning that the senior executives in the benchmarking organization meet with senior executives in the target organizations; and junior managers with junior managers. The best results are obtained when the senior executive in the business unit writing the strategic plan is a full participant in the benchmarking program.

The final outcome of a strategic benchmark program is a full report of the objectives of the benchmark, the results obtained, and the analysis of those results. A typical benchmark report will be from 25 to 50 pages. It should be provided as input to process improvement teams.

4.1.4 Conduct Strength/Weakness/Opportunity/ Threat (SWOT) Analysis. Once an organization has articulated it mission, vision, values, and beliefs, understands who its customers are and their general needs, and has looked outward for ideas and inspiration, it is ready to analyze its situation with respect to the environment in which it operates. This is called a *SWOT* analysis, which is the acronym for the areas that are studied. The results of the analysis are used to develop breakthrough objectives in the strategic plan, business plans, and process improvement plans. Combined with the results of strategic benchmarking, this analysis is all that is required to establish process performance gaps, which, along with performance measures, are the essential input to process improvement projects.

SWOT analysis is usually performed in a workshop environment by functional managers assisted by staff analysts who have collected meaningful data on environmental factors, statistics, and measures. Strengths and weaknesses supply the basis for understanding how the organization can best respond to probable or potential opportunity and threat factors that exist in the external environment. Long a mainstay in military planning, SWOT is equally valuable as a planning technique for business-type processes. While the geopolitical factor is most important in military planning, the technical factor is often the most critical in non-military planning

4.1.5 Identify Core Competencies. Core competencies are those things that the organization does best; they are in a sense the capabilities that define the organization. Core competencies directly relate to mission and customer service and are those processes and functions which could not be realistically outsourced without substantially

weakening the organization. SWOT analysis combined with strategic benchmarking helps to crystalize just which functions and processes make up the core business.

Recognizing and defining core competencies are crucial because process improvement efforts should focus on them first and foremost. If the core competency of an organization is outbound logistics, that should be the focus of process redesign and process reengineering efforts. Other supporting processes should be subject only to streamlining and continuous improvement efforts until the core processes are *world class*.

This task is a continuation of SWOT analysis and is best performed in a workshop environment. Strategic benchmarking projects should also focus on core competencies so that the organization has a basis for evaluating status with respect to other organizations with similar processes and identifying performance gaps that need attention in process improvement projects.

4.1.6 Determine High-Level Customer Requirements. With inputs from the results of the tasks described above, the organizational unit is ready to identify the specific product and service needs of its customers. This analysis will provide the basis for detailed customer requirements analysis performed during business planning and in process improvement projects. It is important that senior managers participate in this task so that there is no misunderstanding of how all of the elements of the strategic plan fit together. When this task is complete, the organization will have a firm foundation for defining a program of process management and process improvement that everyone in the organization can understand and support. From this point on, there is a well-defined context for leadership and decision making.

Quality function deployment (QFD) also known as *The Voice of the Customer* is an excellent technique for capturing customer needs, requirements, and desires in a form that can be readily used to drive improvement projects. This technique can consolidate all of the inputs gained from customer surveys, questionnaires, interviews, focus groups, on-site tours and inspections, as well as the data resulting from brainstorming and historical research.

This task can be scheduled to coincide with strategic benchmarking because both usually take the same amount of calendar time to complete. The results produced by these techniques are complementary with respect to defining breakthrough performance objectives.

4.1.7 Prepare Breakthrough Objectives. While the results of strategic planning have many uses within the organization, one of the most important is to provide data that can be used to develop a series of breakthrough objectives that, if accomplished, move the organization toward its vision or desired future state. Breakthrough objectives along with process vision (developed later in the methodology), and performance measures (developed next in the methodology) are the only necessary inputs to process improvement. With these data, process improvement teams can work out the details of how to achieve the breakthrough objectives.

A breakthrough objective is one that describes a quantum leap in one or more performance areas. If a logistics process averages two weeks to deliver a spare part, a breakthrough objective may be to reduce that time to one or two days. Entire processes, companies, and even industries have been established on this principle (Automated Teller Machines, Federal Express, and personal computers are respective examples).

Because breakthrough objectives are transforming from an organizational standpoint, they must be developed with or by the most senior leaders in the organization. Breakthrough objectives can only be accomplished as top-down initiatives. The impacts on every facet of the organization are profound, and the risks associated with implementing them are substantial. Also for the same reasons, there can be no more than one to three breakthrough objectives in the strategic plan. The strategic plan should not be cluttered with minor or incremental objectives best specified in lower level business or operational plans.

Breakthrough objectives are developed in a workshop environment using the outputs from the previous strategic planning tasks. The most important input to this workshop is usually the strategic benchmarking report, which often establishes the basis or credibility for forming a breakthrough objective.

4.1.8 Identify Performance Measures. Without measures, there is no way to define, monitor, or manage processes or process improvement. There is no accountability for results because there is no way to determine results. Every strategic and business objective, whether it applies to maintaining the status quo, incrementally improving a process, or radical process innovation is defined in terms of measures. Four categories of measures that must be defined for every strategic or business plan objective:

- Fitness for Purpose (FFP) provides a means of measuring the effectiveness of a process or product with respect to stakeholder interests.
- Conformance to Standard (CTS) provides a means of measuring the quality aspects of a process or product.
- Process Time Measures (PTM) quantify the response and cycle time characteristics of a process.
- Process Cost Measures (C$T) weigh the efficiency and productivity characteristics of a process.

Furthermore, each measure category should be applied to each of the four categories of process stakeholders as appropriate.

The process stakeholders are defined in Figure 2-2 and listed below:

- Customers
- Higher Authority
- Suppliers
- Resource Providers

This means that there are 16 possible measurement categories for a process, each of which will have more or less relevance or importance based on the requirements in the strategic plan and the nature of the process itself. The performance cell technique can be used to establish measures for both process management and process improvement. Please see Section 10 in this guidebook and the F/MPI Performance Cell Tutorial for more information on performance cells.

Whether the performance cell technique or other means are used to define performance measures, performance targets, and critical success factors, strategic planning is not complete until they are defined. This is critically important for the breakthrough objectives defined in the plan. Performance measures should be developed off-line by planning team members and reviewed and approved during a workshop session.

4.1.9 Document the Strategic Plan. Once all of the above tasks have been completed, the next task is to document the results of strategic planning in the form of the strategic plan itself. A suggested table of contents for the strategic plan can be found in the F/MPI Planning Tutorial. The essence of a strategic plan is substance and clarity, not volume. A complete strategic plan for a typical organizational unit should take no more than ten pages of text supplemented with charts, diagrams, and drawings wherever meaningful. Backup and substantiating data should be maintained in separate files for reference and for use in the succeeding planning cycles.

4.1.10 Review and Approve the Strategic Plan. The strategic plan is subject to a final review and approval process by organizational management and higher authority. If the strategic plan is a valid subset of higher authority strategic plans, and if the senior leadership participated in the planning process as recommended, it should not take long to secure approval. Once the plan is approved, it should be briefed in whole or in part to everyone in the organization. Only to the extent that everyone understands the strategic objectives of the organization can they direct their actions to fulfilling it.

This concludes the strategic planning step of the F/MPI methodology. The next step in the planning phase is to develop and/or validate the business systems plan.

4.2 Step 2: Develop/Validate the Business Systems Plan

The Business Systems Planning (BSP) methodology was introduced by IBM in 1970 as a way to incorporate organizational or business strategy into information systems strategy.[7] Many derivatives of the BSP methodology are in use in DoD components. Functional managers contemplating process improvement efforts will find that performing or updating a business or information systems planning study provides valuable, time-saving information that will enhance process improvement efforts.

Business systems planning is concerned with understanding the inter-relationships of process, organization, data, application (functional) systems, and geotechnical computer and data communications platforms as they relate to strategic and business objectives, goals, and strategies. These entities already exist in DoD component organizations; and process improvement efforts should understand how these structures may enable or constrain modifications to the existing information infrastructure.

The objectives of a business systems planning study are to:

- Determine information systems priorities
- Plan long-lived information systems based on enduring business processes
- Manage systems resources to support business objectives
- Assign systems resources to high-return projects
- Improve relationships between functional and technical organizational units.

The benefits of conducting a study include:

- Coordination of process improvement plans with technical improvement plans
- Assurance that the data, application, and geotechnical architectures are aligned with functional process requirements
- Directed information systems strategies
- Action plans and resource requirements for information systems implementation strategies.

Because business systems planning studies are performed (or reviewed and updated) prior to launching process improvement projects, the principal contribution of such a study is to establish a well-documented baseline for systems architectures as an input to process improvement efforts. Later, as the process improvement project enters the Enterprise Engineering Phase, these architectures will be redesigned to accommodate the needs of the redesigned process. When the systems architectures are redesigned, technical staff can ensure that systems improvements in support of a redesign process are properly integrated into the existing information systems infrastructure in a way that does not adversely affect other functional processes.

It should be noted that business systems planning methods were developed long before the concept of process improvement came about. Now that functional managers are expected to take the lead in directing information systems support, business systems planning is reduced to a supporting role in process improvement efforts. This does not invalidate its importance in ensuring a stable and well-functioning information systems infrastructure.

The following tasks are performed in the business systems planning step:

- Review/validate the current business systems planning architectures
- Identify major business processes

7 *Information Engineering Concepts Volume I*, Kenmore S. Brathwaite, CRC Press, 1992.

- Develop the business process/ organizational map
- Prepare/validate information systems architectures
- Review and approve the business systems plan.

This guidebook provides an overview of the business systems planning methodology. Please contact your technical support organization for further information of the specific methods used by them to accomplish these tasks.

4.2.1 Review/Validate Current Business Systems Plan. Most DoD components have an existing business systems plan that should be reviewed and validated. It is critically important that this review take the DoD Enterprise Model into consideration. Eventually, all functional and business processes, and supporting information systems will need to conform to this overarching view of the DoD enterprise.

During the review, elements of the business systems plan that do not conform to the DoD Enterprise Model, or that are out of date, or that may be affected by potential process improvement projects should be noted and scheduled for corrective action. If the existing business systems planning study is over five years old, it will be worth the investment to conduct another study. Because business systems planning is no longer the primary engine of driving improvement projects, such a study should be doable in less than one calendar month.

4.2.2 Identify Major Business Processes. The first objective of a business systems planning study is to develop or validate a portfolio of current business or functional processes. Processes are determined by interview and research techniques independent of process improvement efforts to ensure that all functional managers in an organizational unit agree as to what business processes exist. At this time, processes can be given an acceptable name and decomposed into valid subprocesses. This is also an excellent time to bring each component's processes into alignment with the DoD Enterprise Model.

The strategic plan completed in the previous task is the starting point for process identification. Any mission changes or significant changes with respect to customer service may result in the need for new processes.

The rules for identifying processes include the following:

- Processes are independent of organizational structure.
- Processes are significant to the nature and purpose of the enterprise.
- The naming convention for processes are *verb-name* such as Design Project or Provide Spare Parts.
- Well-defined processes can be both aggregated or disaggregated, which is to say that they have a logical structure.
- Process redundancy is to be avoided.

At this time, breakthrough objectives in the strategic plan should be thoroughly studied to determine if their accomplishment may require any modifications to the portfolio of processes for the component. It is quite possible that a radical improvement called for by the strategic plan may call for new levels of cross-functional process integration, or eliminate some processes or subprocesses. Understanding potential impacts resulting from strategic planning will help guide the completion of the next task.

4.2.3 Develop Process Map. A process map or matrix shows the relationships between business processes and organizational (functional) entities. Figure 4-2 illustrates such a matrix.

With the Process v Organizational Matrix, it is easy to identify functional units that should be part of any process improvement effort. If the Plan Project process is to be reengineered, the Planning Division and the Engineering Division must be included in the cross-functional team, and the Construction Division should at least be part of the review team for process improvement deliverables.

\ Functional Process \	Plan Division	Engineer Division	Construct Division	Operate Division
Conduct Study	✱	○		
Plan Project	✱	☒	☒	
Design Project	☒	✱	☒	
Construct Project		☒	✱	☒
Operate Project				✱
Maintain Project		☒	☒	✱

✱ = Primary Responsibility, ☒ = Major Involvement, ○ = Minor Involvement

Figure 4-2. Process v Organization Matrix

4.2.4 Prepare/Validate Architectures. Business systems planning continues with the preparation and/or validation of several other matrices:

- Process v Data Class
- Process v Automated Information System (AIS)
- AIS v Geotechnical Platforms
- Business Strategy (Breakthrough Objective) v Process
- Business Strategy (Breakthrough Objective) v Organization
- Business Strategy (Breakthrough Objective) v Data Class.

The use of matrices can help ensure that all elements of process improvement are understood in terms of their interrelationships. Some of the specific uses include the following:

- Understanding how data is shared throughout the organization and between business processes
- Illustrating process and information system interdependencies
- Determining the relative importance of data with respect to business strategies
- Identifying organizational responsibilities and ensuring optimum participation in cross-functional process improvement projects
- Understanding legacy and migration system impacts on process improvement efforts.

In summary, business systems planning provides an excellent medium for synchronizing the interests of functional users with those in the technical support organizations. The matrices and other deliverables inherent in business systems planning ensure clarity and precision of terminology and language, which are critical to process improvement project success. The most important deliverable is the data architecture, which is the basis for controlling cross-functional operation of end-to-end business processes.

4.2.5 Prepare, Review and Approve the Business Systems Plan. The final task in this step is to prepare the formal documents for the business systems planning study. These documents need not be as extensive as required in the BSP methodology now that the process improvement methodology supplants many of the functions of BSP.

A reasonable business systems planning study report will have the following sections:

- Executive summary
- Background section explaining the objectives of the study and the methods used
- Study perspective highlighting the objectives expressed in the strategic plan, especially the breakthrough objectives
- Findings with respect to information systems needs, requirements, and opportunities
- Potential constraints based on the information systems infrastructure that may hinder process improvement efforts and suggested means of dealing with these constraints
- Information systems strategies and recommendations based on the implications of the strategic plan
- High-level architectures and matrices for use in process improvement projects
- Appendices of detailed architectures including the application portfolio and data structures.

The business systems plan should be reviewed and approved by all functional managers in the organizational units covered by the plan. Once approved, this plan, along with the strategic plan are passed on to the next step in the process improvement methodology: business planning.

4.3 Step 3: Develop/Validate the Business Plan

Business planning proceeds from strategic planning. While the strategic plan establishes broad objectives and goals over a long-range planning horizon, the business plan specifies detailed objectives that can be accomplished within a single business year cycle. While the strategic plan is complete once the objectives, goals, and broad strategies are in place, the business plan always proceeds to the action or implementation plan stage for all objectives. The strategic plan is reviewed and updated annually, but the business plan is monitored and measured on a monthly or quarterly basis. While the strategic plan is constructed on the basis of explicitly stated assumptions about what will happen or not happen outside the organization (the environment), the business plan is developed as if the assumptions in the strategic plan were facts.

The purpose of the annual business plan is to concentrate all business unit activities on delivering products and services to an established base of internal and/or external customers; and satisfying other defined stakeholder requirements. The business plan should focus the consumption of resources on producing required and desired process outcomes for all business processes served by the business unit. The business plan specifies what needs to be done by the business unit and assigns responsibilities, performance measures, and schedules for completing work.

The business plan is designed to help the business unit accomplish three broad objectives:

- Raise the business unit to a higher level of performance with respect to its purpose and mission
- Provide a framework for making better decisions with respect to current assigned operating responsibilities
- Enable managers and employees to be more proactive in managing the events that may affect the business unit.

There are three components in a business plan:

- Program Plan
- Operations Plan (Process Management Plan)
- Process Improvement Plan.

The program plan is oriented to a function rather than to a process. It sets forth the policies, programs, procedures, standards and training requirements that will be in force over the planning period for the functional unit. It also contains the resource plan, which includes staffing, facilities, equipment, materials, contracting, and funding requirements. The program plan must be synchronized with the other two components in the business plan that are oriented to processes.

The operations plan is concerned with the management of processes on a day-to-day basis. It establishes standards of performance, based on key indicators and measures, and assigns responsibilities for maintaining process performance within allowable variances. The operations plan may also include continuous process improvement objectives.

The process improvement plan is concerned entirely with the breakthrough (process improvement) objectives specified in the strategic plan. This is the part of the business plan that specifies how the breakthrough objectives are going to be accomplished.

Both the operations and the improvement plans are cross-functional in nature. This means that business planning sets the stage for process management and improvement. Once the business plan is in place, each functional unit knows its role in process management and improvement, and how functional controls and resources must be aligned in support of processes.

Figure 4-3 shows the relationships between strategic and business planning and the sources for

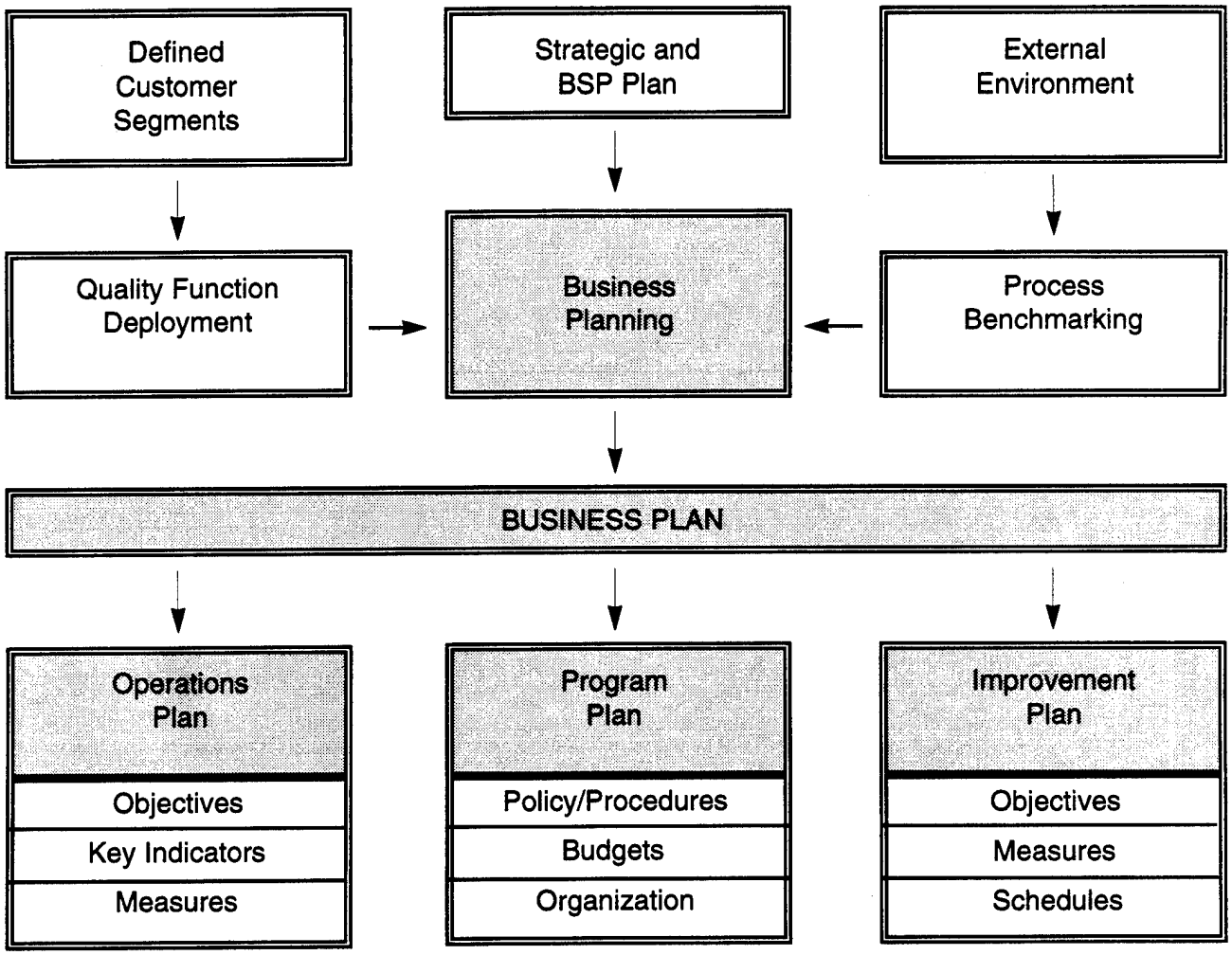

Figure 4-3. The Business Planning Process

constructing a sound business plan. Along with the strategic plan itself (and business systems plan), the other two primary inputs to business planning are customer requirements and additional information obtained from environmental analysis. Customer needs and requirements can be obtained in many ways, but using Quality Function Deployment (QFD) is a proven technique for generating and consolidating customer requirements in the most useful manner. (See Section 10 for more information on QFD.) The environmental analysis in support of business planning should focus on searching for best business practices and innovative uses of technology.

Business planning is best conducted in a workshop environment taking advantage of the combined knowledge, skill, and experience of functional and process managers, professionals, and staff. QFD and best practices benchmarking help ensure that planning teams are not so inwardly focused that they miss opportunities for innovative process improvement.

Business planning should take no more than five days, not including the time it takes to conduct best practices benchmarking or survey and interview customers. These activities should be performed in advance of the planning workshops.

The following tasks are performed in the business planning step:

- Review strategic and business systems planning materials
- Develop preliminary process notebook
- Conduct detailed customer requirements analysis
- Categorize process improvement projects
- Develop the business plan report
- Review and approve business plans.

See the F/MPI Planning Tutorial for information on business planning. Also review the Hoshin planning technique in Section 10 of this guide for more information.

4.3.1 Review Strategic and Business Systems Plans. The strategic and business systems planning outputs are the starting point for business planning. It is vital that the resulting business plan support the requirements and objectives established by senior leadership. The status of each process supported by the functional unit doing business planning should be reviewed to determine its appropriate emphasis in the business plan. All strategic objectives should be analyzed to determine the role the functional unit may have in achieving them. If there are multiple objectives, they should be prioritized, especially if there is doubt that the necessary resources will be available to accomplish all of them.

A matrix is an excellent technique for organizing this type of information. Use matrices to show the relationships of objectives by process and objectives by functional element. Potential cross-functional interactions can be recognized and recorded in this task.

4.3.2 Develop Preliminary Process Notebook. A process is a critical entity within the enterprise. Much that can be known about a process should be documented for use by process managers and process improvement teams. Establishing a process notebook is one way of doing this. A process notebook can be as simple as a word-processed text document, or as robust as a multimedia file with text, graphics, tables, spreadsheet data, and even audio and video segments—all referring to process characteristics. It can also function as an historical record of all process improvement actions taken, which can facilitate future process improvement actions. The type of data that can be maintained in the process notebook may include the following:

- Process description supported by charts and diagrams
- Process deployment map showing functional relationships
- Stakeholder identification and interactions with the process
- Descriptions of output products and services
- Critical success factors and key results areas
- Existing measures
- Estimated cycle time for major outputs (models and tables)
- Estimated costs for major outputs (models and spreadsheets)

- Process personnel descriptions (duties and responsibilities)
- Deployed technology (configuration maps, models, and architectures)
- Known process strengths and weaknesses
- Known product/service strengths and weaknesses
- Current improvement objectives and status
- Relevant directives and guidance
- Existing (in-house) training programs.

4.3.3 Conduct Detailed Customer Requirements Analysis. The next task is to construct a detailed customer requirements matrix for the process based on the responsibilities of the functional unit. If there are no current baseline models for the process, it will be difficult to determine requirements for internal customers so the results obtained will only be preliminary.

Techniques that can be used to capture this information include surveys, questionnaires, interviews, focus groups, brainstorming, site visits, quality functional deployment and process benchmarking. As information is gathered and analyzed, it should be summarized in the process notebook.

At the conclusion of this task, the following data should be recorded:

- Customer/process matrix showing all internal and external customers
- Customer/product and service matrix
- Requirements by product and service
- Stakeholder interests.

This information will be used to establish process management and process improvement requirements and objectives in the business plan.

4.3.4 Categorize Process Improvement Projects. Process improvement projects can be organized into one of three levels as described in Section 2 of this guide. It is important that as process improvement actions or projects are commissioned, the general scope or level of process improvement be well-understood by the improvement teams. Experience has shown that it is best to confine an improvement team to only one level of improvement project. This means, for instance, that minor incremental improvements should not be attempted during a process reengineering effort. Such minor changes can conflict with the objectives of the reengineering effort and confuse the staff.

All proposed process improvement actions and projects should be categorized in the business plan into one of three levels:

- Continuous Process Improvement
- Process Redesign
- Process Reengineering.

4.3.5 Develop Business Plan. The next task is to develop the actual business plan. All the data and information needed to do this should be available as a result of performing the previous steps and tasks in the planning phase of the methodology. If steps or tasks were omitted, it will be much more difficult to achieve a business plan that accomplishes the general objectives of planning listed in Section 4.3. The business plan will contain three major components, as described in the following subsections.

4.3.5.1 Program plan component. The purpose of this component is to organize the business unit for action. This part of the business plan has a functional orientation. The actions themselves to be performed by the business unit will be developed in the other two components of the business plan: this component provides the foundation for carrying out the objectives of the other two components. The general contents of the program plan are listed here and more fully described in the F/MPI Planning Tutorial.

- Functional objectives and goals (improving the functional unit)
- Program Description (related to each functional objective)
- Milestones for each functional objective
- Functional Organizational Structure (including staffing)
- Budgets and Funding
- Functional Policies and Practices

- Functional Procedures
- Standards of Excellence and Performance.

4.3.5.2 Operations plan component. The purpose of this component is to set a performance management plan in place for all processes that are not scheduled for process improvement (other than continuous process improvement, which should always be in place.) The operations plan (which can also be called the process management plan) identifies the critical success factors, measures, and allowable variances for all processes. It assigns responsibilities for all process activities and includes contingency plans to be activated whenever process performance is out of variance. The F/MPI Planning Tutorial explains in detail how to construct the operations plan.

4.3.5.3 Process Improvement Plan. The process improvement plan is the most important component of the business plan because it establishes how the strategic breakthrough objectives are going to be accomplished. The Hoshin planning technique is recommended for constructing this part of the plan. With Hoshin planning, every breakthrough objective is decomposed into enabling objectives until it is possible to construct an implementation plan with tasks, schedules, milestones, resources, and assignments. Hoshin planning combines the best practices of management by objective and project management. It is well suited for planning improvement projects.

It is important to note that the process improvement plan is concerned with WHAT must be accomplished to fulfill the strategic breakthrough objectives, not HOW it is going to be done. The HOW of process improvement is dealt with in the next phase of the improvement methodology, process reengineering. The F/MPI Planning Tutorial explains in detail how to construct the improvement plan. In general, the following data are included in the plan:

- *Candidate Process Owner(s).* There should be one executive process owner, sponsor, or proponent for the overall effort and representatives from each of the major functional units who will participate in the improvement project.

- *Candidate Project Managers.* Once the process improvement project is authorized, there will need to be an assigned project manager. In this task, suitable project managers can be identified.

- *Objective Decomposition.* The breakthrough objective from the strategic plan must be broken down into its enabling objectives. Each objective has a quantified goal, strategy for implementation, performance measure, and responsible person. The decomposition process continues until it is possible to construct an implementation plan (generally after two or three levels of decomposition.)

- *Implementation Deployment Plan.* The deployment plan shows the participation of the functional units in fulfilling the requirements of the objective. It is the basis for setting up cross-functional teams.

- *Implementation Action Plan.* The action plan sets the schedule for completing the objectives. With Hoshin planning, as the objectives at each level are accomplished, the higher level objective is automatically accomplished. Also, there is traceability from the lowest-level action through the enabling objectives all the way to the strategic breakthrough objective.

It is usually necessary to adjust the other components of the business plan after completing this component. Before business planning can be considered complete, all three components should be mutually complementary and supporting.

4.3.6 Review and Approve Business Plans. The final task in this step is to complete the documentation for the business plan and submit it to

higher authority for review and approval. The approval of the business plan is facilitated when functional units concerned with a single process have worked together to ensure that the plans submitted by each functional element are compatible with respect to shared processes. The business planning technique presented in this guide supports the concept of process management *within* a functional organizational structure.

It is possible to adopt process management principles while still retaining a functional organizational structure providing planning is not done in isolation. Functional units are still important because it is in the functional unit that a body of expertise, standards of performance, skill development, and resources can best be tapped and managed.

4.4 Step 4: Construct Performance Cells

Traditional planning techniques, based on the functional (hierarchical) organizational model, are not sufficiently robust to generate the type of planning information needed for performance-based management. This is because traditional planning techniques take a top-down hierarchical view of the organization, and express all planning objectives and goals from the point of view of corporate management. Other stakeholder interests are only accounted for incidentally and, even then, not in any coordinated or integrated fashion. Traditional planning techniques can give process improvement teams vital information concerning strategic and business objectives, but typically do not express those objectives in terms of performance targets. Nor do these plans typically capture baseline performance data for use in performance gap analysis.

The Performance Cell Technique (PCT) is designed to provide a bridge that links business planning, process identification, and process improvement as shown in Figure 4-4. Once established in an organization, PCT furnishes critical performance data (baseline and target) that together with business planning improvement objectives function as a *charter* for process improvement action teams. Please refer to the

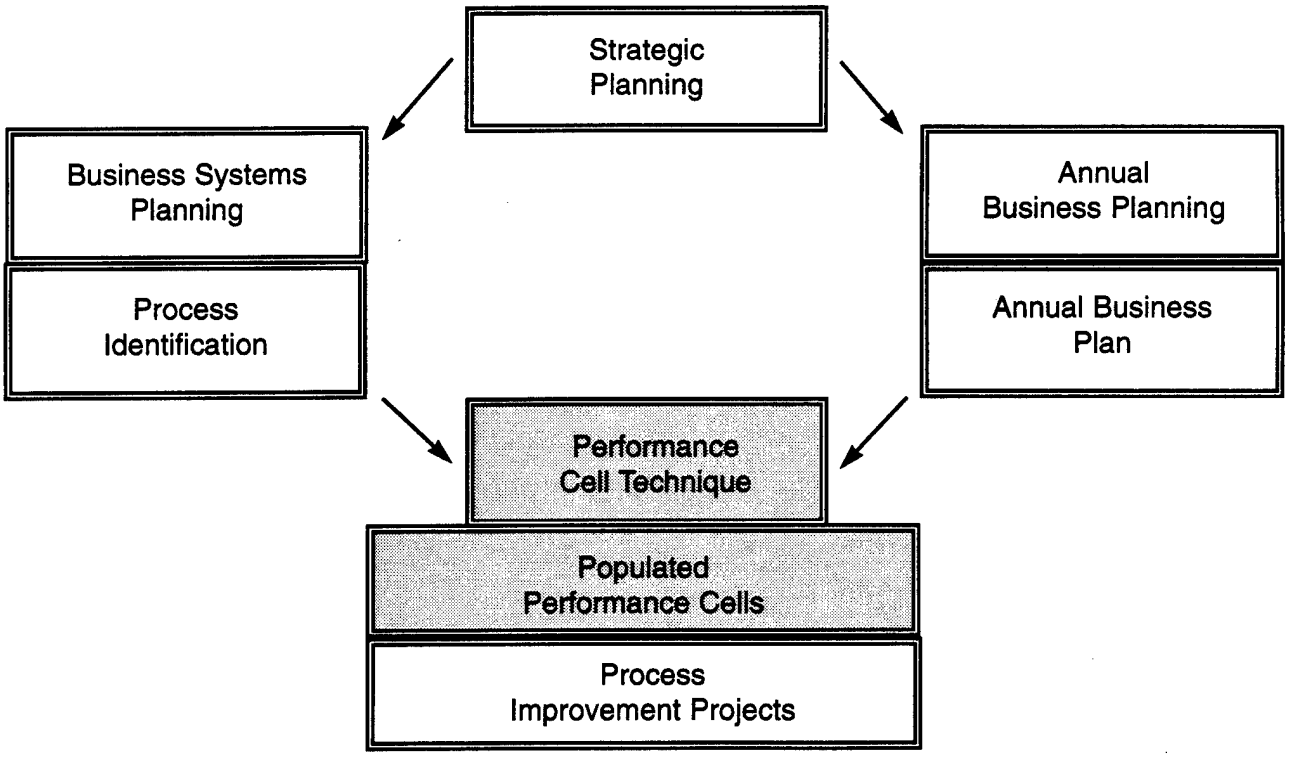

Figure 4-4. Performance Cell Technique Positioning

F/MPI Performance Cell Tutorial for detailed information on how to employ the performance cell technique.

The following tasks are performed in this step:

- Select performance cell by process
- Assign responsibility for performance cell development
- Develop performance cells
- Review and approve the performance cell document.

4.4.1 Select Performance Cell Measures by Process. Every process must recognize and satisfy stakeholder interests. Most of the literature on process improvement stresses satisfying *customer* requirements, which, of course, is the focus of process management and improvement. But there are other stakeholders in the process who have legitimate claims on process performance. For instance, in the private sector, a company that satisfied its customers but not its shareholders would not be considered a successful company. In the public sector, processes must satisfy the citizens who pay for the process as well as those who receive services.

There are four principal stakeholders of interest:

- *Customers* are the recipient of output products and services produced by the process. Customers are the focus of process improvement efforts.

- *Suppliers* provide the input data and materials used by the process to produce outputs. In the information age, suppliers are best treated as business partners with the common objective of satisfying process objectives. Together, customers and suppliers make up a value-chain consisting of value-added activities that progressively transform inputs into useful outputs.

- *Higher authorities* set the controls on a process. Controls consist of policies, directives, procedures, requirements, product standards, performance standards, budgets, and other constraints on process performance.

- *Resource providers* make available the facilities, equipment, people, and funds that enable the process to transform inputs into higher-value outputs. Together, higher authorities and resource providers make up a control-chain consisting of enablers of and constraints on process performance.

Process management is concerned with optimizing the value-chain; functional management is concerned with optimizing the control-chain. Process improvement principles provide an opportunity to optimize both simultaneously.

There are four categories of process measures:

- Fitness for purpose measures how well a product or service satisfies customer requirements.

- Conformity to standard measures how well a product or service satisfies standards of performance norms.

- Process time measures how responsive a process is to customer requests and how many outputs it can deliver in a given unit of time.

- Process costs measure how efficient the process is in its consumption of resources.

If we build a matrix of process stakeholders vis-à-vis process measures, we will have 16 cells in the matrix, each of which relates a measure to a stakeholder. The first task in this step is to determine which of the 16 performance cells are relevant for each process identified by business systems planning.

4.4.2 Assign Responsibility for Performance Cell Development. The second task is to assign responsibility for performance cell development for each process. Identifying performance cells

measures is a non-trivial task because each measure must be relevant to a stakeholder's interest and there must be a way for the process to generate measurable data. This means that the person selected to develop performance cells must be both experienced in the process and able to communicate well with stakeholders in the process.

4.4.3 Develop Performance Cells. The next task is to populate the performance cells. Appendix A of the F/MPI Performance Cell Tutorial contains guidance on developing measures for each of the 16 performance cells. Figure 4-5 illustrates a completed performance cell. The specific contents of the performance cell depend heavily on the process itself and the expectations of the indicated stakeholder. But once the task is completed, process managers and process improvement teams will have specific objectives to guide their process management and process improvement efforts.

Specific measures can include baseline or current measures, target or objective measures based on management expectations, and/or measures based on specific scenarios (scenario analysis). For example, a logistics process would have different performance measure objectives in peacetime than in wartime. Performance cells provide a means of recording this kind of data.

4.4.4 Review and Approve Performance Cells. Once a set of 16 performance cells for each process has been developed, they should be submitted to all process managers for review and approval.

CUSTOMER/FITNESS FOR PURPOSE PERFORMANCE CELL 23			Priority: 3/16 Weight: 1.0
General Business Objective	We will strive to maximize the fitness for purpose of all our ouput products and services by working with our customers (process owners) to meet and exceed all customer requirements.		
Key Indicator	Annual Customer Satisfaction Survey		
Critical Success Factor	15%/year increase in Customer Product Utilization		
Principle Improvement Techniques	Competitive Benchmarking Quality Function Deployment		
Item/Measure	Unit of Measure	Baseline Performance	Target Performance
Output Volume	Units/Mon	4,500	6,000
Number of Customers	Units	45	50
Satisfaction Rating	Percent	77%	92%
Requests per Customer	Ratio	10	12
Courtesy Telecalls	#1 / Month	2	4
Est. Market Share	Percent	15%	25%
Est. Market Penetration	Percent	50%	50%

Figure 4-5. Performance Cell Example

Performance cells provide an excellent means of ensuring that all functional managers involved with a process have a common understanding of what constitutes superior process performance. Performance cells also assist in reducing the amount of subjectivity in process management and improvement by encouraging the development of specific measures that reflect total process performance, not just customer satisfaction (which is not sufficient in government sector processes.)

4.5 Step 5: Establish Process Improvement Project

This step is performed when the strategic plan has directed the formation of a process improvement project by virtue of including one or more breakthrough objectives. At this point, all of the information needed by a process improvement team has been recorded in the strategic plan, business systems plan, and annual business plan. If performance cells were constructed for the processes needing improvement, process improvement teams will also have specific performance objectives to guide their process improvement efforts.

When this step is completed, all planning activities will have been accomplished. This means process improvement teams will be ready to move to Phase 2 of the methodology, process reengineering. The following tasks are performed in this step, which when completed establish a process improvement project:

- Specify process improvement project
- Select and confirm a process manager and project manager
- Develop and/or validate the process deployment map
- Record functional management considerations
- Document the scope/mission/objectives of functional elements
- Select and train the cross-functional process improvement team
- Develop a preliminary process vision
- Develop the process improvement strategy
- Develop the project plan
- Review and approve the project plan.

4.5.1 Specify Process Improvement Project. A process improvement project is an expensive and risky undertaking. If the objective is true process reengineering, the project may extend for two years or more and consume not only funding resources, but also huge amounts of intellectual capital of people who otherwise would be doing something else. For these reasons, project improvement projects must be commissioned by higher authority based on the criticality of the breakthrough objectives in the strategic plan.

The process improvement project must be funded through the planning stage—this step. The chief output of this step is a project plan that will include complete process improvement project cost, time and staffing estimates with contingencies. The process improvement project (planning step) should be formally inaugurated with an assigned executive sponsor and a letter to proceed that specifies initial funding and planning objectives.

4.5.2 Select/Confirm Process and Project Manager. The first and most important decision that is made is the selection of the project manager. The project manager should be experienced in project management, knowledgeable of the process to be improved, and equipped with superlative communications and team skills. The F/MPI Project Manager's Guidebook contains a complete listing of the specific skills needed by a project manager and a complete catalogue of general project management duties and responsibilities.

4.5.3 Develop/Validate Process Deployment Map. The planning activities described above should have produced a process deployment map. This map must be reviewed and confirmed by the project manager because it will be the basis for staffing the project improvement team and coordinating all process improvement actions and communications. The process deployment map shows the relationship of the process to the functional elements that support the process. It also indicates the level of responsibility and involvement

of each functional element in the process. The process deployment map should be reproduced in wallchart form and posted in the project room for easy reference.

4.5.4 Identify Functional Management Considerations. One of the first duties of the project manager is to develop an understanding with each of the functional managers involved in the process. They should agree on the current status of the process with respect to strategic and business plans, and accept of the improvement objectives and goals described in the strategic and business plans. It is not enough that these plans have been reviewed and accepted by higher authority; they must also be endorsed by the process owners who are the managers of the functional units.

Each functional manager should understand and concur with the following:

- Process baseline status as indicated by performance cell measures or other means
- Validity of the process deployment map
- Assignment of improvement objectives with respect to the process
- Degree of participation required of the functional manager and a preliminary list of candidates for assignment to the improvement team
- The charter that launched the process improvement project
- The proposed method of designing the process improvement project—especially how communications will occur and project status will be reported
- Specific considerations expressed by the functional managers with respect to the process and the improvement project.

4.5.5 Document Scope/Mission/Objectives of Functional Elements. At this point, the project manager should be able to construct a statement of project improvement mission, scope and general objectives. It may even be possible at this point to document some or all of the performance measures that will be used to design the improvement project and measure its success. This will be especially true if the performance cell technique was used. Note that we recommend completion of this task before the actual process improvement team is formed, because the project manager should achieve this understanding with the functional managers to optimally staff the improvement project.

4.5.6 Select/Train Cross-Functional Process Improvement Team. At this point it is possible to select staff members to work on the process improvement plan. This must be done with the full cooperation and support of the functional managers, and with reference to the process deployment map. Staff members should be trained in process improvement skills including change management and technology deployment. The F/MPI Training Guide discusses the specific training requirements for this task.

Until the project plan has been reviewed and approved and resources are made available to continue the project, it is only necessary to have a small team of people who are highly knowledgeable of the process. These team members should be process and subprocess managers who understand both the outputs of the process and the primary customer groups who benefit from these outputs.

4.5.7 Develop a Preliminary Process Vision. This is a most important task in the improvement project planning step. In a workshop environment, project team members will endeavor to create the process vision that will ultimately guide all process improvement efforts.

The key activities in this task include the following:[8]

8 See Davenport, chapter 6, for a full discussion of process visioning.

- Assess existing business strategy (strategic and business plans) for process directions. This provides a foundation for constructing the process vision.

- Consult with process customers for performance objectives. This activity supplements the data collected in the process notebook and the performance cell descriptions for the process. If a process notebook was not constructed earlier in the methodology and/or performance cells were not developed, this step must supply all vital data.

- Conduct a benchmark program to develop or validate process performance targets and to discover innovative uses of technology to improve process performance (best practices.) Results of using the QFD technique should also be included in this activity.

- Formulate process improvement performance objectives. This activity validates the performance objectives developed in the process improvement component of the business plan. It should be remembered that functional managers constructed the business plan, and it is now necessary for the process improvement team to validate and/or revise these objectives based on the results of the activities above.

  It should also be remembered that process improvement itself is a highly iterative process, and it is always necessary to review and validate previous deliverables as new information is gained. This activity continues until this question can be answered to everyone's satisfaction: "What business objective is this process suppose to accomplish?"

- Develop process attributes. Process attributes are the specific strategies for accomplishing the process objective. They form the principles of process performance and/or the concept of operation. They include such categories as technology, people, delivery of service, supplier partnerships, and other stakeholder specifications. It is not necessary to determine how these attributes will be accomplished as that is a task in the process reengineering phase.

The final result of this task should be a short statement that summarizes the process vision. It must be written in less than a page and acceptable to all project team members and their functional sponsors.

4.5.8 Develop Process Improvement Strategy. Once the process vision has been established, the project team next works out the strategy for realizing the process vision. The strategy includes a series of actions that will be taken once the project plan is approved. If the process vision includes the use of innovative technology, the project team should develop a strategy for incorporating this technology in the process. If organizational enablers are needed to realize the process vision, the project team should address how they will proceed to make these organizational changes. The strategy should be high-level but sufficient for functional managers to understand the general approach that will be made in the process improvement project should it proceed to the next phase. In fact, the statement of strategy will be one of the determinants of project continuation.

4.5.9 Develop the Project Plan. Finally, the project plan itself is constructed. Everything that has been done to this point in the methodology and all of the data that have been gathered and analyzed are input for the project plan. The F/MPI Project Manager's Guide explains in detail how to draft the project plan, in general, it should include the following sections:

- Process vision including objectives, attributes, and strategies

- Statement of purpose describing the intended project, brief historical statement, authority for the project, and a summary of the time frame and estimated costs

- Benefits to be obtained in the project as they relate to the strategic and business plans, stakeholders, and performance measures
- Critical success factors for the project
- Project scope with respect to the DoD Enterprise Model
- Work breakdown structure showing the major tasks to be completed
- Organizational breakdown structure showing all functional participants
- Resource assignment matrix showing how the tasks in the work breakdown structure will be resourced
- Schedules and milestones in Critical Path format
- Detailed budgets and cost estimates
- Resource allocation plan including labor, contract requirements, facilities, and equipment
- Project management plan showing how the project will be managed, how problems and issues will be resolved, the degree of project communications and status reporting, and document management.

The project management plan should be the basis for the decision to proceed with the project immediately, delay project initiation, or cancel the project. It should be written in a way that facilitates that decision so that the decision itself will be acceptable to the project team and their functional sponsors. It other words, the project plan should be a true representation of the findings and analysis of the project team members. The project team may feel that a briefing package should be developed to communicate the results of the project team and ask for a specific recommendation.

4.5.10 Review and Approve Project Plan. The project plan is submitted to higher authority for review and approval. In some cases, the review team will need to supply clarification or conduct further research or analysis. For this reason, the project team should remain in place until the decision is made.

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SECTION 5. PHASE 2A: BUSINESS PROCESS REENGINEERING

Michael Hammer is generally acknowledged to have defined the concept of business process reengineering[9]. He counsels that the rules have changed and organizations need to reconceptualize their business processes. He gives several principles for doing this:

- Organize around outcomes, not tasks. This principle overturns the concept of division of labor, which was the basis for the factory system.
- Have those who use the output of the process perform the process. This principle is concerned with reducing the internal bureaucracy within an organization, and helping external customers do more for themselves.
- Subsume information processing work into the real work that produces the information. This principle is embodied in the term "end user computing."
- Treat geographically dispersed resources as though they were centralized. This principle supports the concept of distributed processing and client-server architectures.
- Link parallel activities instead of integrating their results. This principle supports the concept of concurrent engineering where work teams closely coordinate with each other throughout the process.
- Put the decision point where the work is performed and build control into the process. This principle encourages the formation of self-directed, empowered work groups and flatter management hierarchies.
- Capture information once and at the source. This principle supports such technology enablers as barcoding, electronic data interchange, relational databases, and object-oriented application code development.

While it is possible to disagree with Hammer's philosophy and recommended methods of process reengineering, virtually all of his principles are supported by other authorities in process reengineering. In essence, Hammer is saying is that process reengineering is radical and encourages process improvement teams to "think big" and seek order-of-magnitude increases in critical process performance measures.

Thomas H. Davenport suggests that American enterprises need to combine the concept of radical reengineering (Hammer) with the discipline of continuous process improvement (TQM).[10] He focuses on the use of technology enablers combined with organizational change management and suggests that the project management concept (matrix management) is the way to achieve maximum benefits with the lowest risk. He also encourages the inclusion of customers (internal and external) in process reengineering work teams. In general, Davenport recommends a more structured, controlled approach to process reengineering [than Hammer's radical approach] which seems more appropriate in government enterprises.

H. James Harrington stresses that before an organization can approach process redesign, it first must adopt a process management philosophy.[11] Harrington argues more for the concept of process redesign (as defined in this guidebook) rather than

9 "Reengineering Work: Don't Automate, Obliterate," Michael Hammer, *Harvard Business Review*, July-August 1990.

10 Davenport, Introduction.

11 *Business Process Improvement*, H. James Harrington, ASQC Quality Press, 1991.

process reengineering. Harrington, therefore, is an appropriate reference for those organizational units striving for more modest gains in process improvement. He gives ten requisites for preparing for process improvement:

1. The organization must believe that change is important and valuable to its future.
2. There has to be a vision that paints a picture of the desired future state that everyone sees and understands.
3. Existing and potential barriers must be identified and removed.
4. The total organization must support the strategy to achieve the vision.
5. The leaders of the organization need to model the process and set an example.
6. Training should be provided for the required new skills.
7. Measurement systems should be established so that results can be quantified.
8. Continuous feedback should be provided to everyone.
9. Coaching must be provided to correct undesired behavior.
10. Recognition and reward systems must be established to effectively reinforce desired behavior.

Daniel Morris and Joel Brandon[12] argue that reengineering methodologies are only tools that must be used in the context of organizational change. Their concept, called *Positioning,* emphasizes the strategic nature of organizational change. Three components must be used together to effect change:

1. Positioning, which is the framework for organizational change
2. Traditional project management methods, which implement the change
3. Reengineering techniques, which provide the means of change.

They have determined that there are seven critical success factors for process reengineering:

1. The ability to conduct reengineering in accordance with a comprehensive, systematic methodology
2. Coordinated management of change for all of the affected business functions
3. The ability to assess, plan, and implement change on a continuing basis
4. The ability to analyze the full impact of proposed changes
5. The ability to model and simulate the proposed changes
6. The ability to use these models on a continuing basis
7. The ability to associate all of the management parameters of the organization with each other.

There are other authorities on process reengineering, but the four introduced above together seem to capture the essence the concept. Hammer is radical and visionary, Davenport is practical, Harrington is cautious, and Morris and Brandon are methodical. This points up the importance of selecting an appropriate process manager and project manager for improvement efforts. In the final analysis, it will be up to the leaders of change to fashion the nature of the improvement project and the means to bring it about.

12 *Re-engineering Your Business*, Morris and Brandon, McGraw-Hill, 1993.

This phase of the methodology focuses primarily on the reengineering level of process improvement. Please refer to the F/MPI Process Reengineering Tutorial for more detailed information on how to approach this phase of the methodology.

At the completion of this phase, the process improvement team will have produced a Functional Economic Analysis (FEA) management decision package that presents a case for action. The FEA recommends a course of action that is justified based on the organization's planning documents, the analysis of the current situation of the process in question, the results of an improvement analysis, and the design of the future state process. The FEA will present a full risk-adjusted economic analysis of the recommended changes. It will include the elements of organizational change management needed to support the new process and a full evaluation of the technology enablers that are needed to implement the change. The FEA is one of the principle inputs to the next phase of the methodology, Enterprise Engineering.

The process reengineering phase of the Framework methodology is supported, in part, with the following resources:

- F/MPI Management Briefing on Process Reengineering
- F/MPI Process Reengineering Assessment
- F/MPI Process Reengineering Tutorial
- F/MPI Process Reengineering Evaluation Worksheet
- Process Improvement Methodology for DoD Functional Managers
- Functional Economic Analysis Guidebook
- Functional Process Simulation Guidebook
- Baseline Workshop
- Preparing For and Initiating Functional Process Improvement (FPI) Programs Guidebook.

The techniques (described in Section 10) most useful in this phase include the following:

- Brainstorming
- Nominal Group Technique
- Affinity Diagrams
- Relationship Diagrams
- Activity Modeling
- Data Modeling
- Activity-Based Costing
- Pareto Analysis
- Best Practices Benchmarking
- Simulation
- Economic Analysis
- Program Decision Process Chart
- Cause and Effect Analysis
- Survey/Interview
- Checksheets.

5.1 Step 6: Conduct Baseline Analysis

The concept of process is relatively new and somewhat troublesome in organizations with a strong functional management structure. Few people in such organizations truly understand the nature of their end-to-end processes. Several could not precisely describe the products and services produced by these processes. Many are not even sure who the process customers are and what they require of the process. It is difficult to envision successful process improvement in such organizations without the intermediating step of conducting a baseline process analysis.

The purpose of conducting a baseline analysis is to establish a firm foundation from which to begin the improvement effort. In many cases, this is the beginning of shifting the organization from a functional management concept to a process management concept. The goals of baseline analysis (while challenging to achieve) are clear and straightforward:

- Rigorously define the structure of a process (or subprocess) in terms of the activities that are performed in the process, the outputs they produce, the inputs they require, the resources they consume, and the standards they operate under.

- Rigorously define the data elements required, produced, or modified by the process and the business rules inherent in existing data structures.
- Understand the relationship of the process to each functional element that participates in process performance.
- Identify and characterize the stakeholders of the process including customers, suppliers, higher authority, and resource providers and determine their relationship to the process in terms of quantifiable measures.
- Clarify exactly how the process works, not how process participants think or believe it works.
- Determine the unit costs of each major output produced by the process. (These are called cost measures in this guidebook.)
- Determine process cycle and response times with respect to producing desired output products and services. (These are called time measures in this guidebook.)
- Document known problems, issues, deficiencies, and defects with respect to organizational structure, process operation, and output products and services. (These are collectively called quality measures in this guidebook.)
- Document the status of the technology elements that support the process computer and communications platforms, networks, data bases, application systems, and technical support services. (In this guidebook, these technical elements will collectively be called Information Technology (IT) when referring to the facilities themselves, and Information Systems (IS) when referring to the services delivered to the process.)

If all the planning steps described in this guidebook were performed prior to starting the process reengineering phase, much of the information listed above will available in whole or in part. It is important not proceed beyond this step until this information is as complete as can reasonably be expected.

When this step is complete, the process improvement team will know two important things about the process: the present state (baseline analysis) and the future state (planning objectives and goals). With this information, the remaining steps and phases in the Framework methodology will provide guidance on how to get from present state to future state in the most expeditious manner possible.

The following tasks are performed in the baseline analysis step:

- Develop or confirm the project scope
- Develop or review and revise AS-IS Activity Models
- Develop or review and revise AS-IS Data Models
- Perform activity based costing
- Perform time-line analysis (simulation)
- Document the baseline condition
- Revise performance cell descriptions
- Review and approve baseline documentation.

5.1.1 Develop/Confirm Project Scope. In a large enterprise like the Department of Defense, major processes can extend throughout the organization. It is seldom feasible to attempt to perform process improvement on such an extensive basis. This means that the focus of improvement efforts will have to be at the subprocess level. This requires a firm understanding of the scope of the improvement project. In this context, the term *scope* does not refer to the amount of improving that will be attempted; it refers instead to the potential involvement of functional units in the improvement project.

The most important techniques for setting the scope of the project are developing or confirming the process deployment map (or matrix), and using the IDEF0 context diagram technique to establish bounds on the improvement project. The deployment map (Figure 5-1) shows the functional elements that are involved with a process and the degree of their participation. The context diagram (Figure 5_2) shows the boundary conditions of the process with respect to inputs, outputs, controls and mechanisms (resources). Each of these lines (input, output, etc.) is connected to a process stakeholder. Please refer to the F/MPI Process Reengineering Tutorial for al fuller explanation of this task and the following tasks of this step.

As shown in the figures, the project scope identifies the functional elements that will participate or be affected by the improvement project and the stakeholders in the process. These data will be useful in establishing performance measures and performance goals later in the methodology.

This task as well as the other tasks in this step are usually performed in a workshop environment with experienced process participants and representation from key stakeholders. Once the scope of the improvement project is established, the next four tasks develop detailed models of the baseline process.

5.1.2 Develop/Review/Revise AS-IS Activity Models. During the first iteration of process improvement, it is not likely that activity models will exist for the process scheduled for improvement. In this case, activity models will be developed for the first time in the baseline workshop. If models do exist, they still need to be reviewed and revised as necessary to reflect the actual status of the process.

Activity models are developed to display business activities and their relationships. When completed, an activity model represents a detailed understanding of how the process works and how

Process Deployment Matrix	**Marketing**	**Engineering**	**Manufacture**
Research	*	⊠	
Component Design		*	o
Process Design	⊠	*	⊠
Equipment Design		*	⊠
Production		⊠	*

Key: * = Responsible, ⊠ = Major Involvement, o = Minor Involvement

Figure 5-1. Process Deployment Matrix

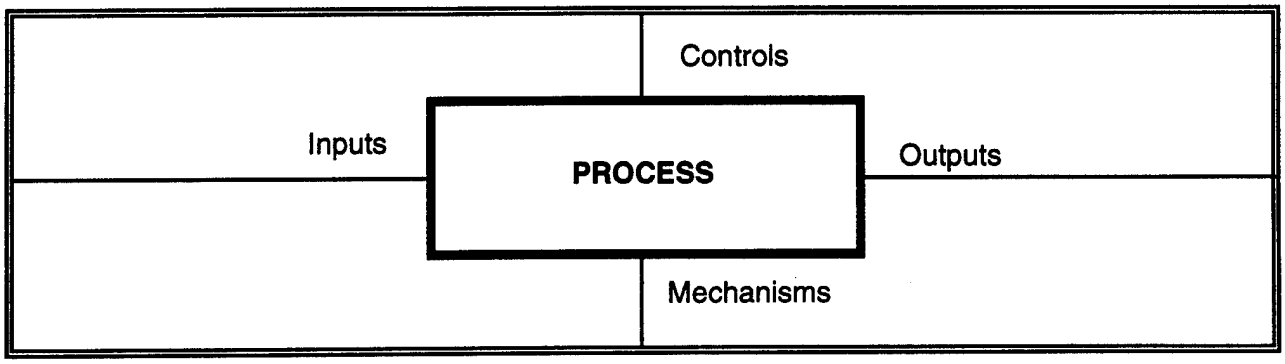

Figure 5-2. Context Diagram

information and physical artifacts *flow through* the process. Activity models also aid considerably in identifying process performance measures that reflect stakeholder interests.

The task then is to develop a fully decomposed activity model using the process context diagram as a starting point. A process is fully decomposed when the resulting levels of activities clearly show the major outputs produced by the activities in the process. Node trees, which are hierarchical representations of the activities in a process, are produced before the decomposition process is begun.

IDEF0 is the standard activity modeling technique to be used in DoD and all other Federal agencies. Process improvement team members must be trained in IDEF techniques prior to or in conjunction with a process improvement effort. For more information on IDEF0 activity modeling, refer to the Process Improvement Methodology for DoD Functional Managers Guidebook and Section 10 in this guide.

5.1.3 Develop/Review/Revise AS-IS Data Models. The next task is to develop a data model that shows the structure and relationship of the elements of data that support the business process. While an enterprise may have an infinite number of business activities, which themselves may be highly dynamic, the enterprise generally has only one relatively stable base of data to support those activities.

For instance, once the data elements related to *employee* are encoded in a data base, these data elements may be used in a great number of different applications. Furthermore, data about employees such as name, Social Security number, address, grade, etc., change infrequently or not at all. Therefore, a well-constructed data base serves as a strong foundation for building information systems to support business processes.

Furthermore, processes are integrated primarily by transferring data effectively between and among them. For instance, in concurrent (integrated) manufacturing systems, engineering and production are integrated via a shared data base of commonly used data elements.

This task is concerned with constructing the data models that represent how the process uses data—which elements of data it creates, references, changes, and deletes. The data model also inherently contains *business rules* that act as constraints on process operations. For instance, the structure of the data model may prevent the deletion of a customer record if that customer has outstanding invoices. In other words, the rule is that before a customer can be deleted from the data base, all open invoices must be closed out.

Data models are created at different levels. The higher-level models are completed by functional process improvement team members; the more detailed models are completed by technical staff working from the higher-level models. Data models then become an effective means of communication between functional and technical people.

IDEF1X is the standard data modeling technique to be used in DoD and all other Federal agencies. Process improvement team members must be trained in IDEF techniques prior to or in conjunction with a process improvement effort. For more information on IDEF1X Activity Modeling, refer to the Process Improvement Methodology for DoD Functional Managers Guidebook and Section 10 in this guide.

5.1.4 Perform Activity-Based Costing. The next task in this step is to develop a cost model of the process under study. Activity-based costing techniques are used to determine approximately the resources it takes to produce a specific product or unit of service. With respect to an activity model, it is said that outputs *consume* activities and activities *consume* resources.

For instance, if an activity can produce 100 widgets a week, then producing 100 widgets a week consumes the entire activity. If the cost of the activity is $10,000 per week in terms of labor and facilities charges, the activity will consume $10,000 to produce 100 widgets. The unit cost of each widget is then $100 plus materials. If this seems

too easy, it must be remembered that most activities produce many different kinds of products and services, and have many different categories of overhead or indirect labor charges associated with them. The trick is to understand the unit costs (direct and indirect) of each type of product or service produced.

ABC techniques allow the process improvement team to allocate all overhead costs to specific products and services that *benefit* from or are the reason (cost driver) for the overhead costs.

In service-type processes as opposed to product producing processes, process costs are caused by the demands of the customer rather than the demands associated with producing tangible products.[13] For this reason, ABC techniques are best employed in service organizations after customer requirements and demands are understood by the process improvement team.

Once the unit costs are known for each product and service, this information can be used as a baseline figure for process improvements that will lower the unit cost of outputs. As we will see, unit costs can be lowered by eliminating non-valued added activities, applying innovative technologies, increasing training to reduce waste and rework, improving the quality of incoming materials to reduce rejects and scrap, and by many other means.

Performing an activity-based costing study will identify the sources or triggers for costs expended within a process. Cost driver analysis will be performed during the next step in the methodology—process improvement analysis. Additional ABC analysis work will be recommended during the process redesign/ reengineering step.

For more information on activity-based costing techniques, refer to the Process Improvement Methodology for DoD Functional Managers Guidebook and Section 10 in this guide.

5.1.5 Perform Time-line Analysis (Simulation). While knowing the current unit costs of a process is vital baseline information, it is equally important to understand the baseline cycle times for a process. Cycle-time measures show how long it takes to produce a product or service once the request for that product or service has been *triggered.* Experience has shown that the best way to reduce process costs is to focus on reducing process cycle time. Cycle time is made up of several elements:

- Operations time, which is the actual processing or machine time needed to produce an output
- Delay time, which is the time work sits in queues (in-baskets) waiting for attention or resources.
- Quality rework time, which is the amount of time spent discovering and fixing problems (rework time is an overhead that has to be distributed to all output products.)
- Inspection and oversight time, which is time spent ensuring that products and processes conform to standards and requirements.

Each of these elements of time is a contributor to overall process cycle time. Each element of time can be reduced using appropriate techniques. Employing technology enablers is one technique, increasing training time is another, just-in-time inventory and work flow is another, and eliminating unnecessary directives and other constraints is another. But before these techniques can be applied, it is necessary to understand where the time now goes in the baseline process.

Simulation techniques are used to determine baseline cycle time and, of course, to test potential improvements. For more information on simulation, please refer to the Functional Process Simulation Guidebook. Prior to using the simulation techniques described in this guidebook, a well-constructed activity model is prerequisite.

5.1.6 Document Baseline Condition. Once the modeling, activity-based costing, and cycle-time

13 *The Design of Cost Management Systems*, Robin Cooper and Robert S. Kaplan, Prentice Hall, 1991.

tasks have been completed, the information generated must be summarized in the baseline report. At this time, everything known about the process is organized and described. It is critically important to include data that are not directly contained within the models. Such data include quality measures, problems and issues that were noted during the study; stakeholder concerns and suggestions; organizational and human factors that affect process performance and quality of work life; and any other data that can be useful to the process improvement team.

Generally, the activity and data modeling reports form the basic documentation package, and all other considerations are documented in appendices to these reports. The general rule is simple: anything that can be of potential use to the improvement team should be included, anything that is extraneous to this purpose should be omitted or stored separately as backup documentation. The objective is not to measure the value of the report by its thickness, but by its useful content.

5.1.7 Revise Performance Cell Descriptions. If the performance cell technique was used in the planning phase of the methodology, this is a good time to revisit the baseline measures that were included in the performance cell charts. With the additional data gathered in this step, the baseline measures can be validated or updated to reflect reality.

It may also be necessary to update the targets in the performance cells if the current targets seem either too ambitious or too insignificant with respect to the baseline measures obtained in this step. Significant changes to performance targets must be highlighted for approval by the process owner(s). Updated and valid performance cells provide an important input to process improvement efforts.

5.1.8 Review and Approve Baseline Documentation. After all baseline data have been assembled and reviewed and accepted by the process improvement team members and their functional sponsors, it is submitted to the process owner or other higher authority for review and approval.

As stated in the introduction to this step, the process improvement team will now have achieved two important accomplishments at this point in the methodology: a description of the desired future state for the process produced in the planning phase, and a description of the actual present state of the process provided in this step. With the baseline described and the future state objective known, all that is left is to figure out how to get from here to there. The rest of the Framework methodology is dedicated to this objective.

5.2 Step 7: Conduct Improvement Analysis

At this point in the methodology, the baseline situation of the process is documented and its future state has been visualized. This step is concerned with understanding, quantifying, and documenting the performance gaps separating the current state from the future state. The mission of this step is to reconnoiter the territory that must be taken without yet engaging the enemy. That is, understand what must be done, but don't do it yet. The next step in the methodology is concerned with designing the program that will close the performance gaps and bring the process to a new higher level of performance.

This step prepares the process improvement team for process redesign or reengineering by identifying and quantifying the existing gaps in satisfying stakeholder needs; the deficiencies in quality, cycle time, and cost factors; and the enablers and constraints associated with process-related organizational and technical issues. When these factors are well-understood prior to process redesign or reengineering, the risk of process improvement effort are minimized.

This step requires the application of process improvement techniques for data gathering and objective performance gap analysis. The data provided by the application of techniques establish a basis for effective workshop participation among the improvement team members.

This results of this step will also help the improvement team decide whether a process redesign (incremental change) effort is indicated or

whether a process reengineering (radical change) effort is indicated. This is a critical decision because process redesign projects take less time to complete and therefore deliver results (process improvements) faster at lower cost with less risk than reengineering projects. The results of this step will also provide meaningful data for inclusion in the Functional Economic Analysis (FEA) package completed at the end of the process reengineering phase. The FEA package will be the basis for the management decision to proceed or not proceed with the recommended process improvement project.

In this step, the process improvement team will investigate performance gaps in the following areas:

- Satisfying external customer product/ service needs and requirements
- Satisfying other stakeholder requirements vis-à-vis customer needs
- Error rates associated with delivered products and services
- Delays in responding to customer and other stakeholder requirements
- Asset deployment and utilization
- Cross-functional understanding and cooperation
- Productivity
- Flow of work throughout the process (workflow management)
- Process adaptability and flexibility to respond to changing requirements
- Excessive resources and head count (right-sizing).

The following tasks are performed in the improvement analysis step:

- Review process vision, objectives, and measures
- Conduct stakeholder requirements gap analysis
- Conduct best practices benchmarking analysis
- Select data gathering and analysis techniques
- Identify and document performance gaps in product quality
- Identity and document performance gaps in process cycle time
- Identify and document performance gaps in process cost
- Identify and document process-related issues
- Identity and document organizational issues
- Identify and document technology issues
- Develop process improvement opportunities
- Prepare process improvement analysis report
- Review and approve process improvement analysis report.

5.2.1 Review Process Vision, Objectives, and Measures. The planning phase of the methodology produced a process vision that incorporated a series of breakthrough improvement objectives supported by the identification of performance measures. This information needs to be reviewed and reaffirmed by the process improvement team to ensure all team members have a clear view of the desired future state of the process. At this time, information and insights that were gained during the baseline analysis step should be tested against the future state concept. This is especially true with regard to measures. The more well-defined the performance measures, the easier it is to conduct a performance gap analysis.

The process team should also have a clear understanding of the functional objectives as they relate to process objectives. Functional objectives make up the control-chain that ensure that process performance is consistent with established policy, directives, guidance, and standards. Any functional objectives that may affect the vision of the future state of the process should be noted and investigated during this improvement analysis step.

Finally, the process owner or sponsor should construct a series of challenges that have motivational power to encourage the improvement team to uncover all process and functional gaps and factors that need to be addressed during the process redesign/reengineering step that occurs next. The improvement team should understand what areas related to process performance and functional

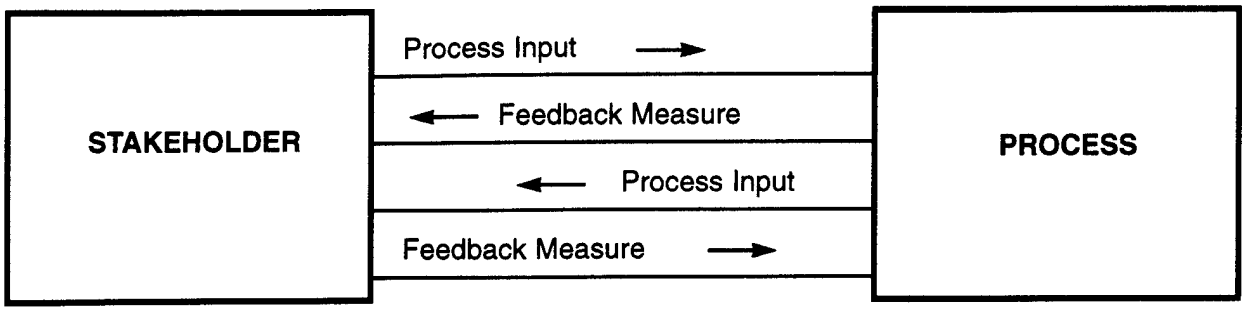

Figure 5-3 Stakeholder/Process Relationship

organization are open to investigation and which areas, if any, are outside the bounds of the study.

5.2.2 Conduct Stakeholder Requirements Analysis. To complete this task, the improvement team should use the performance cells developed earlier as the basis for conducting an investigation of stakeholder needs, requirements, interests, and desires as they relate to the vision of the improved process. While the customer stakeholder needs to be the focus of these efforts, successful process improvement projects will require the support of the other process stakeholders as well. This support is obtained more readily if these stakeholders are included in the performance gap analysis step.

The relationship of a stakeholder to a process is shown in Figure 5-3. If the stakeholder provides an input to the process, feedback measures tell the stakeholder how the input was used. If the stakeholder receives an output from a process, feedback measures indicate how the output was used by the stakeholder. Measures, it will be remembered, are grouped into four categories: fitness-for-purpose, conformance-to-standard, process time, and process cost.

Because there is an expectation on the part of the stakeholder who provides a process input, the process improvement team must know what that expectation is, and whether there is a gap between expectation and performance. The same holds true if the stakeholder receives an output from the process. Measures are the means to determine the existence of, and extent of, the gap. The process improvement team must understand any performance gaps in terms of the value-chain from supplier to customer and the control-chain from higher authority to resource provider.

During process redesign or reengineering (the next step), improvement teams will want to monitor whether the gaps identified in this step increase or decrease based on the proposed changes in process performance. This is where a firm understanding of value-chain versus control-chain is important.

The areas of investigation are included in the following list:

- The functionality, usability, and performance of process inputs and outputs
- The reliability, accuracy, and security of process inputs and outputs
- The availability (when needed) of inputs and outputs, and the responsiveness of the process in handing inputs and outputs
- The degree of assurance or confidence the stakeholder has in the process and how well it supports stakeholder interests
- The degree of interest and empathy process participants have in working with stakeholders, and the degree to which process participants can anticipate stakeholder needs, requirements, and desires.

If the gaps in expected versus actual process performance in these areas are significantly large, process reengineering may be called for. If not, it is an indication that process redesign or streamlining may be sufficient (at lease with regard to stakeholder interests.) The improvement team needs to understand that stakeholder interests are not the only (and perhaps not the most important) factor in deciding how radical process improvement efforts should be.

5.2.3 Conduct Best Practices Benchmarking Analysis. With the understandings gained thus far in following the methodology, the process improvement team is positioned to conduct a best practices benchmark. Unlike the strategic benchmark, which is used to establish performance targets and breakthrough objectives, the best practices benchmark is more tactical. It is designed to discover the best way of performing a process, subprocess, or group of activities. In other words, the strategic benchmark develops the process performance goals; the best practices benchmark discovers one or more strategies for, or means of, attaining the goals.

The focus of a best practices benchmark is on process characteristics as well as the organizational, cultural, and technical enablers that support the process. This task produces critical data that can be used in performance gap analysis in all areas associated with the process.

Most techniques used in process analysis and design are relatively easy to learn and use. But best practices benchmarking, if it is to be effective, requires that process teams be well-trained prior to embarking on the benchmark program. The period of the benchmark program may extend over the remaining tasks in this step and well into the tasks of the next step. There are many advantages to this concurrency and some disadvantages as well. The project leader must determine whether to perform best practices benchmarking in series or in parallel with other steps and tasks.

5.2.4 Select Data Gathering and Analysis Techniques. The improvement team is now prepared to launch an extensive data gathering and analysis program in support of the remaining tasks in this step. The process improvement team should not rely 100% on information generated in the workshop environment to understand and quantify performance gap data. Much of this type of data is subjective and not easy to verify. Total reliance on subjective data increases both the cost of an improvement project and the risk of failure. Data should be gathered from all sources related to the process and using all available performance measures. The results of this off-line effort can be effectively used back in the workshop to stimulate further analysis.

There are well over 30 recognized techniques for data gathering and analysis. Many of these are briefly described in Section 10 of this guide and more extensively in the F/MPI Process Improvement Techniques Tutorial. The following techniques are most often used in performance gap analysis.

- Data Gathering
  - — Survey and On-site visits
  - — Interview and Focus Groups
  - — Questionnaires and Assessments
  - — Brainstorming
  - — Checksheets
  - — Quality Function Deployment
  - — Benchmarking

- Data Analysis
  - — Process Deployment Map
  - — Pareto Diagrams
  - — Cause-and-Effect Diagrams
  - — Affinity Diagrams
  - — Process Decision Program Charts
  - — Quality Function Deployment.

If the process under study generates sufficient and reliable operational data, statistical process control (SPC) charts and techniques can be used to determine the degree of stability in the process. The results can be analyzed using histograms, bar charts, and other analytical techniques. It should be noted that a minimum of 30 days' worth of data is usually required when using SPC techniques.

5.2.5 Identify and Document Performance Gaps in Product Quality. Process attributes related to developing high-quality products and services should be the focus of all process improvement efforts. Therefore, identifying and quantifying performance gaps in quality-related areas are critical. Failures in quality may be felt externally, which means that customers are not being satisfied (among other things), and/or they may be felt internal to the process, which invariably means that process costs are excessive. There is substantial proof that while quality costs, poor quality costs more.

Performance gap analysis should include investigation of the following factors with respect to output products and services. Once again, excessive performance gaps may indicate the need to consider radical process reengineering, especially if benchmarking results show that other organizations are doing much better.

- Unacceptable products and services
  - — Returns
  - — Rejects
  - — Loss of customers
- Too much time spent redoing work
- Customer complaints
  - — Phone calls
  - — Letters to higher authority
  - — Adverse public comments or publicity
- High warranty costs or service call-backs
- Excessive meeting time devoted to problem/issue resolution
- Low morale or high personnel turnover.

5.2.6 Identity and Document Performance Gaps in Process Cycle Time. Experience has shown that reducing process time factors will always result in reducing process costs. Therefore, it is also critically important to perform a thorough gap analysis in this performance area. Process time is the aggregate of operations time, delay time, overhead time, and quality-related time, as defined in Section 2 of this guide.

The measures to study include the following:

- Cycle time per unit of output or per transaction
- Wait time per unit of output or per transaction
- The ratio of direct labor hours to total hours
- Quality-rework time
- Time allocated to non-value added activities
- Time allocated to satisfying controls placed by higher authority
- Value-chain versus control-chain time allocations
- Response time from request for service to service delivery
- Ratio of operations time to calendar time
- Workflow through the process (relative location of work centers)
- Serial versus parallel processing of transactions
- Interruptions in employee work time for non-value added activities
- Method of setting work priorities
- Supplier-process relationship.

Many of the performance gaps uncovered in this task will need to be subjected to cause-and-effect analysis because experience has shown that process delays are often caused by problems upstream of the process. This is the basis of instituting just-in-time methods of material movement.

5.2.7 Identify and Document Performance Gaps in Process Cost. Process costs should never be the direct focus of performance gap analysis. This is because all process costs are directly related to other process factors. To reduce process costs, these other factors will have to be investigated. The direct contributors to process costs are excessive process cycle time, poor product and service quality, insufficient information about customer requirements, poor supplier relationships, and unneeded or inappropriate controls placed on processes by higher authority (excessive regulation).

Poor process cycle time itself is caused by excessive overhead, obsolete technology, poor work

methods, and poorly trained personnel. Poor product and service quality has many causes, each of which has to be investigated as recommended above. Poor supplier relationships result when suppliers are not treated as partners with respect to servicing customer requirements. Inappropriate controls placed by higher authority are often the result of failing to review controls in the light of changes in the way processes are conducted.

Some cost-related performance gaps should be studied directly. These include non-process and non-product related expenditures including non-productive facilities, excessive frills and perks; unnecessary travel and living expenses; bloated staffing levels; and losses due to waste, fraud, and abuse.

5.2.8 Identify and Document Process-related Issues. The tasks outlined above in this step focus the process improvement team on specific measures. In this task, the team will analyze the process as a whole with respect to the way it satisfies stakeholder interests.

This is the right time to continue with ABC analysis to investigate and understand the sources of process costs (cost drivers). Cost drivers are often a mix of quality, cycle time, and cost measures and they should be studied as a whole. However, cost drivers are often outside the process, and the tendency of the process improvement team is **not** to work outside the scope or boundary of the process. The project leader must insist that all cost drivers be investigated and must insist that the results of the study be considered in the improvement analysis. If this is not done, the improvement team runs of the risk of suboptimizing process performance and adding to, rather than deleting, process costs.

The questions to be asked include the following (with respect to each class of stakeholder:)

- Who receives process outputs (or provides process inputs?)
- What do they expect from the process?
- How do they use the output (provide the input)?
- What impact does it have if inputs or outputs are wrong or inappropriate?
- How is feedback on output (input) factors generated?
- How far beyond the primary stakeholders will errors have an impact?
- How well can the process adapt to changing stakeholder requirements?

This is now the time to take a *walk through* the process with major stakeholders to ensure that the process as a whole is well understood before changes in the process are designed. Some of the areas of investigation include the following:

- Procedures used within the process
- Documentation used to control or support process activities
- Training programs related to process requirements
- Techniques, tools, equipment, and support services used within the process
- Facilities with respect to how they enable or constrain process performance
- Location of work centers related to location of stakeholders
- Means of communication used within the process
- How stakeholder interactions are performed, monitored, and evaluated
- Quality and accessibility of records and data needed to support the process.

At this point, it becomes possible to start thinking of the process under study in terms of subprocesses and groups of related activities. By the time the remaining tasks in this step are completed, each identifiable subprocess will be placed in one of five classifications. All data collected and analyzed from this point on should be used to aid in this determination.

The five classifications for subprocesses are:

- Discontinue or disband the subprocess
- Take no further action on the subprocess (leave it alone)
- Designate the subprocess as a candidate for continuous improvement

- Designate the subprocess as a candidate for process redesign
- Designate the subprocess as a candidate for process reengineering

5.2.9 Identity and Document Organizational Issues and Barriers. Process improvement is not a meaningful term apart from organizational change management. Organizational change management is dealt with as a separate phase of the process improvement methodology (phase 2B in Figure 3-1). At this time, the process improvement team can begin to identify problems, issues, potential barriers to change, and suggestions for organizational improvement that can be passed on to phase 2B. This should be done now, while the improvement team has a fresh understanding of process-related performance issues and gaps. This study will aid in the process classification recommendation introduced in the previous task.

The following 12 sets of questions asked and answered will help the team identify organizational issues and barriers. It is important not to try to resolve these issues at this point. This action will be taken after all the facts are discovered and investigated, and analyzed. The following questions are developed from Clemmer's book, *Firing on All Cylinders.*[14]

1. What is the level of commitment to improvement within the functional units, and how is leadership manifested?

2. To what extent are customer needs, requirements, and desires used to shape functional unit activities and priorities?

3. How well do employees understand the mission of the organization, and are education and training programs oriented toward increasing employee awareness of the importance of serving customer interests?

4. How do functional units hire, orient, develop, promote, and support employees with respect to process requirements?

5. What personal skills are valued within functional units and how are those skills developed and rewarded? How well is skill development related to supporting the value-chain within the process?

6. Are managers and supervisors trained in coaching skills, and are those skills focused on developing a high-performance unit fostering improvement and innovation?

7. To what extent is the functional unit developing team skills such as the effective use of techniques and tools, process management, problem solving, meeting/workshop management, and interpersonal skills?

8. How well are the human resource systems aligned with process performance requirements including supplier management, information management, and customer support? What are the relationships with respect to rank, responsibility, authority, and accountability? How prevalent are bureaucratic in-fighting and turf wars?

9. What are the recognition and reward systems and how are they aligned with work team practices, empowerment, customer service needs, and cross-functional cooperation? Is there an excess of *feel-good* rewards and not enough rewards for effective performance in support of mission requirements?

10. How well established are process management principles? Are there process owners in place for all major processes and subprocesses? Are quality

14 *Firing on All Cylinders*, Jim Clemmer, Business One Irwin, 1992.

and process improvement teams in place? Are roles and responsibilities aligned with mission and customer requirements? Are continuous process improvement principles implemented?

11. Are processes managed based on performance measures? Are measures related to delivering customer satisfaction? Are all important elements of process performance measured? Are results continuously provided to process and improvement teams? Are all stakeholder interests related to performance and feedback measures? Are there systems in place to monitor, manage, and improve product and service quality? Is benchmarking established as a management practice? Are performance standards meaningful?

12. Is there a continuing program in place to identify and serve customer interests? Do process participants look for opportunities to develop new internal and external customers? Are customers really *in charge* of the process with respect to designing products and services and setting process priorities?

Negative answers to these questions indicate that organizational change management will be a major, if not *the* major, focus of process improvement. As stated in Section 2 of this guide, process improvement cannot exist in any meaningful way apart from the principles of process management. Process management is an organizational issue.

5.2.10 Identify and Document Technology Issues. Technology is both an enabler of change and a constrain on change. Enablers come from innovative uses of new technologies, while inhibitors are the result of the presence of legacy systems. Phase 2C of the methodology deals with technology change management. This task is concerned with uncovering technology-related issues that need to be investigated and analyzed with respect to process management and improvement. There should be no attempt in this task to resolve technology issues, only to identify them.

As with organizational barriers, an effective way to discover technology-related issues is to ask and answer a series of questions. Until recently, technology and information management systems modeled the organizational hierarchy and as such was part of the problem with respect to adopting a process management orientation. The technology paradigm shift to networks, client-server architectures, distributed data bases, work group computing, etc. actually is an enabler of process management and a major contributor to the breakdown in the hierarchical management model.[15] The following questions are developed from Tapscott and Caston's book. The answers to these questions will tell a lot about the attitudes within the functional units. The attitudes will be a good indication of the probable success of any significant improvement effort, and most certainly one based on technology enablement.

1. To what degree are information systems open? Do suppliers and customers have access to process related data that affect their involvement in the process (interoperable systems)? Can information systems be ported to different hardware platforms?

2. Are systems functionally integrated to support process management requirements? Are communications networks being used to interconnect work teams wherever they are located?

3. Are distributed computing systems being put in place to help empower workers and work teams to serve customer requirements effectively and efficiently? Is *intelligence*, not just data, being made easily available to work teams so support immediate decision-making with respect to customer requests for service and products?

14 *Paradigm Shift, the New Promise of Informaiton Technology*, Don Tapscott and Art Caston, McGraw-Hill, 1993.

4. Are data collected on a real-time basis at the source and distributed to where they are needed? Are just-tin-time practices being put in place for information systems? Are information systems designed to allow processes to easily adapt to changing supplier and customer relationships?

5. Are client-server systems being put in place to support cross-functional process requirements and design more efficient work flows?

6. Are peer-to-peer networks replacing mainframe-dumb terminal platforms wherever possible to support the notion of an enterprise being based on commitment rather than control, accomplishment rather than accountability, customer service rather than serving the hierarchy?

7. Are information systems being develop according to modular concepts that support organizational independence, resulting in a flexible, adaptable enterprise? Are standardized, reuse, or object-oriented application modules being developed that can be reconfigured to serve changing needs?

8. Are systems being developed to specifically support the needs of knowledge workers rather than the needs of clerical workers? Are specialized platforms being installed to support specialized needs such as computer-aided design and drafting systems, rule-based decision making (expert systems), multimedia applications, and team-based requirements?

9. Are user-friendly graphical interfaces being designed into all systems to permit access to a wide-library of information services and systems without the need to learn a large number of specialized interfaces? Does the organization seek to maximize or limit the distribution of information technology and information systems? Is computing power being placed first with those who directly support customers, or are back-office operations given preference?

10. Are wide area networks being put in place to support stakeholders and employees wherever they may be located? Can teams easily form and work together based on availability, expertise, and knowledge rather than on physical location or proximity to stakeholders?

In evaluating the answers to these questions, improvement teams should look for indications that functional management is receptive to change. Problems are indicated when the answers are mostly negative, and managers are satisfied with the status quo. This will be a signal to the improvement team that process reengineering efforts may not be practical at this time, and improvement efforts may have to be limited to process streamlining and redesign.

5.2.11 Develop Process Improvement Opportunities. By the time this task is reached, process improvement teams will have a good understanding of the opportunities for improvement that should be addressed in the next step. They will also be able to classify subprocesses as recommended in task 5.2.8. The following list can be used as a guide in organizing opportunities. All of the data collected and analyzed in previous tasks, steps and phases should be used to complete this task.

Because there will be redundancies in any such list, nominal group and data analysis techniques should be used properly to organize and group these opportunities. All opportunities should be accompanied by performance targets whenever possible. The performance cell techniques can be used to guide the effort to quantify potential improvements. This task is best completed in the workshop environment.

The improvement team should list opportunities to:

- Improve customer service by eliminating problems and complaints
- Improve product/service quality by eliminating errors and rejects
- Strengthen the value-chain by minimizing non-value added activities
- Adjust the control-chain by eliminating inappropriate controls
- Reduce process cycle time (operations, wait, overhead, quality)
- Lower process costs (fixed and variable)
- Add new services and products
- Close performance gaps in baseline-to-target measures
- Emulate best practices found during benchmarking activities
- Develop knowledge-based systems for front-line workers
- Improve workflows within processes by realigning facilities and equipment
- Make processes more flexible and adaptable to changing conditions
- Exploit new technologies (see previous task)
- Satisfy management imperatives (mission, objectives, and goals)
- Develop new supplier partnerships for just-in-time service and lower costs
- Improve work place health, safety, morale, and job satisfaction
- Balance accessibility and security requirements
- Lower risks of process failure and increase process stability
- Realign organizational structures to support process management principles
- Improve training methods in support of competency-based principles
- Reduce paper work, flows, and storage requirements
- Develop in-process performance measures for continuous process improvement
- Maximize resource and asset utilization
- Streamline and flatten organizational units and reduce unnecessary headcount
- Standardize around open systems architectures
- Eliminate and replace obsolete or expensive legacy systems

5.2.12 Prepare Process Improvement Analysis Report. The process improvement analysis report and recommendations can now be prepared. The focus of the report should be on process, subprocesses, and groups of related activities. Each subprocess should be assigned to one of the five classifications described in Section 5.3.8 and specific recommendation should be given for each subprocess with respect to that classification.

To the extent feasible, the following factors should be included for each recommendation based on the data gathered during the tasks in this step. The team does not need to expend time and resources developing these data if they are not readily available. The purpose of including these data is to enable higher authority to better understand the potential impact of designing solutions for these opportunities.

- Estimate of resources needed to exploit the opportunity
- Estimated return on investment of these resources

- Known risks resulting from the improvement analysis
- Potential benefits of implementing the recommended opportunity.

5.2.13 Review and Approve Process Improvement Analysis Report. The improvement analysis report is submitted to higher authority for review and approval. In some cases, the review team will need clarification or further investigation. For this reason, the project team should remain in place until the final decision is made.

5.3 Step 8: Redesign/Reengineer Processes

Up to this point, data supporting process improvement have been gathered primarily using analytical techniques. Methods, procedures, and rules are well-suited to helping improvement teams break things into their component parts. Now in this step, it is necessary to build up those parts into redesigned or reengineered processes. This requires a shift in thinking from analysis to synthesis. Synthesis is a creative endeavor. There are fewer rules to support creative thinking, which is a characteristic of design activities—guidelines will have to suffice.

Figure 5-4 provides a high-level overview of the redesign effort, which will result in one or more recommended improvement packages that will be structured into a complete business case in the next step. Previous steps have produced one or more processes for redesign or reengineering, the process vision and target performance measures, and a set of opportunities for improvement.

The first task in process redesign is formulate one or more improvement initiatives. An *initiative* is a design specification that identifies the scope of the design effort, process boundaries, level of improvement, design objectives, performance targets, and opportunities that will be considered during the design effort.

The process redesign/reengineering task selects or specifies organizational and technology enablers, identifies process improvement strategies, and employs creative thinking to produce a design package for the improved process. The design package consists of TO-BE activity and data models along with narratives, charts, measures and other data that capture the design features of the renewed process. Organizational enablers are provided in phase 2B of the methodology; Technology enablers, in phase 2C.

There are often several alternatives for implementing a design package, usually based on which organizational and technology enablers are selected to support the new process design. For instance, when AT&T was designing its Universal Credit Card customer enrollment process, either dumb terminals or networked personal computers could be provided to service representatives. They initially chose dumb terminals but later replaced them with intelligent work stations as part of a process reengineering effort.

Alternatives always have economic implications, which is why a preliminary economic analysis is performed during this step. In the next step of the methodology, a full economic analysis will be performed when constructing the Functional Economic Analysis (FEA) decision package.

As the appropriate point in the design process, the process improvement team should initiate activities with data administration and the technical staff for information systems. These groups will need to furnish technical data in support of the FEA.

Process improvement team members should read the F/MPI Tutorials on Organizational Change Management and Technology Change Management before proceeding with this step.

The following tasks are performed in the improvement analysis step:

- Review process improvement analysis report
- Refine process vision statement
- Develop initiatives for process improvement
- Redesign/redevelop business processes
- Refine/redevelop process deployment map
- Describe and quantify new stakeholder relationships

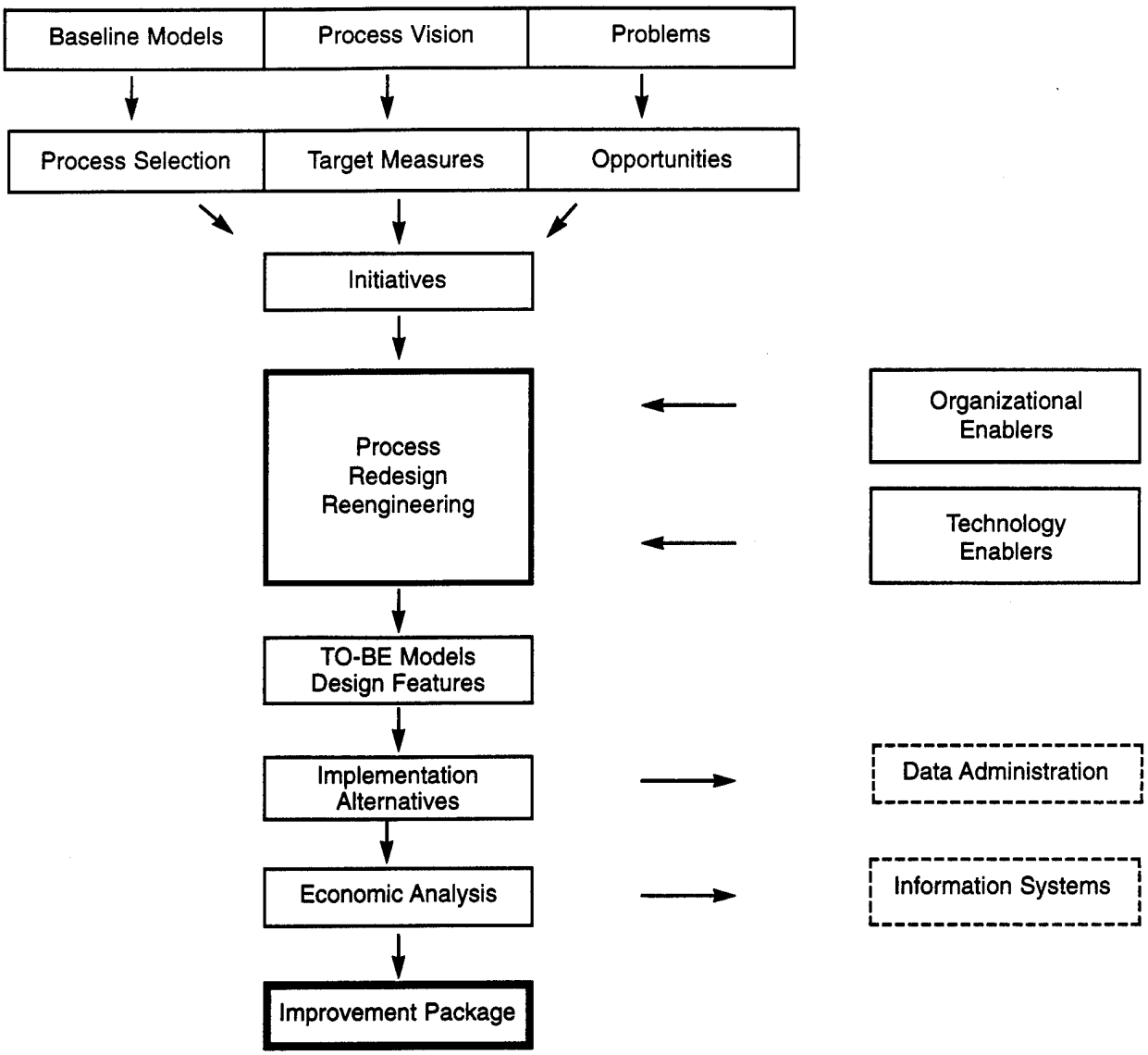

Figure 5-4. Process Reengineering Tasks

- Revise future state performance cell descriptions
- Validate initiatives and models against requirements
- Select alternatives for process improvement actions
- Perform economic analysis on alternatives
- Develop detailed TO-BE activity and data models
- Initiate/coordinate data administration activities
- Initiate/coordinate information systems activities
- Prepare final process design specifications
- Review and approve process design specifications.

5.3.1 Review Process Improvement Analysis Report. The first task in the redesign effort is to thoroughly review the results obtained in the previous steps of the methodology. The planning phase produced the vision, objectives, and performance measures; the baseline analysis step in this phase documented the current state of business processes; and the improvement analysis step produced opportunities for improvement. The

process improvement team is now positioned to design or reengineer the selected business processes or subprocesses.

5.3.2 Refine Process Vision Statement. The process vision statement is the keystone of process improvement. It helps process improvement teams stay focused on the expected outcomes of process improvement and not get lost in the details. At this time it is necessary to revisit the vision statement and ensure that it is still valid as a guide to redesign efforts. Process performance cells should also be reviewed to ensure that the specific performance targets are still attainable. Finally, the strategic and business plans that apply to the processes under improvement should also be reviewed to ensure that business objectives and goals are properly considered during the design effort.

5.3.3 Develop Initiatives for Process Improvement. The previous step developed a multitude of process improvement opportunities—some based on process problems, some on identified stakeholder requirements, and some on business objectives contained in strategic and business plans. Unless the list of improvement is quite small, it is seldom practical to attempt to address all of them in one design effort. Therefore, the process improvement team should develop one or more improvement initiatives that represent a unit or package of improvement specifications. This concept also serves as a means of performing segments of improvement projects in parallel, which can dramatically reduce the overall calendar time needed to complete improvement efforts.

Each package will address a bounded process or subprocess, a set of improvement requirements and opportunities, and a class of improvement effort. There are four classes of process improvements:

Class 1: Quick fixes that require little or no organizational or technical changes

Class 2: Improvements that require organizational changes, but have little or no impact on existing information systems

Class 3: Improvements that require technical improvements, but have little or no impact on existing organizational structures

Class 4: Improvements that require significant organizational and technical enablers and have major impacts on the existing information and technical infrastructure.

When developing initiatives, it is helpful to consider five elements of a process improvement program:

1. Vision statement, which provides overall guidance for improvement efforts

2. Process characteristics:
   A. Workflow through the process
   B. Output requirements for products/services (internal and external)
   C. Stakeholder requirements
   D. Organizational support factors
   E. Technology support factors

3. Performance measures and objectives:
   A. Fitness for purpose
   B. Conformance to standards
   C. Process response and cycle time
   D. Process variable and fixed costs

4. Critical success factors:
   A. Related to people
   B. Related to technology
   C. Related to products

5. Potential barriers to implementation:
   A. Resource availability and allocation
   B. Cultural and cross-functional issues
   C. Technical
   D. Product/service requirements
   E. Regulatory constraints and restrictions.

5.3.4 Redesign/Redevelop Business Processes. There are only three actions the team can do to improve the process:

- Design the process to be more effective
- Design the process to be more efficient
- Design the process to be more responsive, flexible, and adaptable.

There are only three enablers of process design:

- Streamlining
- Technology
- Empowerment.

At this point in the methodology, the process improvement team has all the information it can reasonably expect to have to employ enablers to achieve process design objectives. The task at hand is to use this information in creative and daring ways to come up with innovative process designs. The design effort should focus on measures because it is through measures that an effective business case can be developed that will gain management acceptance.

Most of the measures should be already captured in performance cell descriptions. The most important measurement categories are repeated in Figure 5-5.[16] Some of these measurement categories will require creative efforts to quantify.

Organizational enablers are needed to achieve process flexibility design objectives.[17] This is because *flexibility* is by definition, the ability to respond to situations and events that have not been planned. Cross-functional work teams can help overcome barriers resulting from problems or situations that affect two or more functional areas. The usual terms for cross-functional impediments are red tape and bureaucracy. Worker empowerment is a powerful tool for building

Efficiency Measures	Effectiveness Measures	Flexibility Measures
Process Cycle Time	Product Appearance	Degree that people are empowered to act
	Performance	
Resources Expended per Unit of Output	Reliability	Percentage of events customers expectations are exceeded
	Timeliness	
Value-added Cost per Unit of Output	Usability	Degrees of difficulty to respond to special requests
	Serviceability	
Ratio of Value Added to Non-value Added Time	Durability	Authority people have to continuously improve the process
	Cost	
Cost of Poor Quality	Responsiveness	Amount of time it takes to adjust the process to handle new requirements
	Dependability	
Wait and Delay Time per Unit of Output	Accuracy	Number of pre-planned process scenarios
	Adaptability	

Figure 5-5. Process Measures

16 See Harrington, chapter 3.

17 See Clemmer, chapter 5.

flexibility into processes. When workers are empowered to solve customer problems, processes are by definition more flexible. Managers and supervisors enable process improvement when their roles shift from controlling employees and enforcing rules to coaching team members and removing impediments to serving customers and other stakeholders.

Technology enablers are needed to achieve both process effectiveness and efficiency. Some of the benefits of enabling technology are listed in Figure 5-6.[18]

In summary, process improvement can be thought of as a combination of the following.[19]

- Redesign of appropriate processes or subprocesses
- Redesign of business functions, job tasks, job workflows, and position descriptions
- Design of computer and communication systems enhancements
- Redesign of departmental (functional) operations workflow
- Creation or modification of policies, directives, guidance, rules, and standards.

The design of the new process is captured in high-level TO-BE activity and data models along with narratives of process design features supported with charts and graphs. TO-BE models should be detailed enough to capture the design features of the new process, but they should not be fully developed until after the designs have been validated.

5.3.5 Refine/Redevelop Process Deployment Map. Process redesign will affect the current organizational structure as subprocesses and activities are consolidated or reassigned to functional elements. After the TO-BE models have been developed, the process improvement team should redevelop the process deployment map or matrix that illustrates the interaction of process to function. New or changed boundary conditions should also be documented as the first step in designing new policies, procedures, and work rules.

Automation	Replacing human labor with machine labor
Information	Capturing process information to improve understanding
Sequential	Changing the sequence of activities or enabling parallelism
Tracking	Closely monitoring process status to enable fast response
Analytical	Improving analysis of information and enabling decision making
Geographical	Coordinating processes across distances
Integrative	Coordination between tasks and processes
Intellectual	Capturing and distributing expert knowledge and decision rules
Disintermediating	Eliminating intermediaries from a process

Figure 5-6. Technology Enablers for Process Improvement

18 See Davenport, chapter 3.

19 See Morris and Brandon, chapter 7.

5.3.6 Describe and Quantify New Stakeholder Relationships. Working from the new process deployment map, the improvement team next revisits stakeholder relationships to the new process design. If the needs of stakeholders were considered in the new process design, the interests, requirements, and measures relating to stakeholders will change.

5.3.7 Revise Future State Performance Cell Descriptions. Process redesign and reengineering changes need to be reflected in the performance cells for the process. Objectives, critical success factors, and specific process measures may have changed as a result of process design changes. Current and accurate performance cell documentation will facilitate FEA development, enterprise engineering activities, prototyping, testing, and new process deployment.

5.3.8 Validate Initiatives and Models Against All Requirements. At this point, the process improvement team should validate all process redesign and reengineering changes with respect to the following elements:

- Process vision statement
- Business plan objectives and goals
- Stakeholder requirements
- Performance cell requirements.

This validation task is the last opportunity the improvement team will have to make corrections and adjustments in the process design before materials and documents are formally distributed outside the improvement team.

5.3.9 Select Alternatives for Process Improvement Actions. Once the design elements have been validated, the process improvement team next looks for alternatives in the way process improvements will be implemented. The team should seek to document from three to five alternatives including the status quo (no process changes.) Alternatives will generally apply to organizational and technology enablers, rather than to internal process changes. Organizational alternatives include the formation of self-managed teams to support a process design versus standard manager-subordinate structures. Technical alternatives might involve the use of a distributed data base versus a central data base concept. Alternatives might also deal with technology sizing. For instance, should personal computers with 486 microprocessors be obtained, or should pentium chip computers be recommended?

5.3.10 Perform Economic Analysis on Alternatives. Once a set of alternatives has been developed, the next task is to perform a preliminary economic analysis on the alternatives. This is the only reliable way to judge the merits of alternatives. An economic analysis follows a straightforward six-step methodology described in Section 10 of this guide. The analysis will center on the assumptions and constraints associated with developing alternatives, costs and benefits of each alternative, and the risks associated with each alternative. This data will be passed forward to the next step in the methodology, which is FEA development.

5.3.11 Develop Detailed TO-BE Activity and Data Models. Once the improvement team has considered all reasonable alternatives, the next task is to complete development of the TO-BE activity and data models for the most promising alternative to the level necessary to capture all design features. Supporting design documentation should also be completed at this time. The resulting models should be suitable for distribution to the technical elements once the FEA decision package has been approved. If necessary, other alternatives can be modeled and documented later.

Once TO-BE models are complete, simulation techniques should be applied to test the expected results. Please see the Function Simulation Guidebook for information on simulation. Finally, a functional integration analysis should be completed to ensure that all cross-functional considerations have been addressed.

5.3.12 Initiate/Coordinate Data Administration Activities. The TO-BE data models are now suitable for distribution to data administration personnel so that work can begin on rationalizing the data models that support the new process with the enterprise data model. Data administration will complete this task by developing the Data

Management Plan (DMP), which will be included in the FEA in the following step.

5.3.13 Initiate/Coordinate Information Systems Activities. The TO-BE activity models are now suitable for distribution to information systems technical staff so that work can begin on rationalizing the required application systems changes and enhancements with the current systems migration plan. Technical elements will complete this task by developing the Technical Management Plan (TMP), which will be included in the FEA in the following step.

5.3.14 Prepare Final Process Design Specifications. The process improvement team now prepares the final process design specification package reflecting all recommended process changes and enhancements including organizational and technical features. This package will consist of TO-BE models with sufficient supporting documentation to facilitate development of the FEA formal business case and management decision package.

5.3.15 Review and Approve Process Design Specifications. The process design specification package is submitted to higher authority for review and approval. Higher authority, in this case, is usually composed of the process owner, and improvement sponsors, Principal Staff Assistants, and Functional Information Managers. Following review and approval, the final business reengineering document, the FEA, is prepared during the next step in the methodology.

5.4 Step 9: Prepare Functional Economic Analysis Decision Package

At this point in the business process reengineering phase, the improvement team has developed a program of process improvements that takes into account business objectives from the planning phase and opportunities for improvement based on an analysis of the process itself. The improvement team has also evaluated organizational and technical enablers and constraints as they affect the proposed process improvements. This step is concerned with developing a formal business case, or case for action as it is sometimes called.

To this point in the methodology, the only funds expended have been those needed to support the process improvement team in developing a proposed course of action for process improvement. There has been little or no disruption to current process operations. To go forward from this point into enterprise engineering and especially project execution, major funding will be needed to support the proposed improvements. In addition, functional organizations may be required to make highly disruptive changes in the way workflow is managed. In other words, the element of risk with respect to costs and benefits must be considered before approval to proceed can be granted.

The Functional Economic Analysis (FEA) is a management decision support package designed to provide higher authority with all of the information needed to make an informed decision on whether to proceed with the proposed slate of changes and improvements. Figure 5-7 illustrates the position of the FEA with respect to the total process improvement methodology. As Figure 5-7 indicates, the FEA should be a summary of all the critical decision support data provided by all process improvement activities to this point. [Organizational (phase 2B) and Technical (phase 2C) Change Management are presented in Sections 6 and 7 in this guide.] To summarize, the FEA is a major control point in the process improvement methodology and cannot be completed until phases 2B and 2C are performed.

The FEA package is divided into eight sections. Although it is a functional management responsibility, it requires support from technical elements to produce. It includes the final economic analysis for the proposed process improvement alternative, a summary of other alternatives that were considered, a synopses of strategic and business planning objectives, and a summary of the supporting data and information technical plans. The Functional Economic Analysis Guidebook should be read for specific guidance on preparing the FEA.

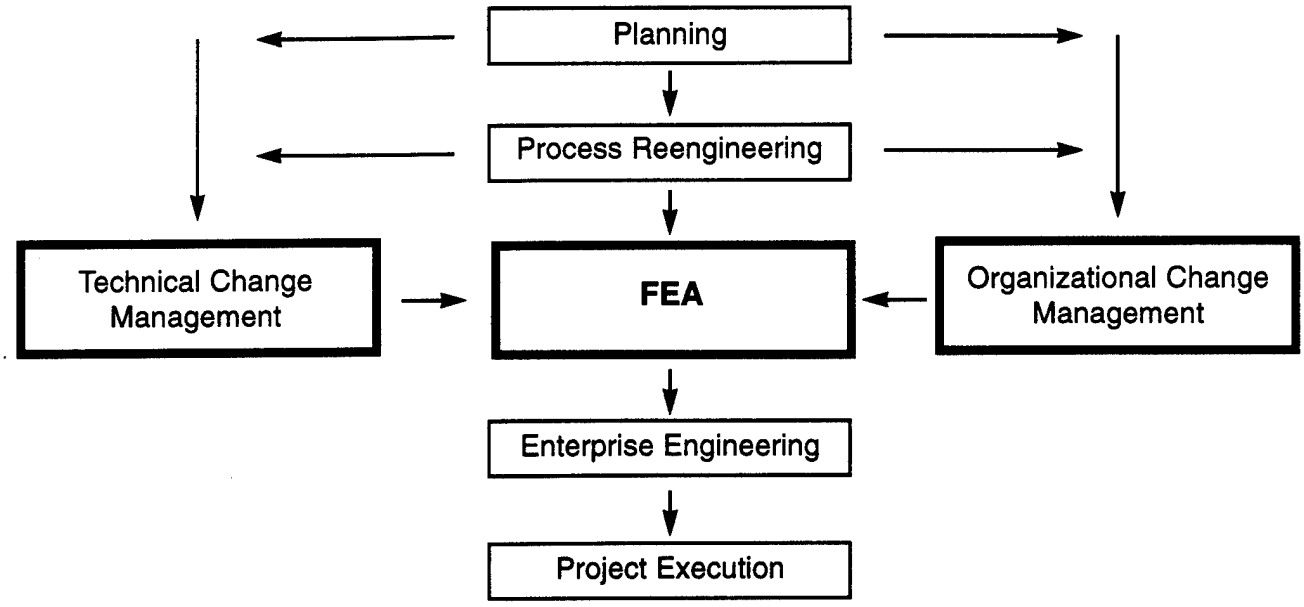

Figure 5-7. Functional Economic Analysis

The features of an acceptable FEA include the following:

- It is comprehensive, presenting sufficient financial and non-financial data to support an informed management decision.
- It provides sufficient justification to warrant an investment in process, organizational, and technical changes and improvements.
- It clearly communicates the current situation with respect to the process under improvement and alternatives means of making process improvements.
- It has internal consistency with respect to data presentation, analysis, and documentation (supports an apples-to-apples type of comparison).
- It includes a risk assessment.
- It includes performance measures that can be used to monitor project continuation upon FEA approval.

The following tasks are performed in the FEA step:

- Review process improvement recommendations
- Review organizational change management plan (from Section 6.3.5)
- Review technology change management plan (from Section 7.3.6)
- Develop preliminary Functional Economic Analysis (FEA)
- Develop preliminary data and technical management plan
- Perform technical review of FEA documents

- Validate/revise preliminary FEA report
- Prepare final Functional Economic Analysis report
- Review and approve FEA

5.4.1 Review Process Improvement Recommendations. The first step in FEA preparation is to review the process improvement report produced in the preceding step. This review should isolate those parts of the report that need to be included in the FEA. The FEA is a summary document and should only include critical management decision-support data. Where required, the FEA can refer to supporting documents including the process improvement report.

This review should also note information that is lacking or needs further development for inclusion in the FEA. The improvement team should refer to the FEA Guidebook and examples of acceptable FEAs to aid in this assessment.

5.4.2 Review Organizational Change Management Plan (6.3.5). Process improvement is invariably associated with organizational change management. During the performance of the first three steps in this phase, organizational enablers and constraints were considered by the person or team responsible for considering organizational issues. Before the FEA can be produced, the results of phase 2B (Organizational Change Management) must be considered. The required organizational changes are included in the FEA so that higher authority can judge the merits of the recommended process improvements with respect to the organizational impacts of the new process. Task 6.3.5 prepares the required report.

5.4.3 Review Technology Change Management Plan (7.3.6). Process improvement, especially process reengineering, will almost always require the application of new information technologies as well as changes and enhancements to the existing information systems infrastructure. Technology enablers and constraints will have been considered by the person or team assigned to perform Phase 2C–Technology Change Management. The results of this team's work must be considered before the FEA can be completed. It is important to distinguish between the costs and risks of new technology enablers and the costs and risks of making changes to existing information systems structures, which often act as constraints to process improvement. Task 7.3.6 produces the required report.

5.4.4 Develop Preliminary Functional Economic Analysis (FEA). Once the three inputs described above have been considered, the process improvement team can develop a preliminary FEA. The FEA is preliminary in the sense that it does not include a thorough analysis of the data management and technical management issues associated with the DoD Enterprise Model or the existing information infrastructure, including legacy and migration systems issues. However, the technical elements cannot reliably provide the this information until they have a good understanding of the proposed process improvement project with the associated organizational and technical implications. The preliminary FEA along with supporting information including activity and data models delivers this information. The following sections of the FEA are written in this task:

5.4.4.1 Section 1: Strategic plan summary. This section should focus on the strategic planning objectives with respect to the process under consideration. This section should include a discussion of breakthrough objectives, critical success factors, cross-functional considerations, and responsibility assignments. Mission and vision considerations should be used as the justification for the improvement project effort. Also included in this section are any impacts due to Defense Management Review decisions and fiscal adjustments.

5.4.4.2 Section 2: Business plan summary. This section should focus on annual business objectives with respect to the proposed improvement project, taking into consideration all cross-functional impacts. A high-level process deployment map should be included along with IDEF context diagrams and high-level AS-IS models to illustrate critical data with respect to improvement efforts. This section should also include a summary of

objective decomposition from the process improvement component of the business plan.

5.4.4.3 Section 3: Performance cell summary. This section should include performance measures, targets, and stakeholder benefits as extracted from the performance cells developed during the planning phase and revised during the process analysis and design steps of this phase. Every process improvement objective must be associated with a measure and a target. These measures and targets should be related to process-critical success factors established during the planning phase.

For the most critical performance targets, this section should provide a brief explanation of how the targets were selected. The usual sources are the strategic plan and strategic benchmarking. Targets may also have been identified during process analysis.

Key stakeholder benefits should be well-documented in this section with respect to performance measures and targets. This is especially true if significant compromises were made in new process design to accommodate conflicting interests.

5.4.4.4 Section 4: Improvement program description. This section is where the process improvement team describes the overall process improvement program in terms that will support an informed management decision about the merits of the improvement effort. All three elements of the process improvement program should be described: process enhancements, organizational changes, and technical enablers. Qualitative factors can be described, provided they are not expected to carry the weight of the decision. This section can also be used to explain why the proposed alternative is recommended and why the alternatives were not. High-level TO-BE context diagrams and models may be included to illustrate proposed improvements.

5.4.4.5 Section 5: Economic Analysis of Proposed Process. The preliminary economic analysis performed earlier is refined based on the results provided by the change management teams and further analysis.

A standard economic analysis contains six steps:

- Clear statement of the improvement opportunity
- Assumptions and constraints that govern alternative development
- Description of each viable alternative
- Costs and benefits of each alternative
- Alternative analysis [Risk-Adjusted Discounted Cash Flow (RADCF) method]
- Sensitivity analysis to correct for imprecise data.

The economic analysis includes a quantitative ranking of alternatives, which should be supplemented with a narrative describing critical non-quantifiable or qualitative factors that influence the selection of alternative.

5.4.5 Develop Preliminary Data and Technical Management Plan. The preliminary FEA and supporting data and reports are used in a series of meetings and investigations with technical support elements. Technical support elements working with functional elements develop a data management and information systems strategy (Section 6 of the FEA) that will support the improvement project within the context of data and systems infrastructure considerations. Of special importance in this analysis are the constraints imposed by legacy and migration systems. Technical risks are also considered with respect to cross-functional integration issues.

5.4.6 Perform Technical Review of FEA Documents. At this point, all of the data and information relating to the process improvement project and all functional and technical issues and considerations are reviewed for consistency by joint

functional and technical elements. At this time, potential problems, issues, and concerns are resolved or documented for resolution during the enterprise engineering phase of the methodology. Also at this time, additional data needed to support the development of the final FEA are identified and assigned as action items for the process improvement team.

5.4.7 Validate/Revise Preliminary FEA Report. Once all actions items assigned in the previous task are completed, the process improvement team performs a final validation of all data currently assembled for the FEA. Working with the project manager, the technical elements now develop Section 7-Data and Systems Changes, and Section 8 -Data and Systems Cost Analysis, of the FEA. These sections of the FEA briefly describe the changes to data and information systems support that will have to be made with an estimate of the associated costs.

The proposed systems changes and associated costs will be reviewed and revalidated during the enterprise engineering phase of the project when all elements of the improvement project are considered in the light of the DoD Enterprise Model, the current information systems infrastructure, the considerations associated with new technologies, and the organizational change management strategy and plan. At the completion of the enterprise engineering phase, the FEA will be updated and submitted for approval before the project execution phase begins.

5.4.8 Prepare Final Functional Economic Analysis Report. The process improvement team now completes the FEA, and performs an internal review and validation effort. The process improvement team should assure themselves that the final FEA report fairly represents the proposed project and provides sufficient data for higher authority to make an informed decision. The Functional Economic Analysis Guidebook should be referenced to ensure that all elements of the FEA are complete and in the required format. The improvement team will also prepare a short briefing package with visuals that can be used to brief management and review teams as necessary.

5.4.9 Review and Approve FEA. The FEA decision package is presented to higher authority for review and approval. Following review and approval, the improvement team advances to the next phase of the methodology, enterprise engineering.

SECTION 6. PHASE 2B: ORGANIZATIONAL CHANGE MANAGEMENT

Business process improvement inevitable requires change to an organization's structure and culture. All change is disruptive. Therefore, business process improvement is disruptive to an organization's structure and culture. Enterprises that have attempted process improvement while ignoring this syllogism have invariably failed. This means that organizational change management is the most critical responsibility in an overall program of process improvement.

Organizational change management begins during the planning phase and extends through the project execution phase. Thus, dealing with organizational change is a continuous responsibility. This responsibility may be vested in one member of the improvement team, or it may be the responsibility of a separate team chartered to support all process improvement teams. The former works when only one process improvement effort is under way across a group of functional units; the latter is necessary when functional units are affected by two or more improvement efforts.

Figure 6-1 shows how a change management team can serve as the focus or hub for multiple process improvement efforts. This arrangement allows the change management team to take a broader view of the relationship of process to organization to help ensure that organizational change management efforts are coordinated for all improvement efforts. Technology change management, discussed in Section 7 of this guide, is also best dealt with by an independent change management team working with separate process improvement teams.

Figure 6-1 also shows that change management must consider the external environment, external stakeholders, and the technical infrastructure when attempting to shape the organization's structure and culture around improved processes.

The role of the organizational change management team or person is to ensure that the organization's structure and culture will be able to successfully assimilate the improved process. An established change management team may even be able to develop enablers that help guide design of the new process.

Structural change management is concerned with the way a functional unit is organized to carry out its work responsibilities. This includes policy and procedure, rules and regulations, management and staffing, facilities and equipment, and human resource practices. Structural change management has to do with *things* or facilities.

Cultural change management is concerned with the way people interact with each other both in peer relationships and superior/subordinate relationships. Cultural change management has to do with *people*, and is therefore the more difficult of the two to successfully deal with.

People and culture—the human systems of an enterprise—are what make or break any change initiative.

The change management team must accomplish four general objectives:

- Understand the organizational changes that are needed as a consequence of process redesign or reengineering
- Design the necessary structural changes needed to support the new process
- Design a program that will begin the cultural transformation of the organization to one that is aligned with the principles behind process improvement
- Anticipate, recognize, and resolve the barriers to change that will spring up in reaction to the change management plan.

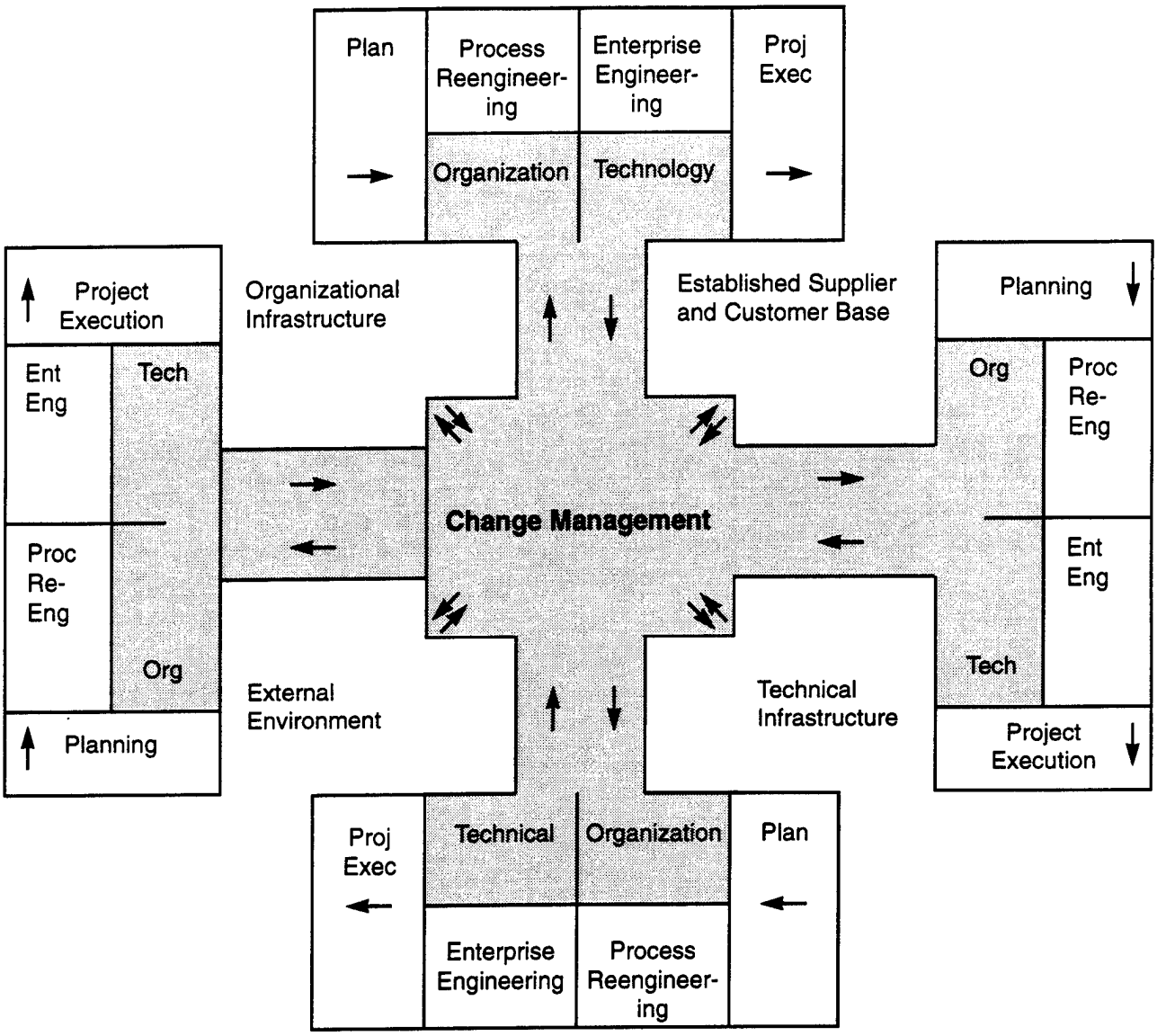

Figure 6-1. Change Management Schematic

Solid change demands careful planning with inputs from all levels of the organization. Carefully timed action steps support change implementation. This requires answers to the who, what, when, where, and why.[20]

- Is the organization's leadership prepared to lead the change effort?
- Have we primed the organization for planned changes?
- Is the organizational structure ready to support change?
- Do team members have the right mix of skills to make the changes happen?
- Is success a reasonable expectation?
- Are functional managers properly committed to the planned change?

20 *Management Processes for Quality Operations*, Richard S. Johnson, ASQC Quality Press, 1993.

- Are sufficient resources available to support the change effort?

Negative answers to the above questions suggest areas for the improvement team to work on because experience has shown that unless and until all questions can be answered in the affirmative, successful implementation of redesigned processes is at considerable risk.

Barriers to change management success are well known. They generally include the following and all must be successfully contained or resolved or the success of the process improvement cannot be reasonably assured:

- Lack of active, visible, and committed leadership
- Ignorance of improvement goals and employees' roles in achieving them
- Ingrained satisfaction with the status quo
- Vested interests in keeping things as they are
- Inadequate training and preparation for the change effort
- Hostility directed at members of the improvement or change teams
- No or little reward or recognition for participating in the change effort
- Threats to personal security and career objectives
- Lack of organizational support
- Inadequate, infrequent, or deceiving communications about the changes.

There have been enough successes with process improvement that some general principles to guide organizational change can be expressed. These principles can be used by change management teams to design a program to support process improvement with assurance that the principles have worked for other organizations. It must be remembered, though, that change involving people, their perceptions, and attitudes takes time to settle in. Therefore, these principles function more as a direction for change than an immediate destination. This in no way invalidates their use.

- Process management must be instituted in such a way that functional managers can support it (see Figure 6-2, value-chain versus control-chain).

- Management hierarchies must be flattened to make the organization more flexible and responsive to changing conditions.

- Employees must be involved in decision making and empowered to act on behalf of internal and external customers.

- Work must be reorganized around cross-functional work groups (teams) who have responsibility for cost, quality, and cycle time performance.

- Unnecessary and obsolete rules and regulations that inhibit process performance must be reduced or eliminated.

- Continuous and just-in-time learning practices must be put in place to facilitate skill development, cross-functional cooperation, and work group flexibility.

- Managers must manage less and lead more.

- The new values of commitment, teamwork, performance, and accomplishment must displace the old values of risk avoidance, strict accountability, self-aggrandizement, and functional myopia.

- Rewards and recognition must be aligned with team accomplishment of process performance goals and individual skill and competency development.

Figure 6-2 illustrates the relationship between process management and functional management. While there are academic arguments concerning whether enterprises should keep a primarily functional organizational structure or adopt process

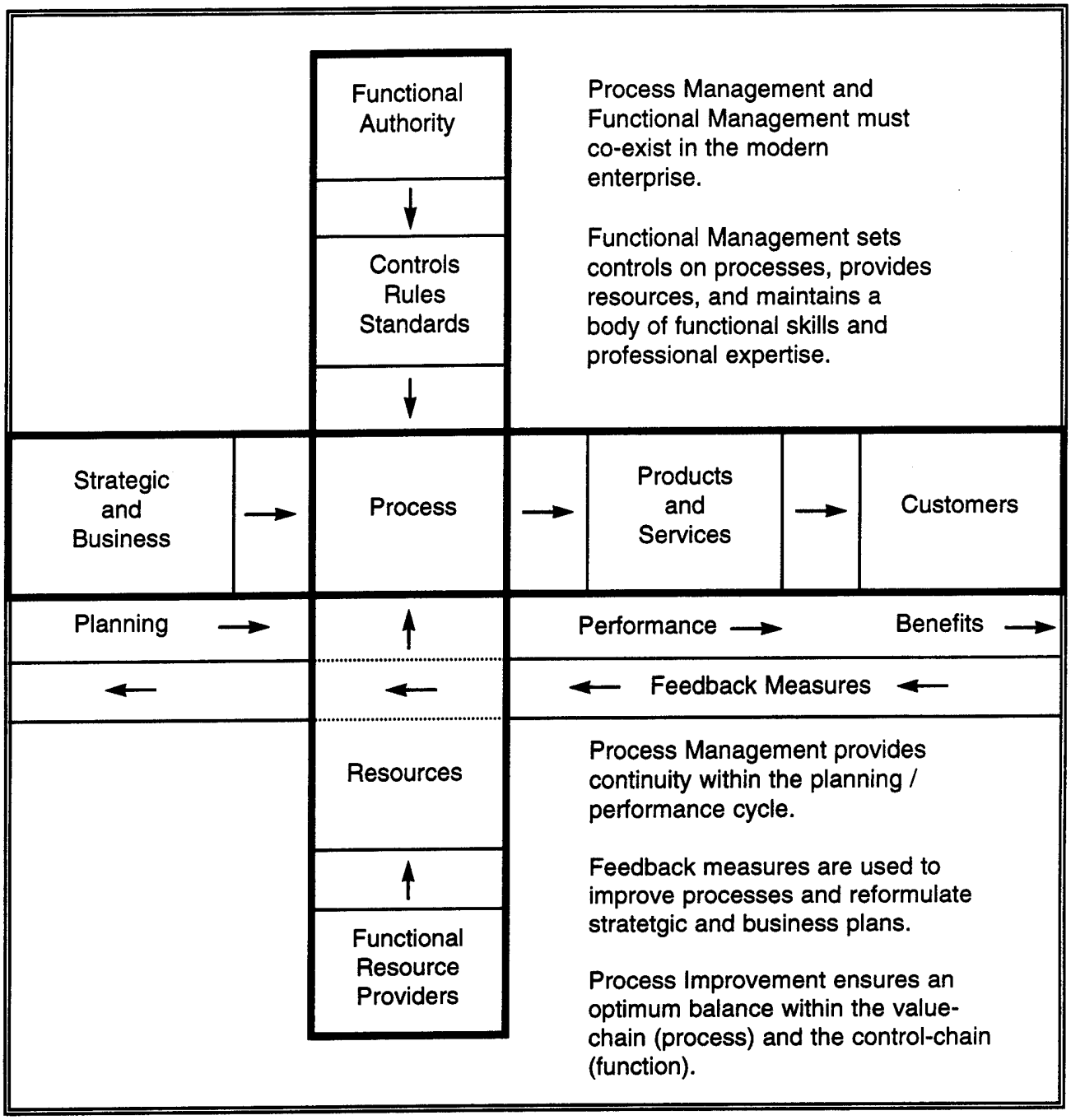

Figure 6-2. Process/Function Management Model

management as an organizational concept, it would seem that there is a need for both in large, complex enterprises. Process management provides the useful construct of the value-chain, while functional management provides an equally useful construct of the control-chain. Change management teams should strive to maximize the potential of each with respect to process improvement efforts.

At the completion of this phase, the change management team will have produced a change management plan aligned with process improvement objectives. The change management plan will be included in the Functional Economic Analysis decision support package. As the improvement project moves through the enterprise engineering and project execution phases, the change management team will coordinate change

management actions with process improvement actions.

The change management phase of the Framework for Managing Process Improvement is supported, in part, by the following resources:

- F/MPI Management Briefing on Organizational Change Management
- F/MPI Organizational Change Management Tutorial
- Merced County Case study in Change Management.

The techniques (described in Section 10) most useful in this phase include the following:

- Brainstorming
- SWOT Analysis
- Affinity Diagram
- Cause and Effect Diagram
- Force Field Analysis
- Pareto Analysis

6.1 Step 10: Assess Organizational Capability

Before process improvement, there is the organization. This step assesses current organizational capability with respect to process improvement efforts. In this sense, this step serves as a baseline from which to plan, design, and develop organizational improvements that will be required for, or that will support, process improvement efforts.

Once the change management team understands the strengths and weaknesses of the organizational units affected by potential process improvement efforts, they can better plan a series of changes and improvements that will condition organizations to accept the new process. The change management team should be cognizant of the fact that, where possible, it may be better to shape the new process around organizational strengths rather than attempt to correct all organizational weaknesses in one go-around.

When the tasks in this step are complete, the change management team will be positioned to identify and prioritize a series of organizational changes needed to support planned process improvements.

The following tasks are performed in the assess organizational capability step:

- Review process improvement organizational implications
- Assess organizational status (strengths and weaknesses)
- Document current organizational status
- Review and approve organizational situation report.

6.1.1 Review Process Improvement Organizational Implications. The first task in change management is actually a continuing task. As the process under study moves through the reengineering phase, the change management team constantly looks for the organizational implications of suggested or proposed process changes and improvements. This is one reason that change management should be dealt with outside of the process improvement team. It is quite easy for the improvement team members to devalue the impact of potential changes on organizational units without this dispassionate perspective.

The implications the change management team should evaluate include the following:

- Organizational structure changes, which can include hierarchical, flat, functional teams, cross-functional teams, centralized, decentralized, and matrix structures
- Process vision with respect to enterprise vision
- General climate of the affected functional units with respect to tolerance for change and growth
- Morale as it might support or hinder improvement efforts

- Physical environment with respect to process (workflow) changes
- Training and development impacts due to changed processes and structural adjustments
- Employee involvement in new process operation as well as in the implementation and deployment phase of the improvement project
- Recruiting practices with respect to type of individuals sought to staff the new process for example, the need for team players rather than rugged individualists
- Alternate staffing issues related to part-time, contract employees, and out-sourcing
- Compensation or grade-level implications
- Reward and recognition adjustments
- Performance appraisal and career path implications.

Because changes involving people usually take considerable time to evaluate, approve, and enact, the change management team must begin their consideration of potential process improvement impacts on structure and culture during the planning phase of the improvement project.

6.1.2 Assess Organizational Status (Strengths/ Weaknesses). Once the change management team begins to understand potential impacts on structure and culture, it needs to evaluate the current situation in all potentially affected functional units. This is much like establishing the process baseline. Unfortunately, the culture of an organization cannot be neatly modeled with boxes and arrows.

The Department of Defense has produced the "Quality and Productivity Self-Assessment Guide" which enables an improvement or change management team to measure four aspects of an organization related to process improvement. The four elements are:

- Climate—people's perceptions of the organization and work groups
- Processes the organization's policies, practices, and procedures
- Management tools—the specific techniques used to promote quality management improvements throughout the organization
- Outcomes—factors related to mission, objectives, and goals.

The assessment instrument is reproduced in Appendix G and may be copied and distributed as needed. There are 215 questions, which will take about 15 minutes to answer. It is important to remember that the term *customer* may refer to an internal or external person or agency that receives work from a process or work activity. After scoring the assessment, the change team will have a better understanding of the organization's readiness for change and process improvement.

An IBM PC-compatible software version of this assessment can be obtained from DPPO, Two Skyline Place, Room 1404, 5203 Leesburg Pike, Falls Church, Virginia 22041, (703) 756-2346.

6.1.3 Document Current Organizational Status. With a baseline assessment of organizational readiness for change, and an understanding of the potential impacts of process improvement on affective functional units, the change management team can develop a status or situation report. This report will note the areas and issues of most concern with respect to organizational change and process improvement. Areas of both strength and weakness should be highlighted.

This report will be used later in this phase to develop an action-oriented plan to enhance organizational enablers, remove obstacles, and lower barriers to change and improvement. The

report may also be used by the process improvement team itself to adjust process design, wherever possible, to take advantage of strengths and avoid or minimize the impact of weaknesses in organizational factors.

6.1.4 Review and Approve Organizational Situation Report. The situation report should be reviewed and approved (validated) by the process improvement team and functional managers who are sponsors of, and targets of, the improvement effort. In as much as sensitive issues are addressed in the situational report and much of the evaluation is based on subjective factors subject to interpretation, the detailed situation report should not be widely distributed. A summary of general conclusions and recommendation may be prepared and distributed.

6.2 Step 11: Identify Organizational Change Requirements

The previous step in this phase produced in an assessment of the current situation of organizational structure and culture, and an understanding of the implications of process improvement on functional units.

This step will result in an organizational impact statement that defines the specific areas in structure and culture that have to be addressed to support the potential requirements of the reengineered process. These requirements will be defined in the Process Improvement Analysis Report produced in Step 7, Conduct Improvement Analysis. The organizational impact statement produced in this step will also include an analyzed list of organizational enablers for use by the process improvement team in Step 8, Redesign/Reengineer Process. The final change management plan will be produced in the next step in this phase.

W. Edwards Deming,[21] who devoted his life to studying how to transform organizations into high-quality, high-performance enterprises, developed 14 points for organizational renewal. A study of these 14 points will prove useful to change management teams who take time to understand them and apply them to transforming their own organizations. "What management can accomplish using the fourteen points is so enormous compared to what you get otherwise," Deming said. The following points are slightly edited to emphasize their applicability to process reengineering.

1. Create constancy of purpose toward the improvement of product, service, and process based on a long-term commitment to continuous improvement.

2. Senior leaders must be committed to process improvement and take an active and visible role in ensuring that it takes place.

3. The focus on process improvement must be to deliver high quality and service to the customer.

4. Create long-term relationships and partnerships with external and internal suppliers to strengthen the value-chain extending through the process to the final customer.

5. Decrease process costs with a never-ending focus on improving quality and reducing cycle time.

6. Employ just-in-time training for everyone affected by change and improvement.

7. Institute leadership at all levels in the organization. A leader is one who leads from where he or she is, not from a position on an organization chart. That is: a leader is one who leads, it is not a title.

21 *The Deming Management Method*, Mary Walton, Perigee Books, 1986.

8. Drive out fear so that everyone may work effectively. Don't use reengineering as a *cover story* for reductions in force that would take place with or without reengineering.

9. Break down the barriers between departments by instituting process management principles and cross-functional cooperation.

10. Eliminate slogans, exhortations, and campaigns that offend already dedicated and willing employees. Rather, managers and supervisors must lead by example and *walk the talk.*

11. Eliminate work quotas bysubstituting leadership and empowerment that focus on delivered results rather than work targets.

12. Remove barriers that rob managers, engineers, and other workers of their right to pride of workmanship.

13. Institute a vigorous program of education and self-improvement. Retrain workers for service in the improved processes.

14. Put everyone in the organization to work to accomplish the transformation by communicating what is happening, and why, and what will happen if the organization is not successful.

As the change management team proceeds through this step, the following questions will be asked and answered several times as the nature of the impacts on the current organization become better understood:

- How will the organization react to change, and what will be the basis for this reaction?
- Who are the potential champions of the change, and why will they be supportive?
- What are *realistic* expectations for the organization, and where will we have to accept compromises both in process design and organizational change?
- How much time is available to make changes based on the estimated time-table for implementing the new process?
- How much of the organization (how many functional units) will be subject to the change? Should we target a single unit or attempt to transform all at the same time?
- How will we measure progress and results? How will we know what success is?

When the tasks in this step are complete, the change management team will have produced an organizational impact statement that presents a clear and honest picture of the potential impacts to structure and culture based on potential process improvement initiatives. This report may be structured to indicate several scenarios related to the process improvement initiatives eventually adopted. The change management team will also be able to provide the process improvement team with one or more *organizational enablers* which may be defined as structural and cultural strengths that can be effectively used in refining process design features.

The following tasks are performed in the Identify Organizational Change Requirements step:

- Review and evaluate process improvement analysis report
- Document organizational best practices
- Evaluate organizational change requirements
- Develop time and cost estimates
- Develop organizational impact statement
- Review and approve organizational impact statement.

6.2.1 Review Process Improvement Analysis Report. This report produced by the process improvement team in Step 7 lays out a series of process improvement opportunities. These opportunities should be reviewed and evaluated by the change management team with respect to the current situation of potentially affected organizational units.

Each of the opportunities in this report will have some potential impact on organizational structure and culture. These impacts should be noted and classified. Brainstorming, followed by classification and prioritization, is the recommended technique for accomplishing this task.

Structural changes will fall into two categories: those that the affected organizational units have the power to change, and those that will require involvement by higher authority to change. Where possible, the specific directives affecting the structural situation should be noted.

Cultural changes cannot be neatly classified. But change management teams need to be aware of the demanding nature of trying to *fiddle* with culture in an established organization. Shuster[22] suggests a series of provocative assumptions that can help change management teams better understand *people,* so that they can deal more effectively with the cultural issues associated with process improvement. With respect to change and growth, a great many hearts have been broken because point 15 below is not well understood.

1. Groups do not act; people do!

2. No one can change another person's mind, but one can place others in an environment that enables them to choose to change their own minds.

3. Obstacles that are imposed upon us are not a matter of personal choice and accountability. Our responses to imposed obstacles are generated within us [and], therefore, are a matter of personal choice and accountability.

4. Every human organization is an organic system, composed of interdependent individuals, such that each influences, and is influenced by, all. The healthiest organizations are those whose individuals are bonded and integrated into an organic community. Members of an organic community are survival interdependent and mutually supportive.

5. People are disposed to resist changing their habitual attitudes and behavior. Individual habitual attitudes and behavior are addictive. People will not change unless, and until, they are psychologically ready to withdraw from their addictions. Purposeful action is required to enable people to work through, and thereby recover from, their addictions.

6. Theory is the window to reality. Theory is driven by imagination. Imagination is more important than knowledge. Workable theory is empirical [pragmatic] theory.

7. People are creatures of integrity and want to do a good job; belong to something bigger than themselves; break bureaucratic chains of alienation; experience joy in work; and be recognized, trusted, treated with dignity, and delegated authority and accountability.

8. Perfection, as an ideal, is an acceptable standard of performance. Perfection can be approached incrementally. Horizons of perfection grow and expand as they are approached with imagination and according to attitudes and events.

22 "Making Cultural Change Happen," H. David Shuster, *Quality Management Journal,* January 1994.

9. Education is not a function of community; it is the community.

10. Processes, although central to transformation, are abstractions rendered operational only by individual action.

11. No one can delegate involvement.

12. Commitment means fanatical trust in people's integrity and obsessive intolerance for anything less than the full and continuous application of management transformation principles and practices.

13. It is not enough to want to change; people must know how to change.

14. Measurement is crucial to management transformation, but it is vital to know what, why, when, where, and how to measure. Sometimes the most important things cannot be measured for example, the business lost by customers who never return or normative assumptions (what one should/should not do).

15. Never try to convince the *unconvincable.*

16. Management transformation is a management philosophy that inspires and commits every individual to visibly and actively participate in the development, nurturing, and sustaining of a working culture that pursues the ethic of total customer satisfaction through dedication to continuous process performance improvement.

Shuster's work needs no elaboration other than to note that his use of the term *management transformation* is roughly equivalent to the term *organizational change management* as used in this guide.

At this point, the change management team should have a workable understanding of the potential effects of the proposed process improvement initiatives on the organizational infrastructure.

6.2.2 Document Organizational Best Practices. By this time, the change management team should understand the functional units under study well enough to develop an annotated list of organizational best practices.

The concept *best practices* is used in the sense of identifying those things that one or more functional units do well (with respect to structure and culture), which should be leveraged in any process improvement effort. These things can also be called enablers of process improvement and should be communicated to process improvement team members. This is important because a process improvement team may not be aware of a best practice in a functional unit not included in the process improvement project.

Examples of organizational best practices can be found in any of the following categories:

- Leadership practices
- Motivational practices
- Training practices
- Organizational structures
- Reward and recognition systems
- Communication systems

6.2.3 Evaluate Organizational Change Requirements. With the information gathered and analyzed to this point, the change management team begins to evaluate the need for specific organizational change initiatives. These organizational changes (initiatives and programs) are directly related to specific process changes that are being designed by the process improvement team.

These questions can be used to evaluate each potential change management requirement:

- What is the situation in the proposed process that indicates a need for an organizational change or institution of a new practice?

- What factors are involved in this situation?

- Who wants the change to occur and why? What are the prime motives?
- Are these motives consistent with, or in opposition to, established policy and cultural factors? Has the possibility of conflict with current policy been fully explored?
- Who can be counted on to support the change effort, and why and how will they support it?
- Who will probably resist the change effort, and what will be their basis for resistance?
- Will higher authority support the proposed changes?

When these questions have been asked and answered for each significant organizational change proposal, the situation, supporting facts, and the approach to implementing the change should be written out in the form of a preliminary plan.

At this point, the change management team will have one or more synopses of potential organizational changes, adjustments, improvement, initiatives, innovations, and programs directly associated with potential process improvement initiatives.

6.2.4 Develop Time and Cost Estimates. The timeframe and estimated costs (level of effort) are developed for each of these change management initiatives. The assumed benefit of the change initiative is that is supports a proposed process improvement initiative. Once the estimated level of effort is known, the change management team can work with the process improvement team to validate and rationalize the overall set of process and organizational changes and improvements.

6.2.5 Develop Organizational Impact Statement. It is now possible to develop an organizational impact statement (OIS) for each set of change initiatives. Like its forerunner, the environmental impact statement, the OIS examines the overall affect of disrupting the status quo with respect to process improvement. The OIS attempts to describe collateral effects in functional units that may not directly benefit from the proposed process improvement but will, nevertheless, will be affected by it. For instance, a change management initiative may recommend a just-in-time training program that may tax the existing training department.

The following questions can be asked in developing the OIS:

- What individuals and groups (functional units) will be affected?
- How severe will this impact be?
- How will they be involved in the change (labor hours, costs, disruption, etc.)?
- How will they benefit from the change and will this be an immediate or long-term benefit? Will significant costs be incurred in the short term for a benefit that will not be realized in the current budget cycle?
- Will they ultimately gain or lose resources?
- Will they gain or lose power, positions, prestige, work, customers, or suppliers?
- What are the tradeoffs for any losses?

6.2.6 Review and Approve Organizational Impact Statement. The OIS is submitted to higher authority for review, validation, and approval. Due to the subjective nature of the OIS, it is probable that the issues, analysis, and conclusions reached will have to be explained or defended. For this reason, the change management team should ensure that backup documentation is available to justify the analysis.

The OIS should also contain a catalog of organizational enablers for process improvement that may influence the final design for processes undergoing improvement. These enablers are strengths that should, if possible, be leveraged in the new design.

6.3 Step 12: Develop Organizational Change Management Plan

After the impact statement has been reviewed and the process improvement team has completed Step 8, Redesign/Reengineer Process, the formal change management plan can be completed. The organizational change management plan will be one of the inputs to enterprise engineering along with the FEA and technical change management plan. It will be the role of the process improvement team during the enterprise engineering phase to integrate all three change plans.

The formal plan for instituting organizational changes must include a strategy for overcoming structural barriers and human resistance to change. The plan should also include a synopsis of likely staffing, training, and development requirements.

The following tasks are performed in this step:

- Analyze organizational barriers to change
- Prepare strategies for overcoming barriers
- Identify process-related training requirements
- Develop organizational change management plan
- Review and approve organizational change management plan.

6.3.1 Analyze Organizational Barriers to Change. Barriers to change may be classified into three general categories:

- Structural
- Cultural
- Regulatory.

Each category must be handled differently. Structural barriers are imposed either within the organization itself or by higher authority. Surprisingly, functional organizations often lose track of the limits and barriers they place on themselves, and fail to realize that they have the authority to make meaningful changes.

Barriers imposed by higher authority are more difficult to deal with. A business case should be developed that justifies the need to eliminate or moderate these types of barriers.

Cultural barriers are the result of ingrained practice, a form of on-the-job training as it were. Cultural barriers have to be understood in the context of Shuster's assumptions given in the previous step.

Regulatory barriers (public law, regulations, higher headquarters policy, etc.) require a major effort to change. The change process may take years if it happens at all. The change management team must always have a fall-back position with respect to regulatory barriers. Suboptimization due to regulatory barriers should be documented and transmitted to higher authority for consideration.

Some of the barriers common within DoD include the following:

- *Senior leadership commitment and buy-in:* Business process reengineering is a top-down initiative and depends upon strong leadership to overcome obstacles.

- *Focus on current operations:* Process improvement disrupts established procedure and challenges existing regulations and directives. Management must successfully guide employees through the transition period from existing process to reengineered process.

- *Becoming customer centered:* Managers and employees must shift from a rule-based to a customer-based mode of operation and establish performance measures that focus on process outcomes rather than process inputs such as budget.

- *Aversion to job elimination, risk, and change:* The very essence of process improvement is the elimination of non-value activities, radical change, and adoption of high-technology solutions—all of which challenge the organizational status-quo.

- *Mismatch between authority and responsibilities:* Process improvement includes the concept of team-based performance and worker empowerment, both of which challenge traditional management and organizational wisdom.

- *Functional and technical stovepipes:* The concept of process crosses established organizational boundaries and requires new methods of managing work products.

- *Inconsistent rules, methods, and techniques underlying management processes:* Many of the non-value added activities associated with processes undergoing improvement are traceable to obsolete or inappropriate rules, regulations, methods, and techniques whose worth must be reevaluated.

- *Policies on job descriptions, training, and reassignment:* Process improvement calls for a radical reengineering of personnel policies that currently limit the authority of management to develop a flexible, customer-centered work force with appropriate rewards and recognition for team-centered performance and individual skill development.

- *Funding:* Current funding practices support the status quo and inhibit management's ability to apply scarce resources to activities that produce products and services most needed by internal and external customers.

All barriers identified in previous steps should be classified and analyzed so the all assumptions and facts relating to each barrier can be properly analyzed.

With respect to any kind of change, there are generally two groups of people involved: those who are sponsors of change (want the change) and those who are the targets of change (resist the change, at least initially). Carr and Littman[23] suggest a matrix approach to help understand how to approach the task of overcoming barriers.

Figure 6-3 illustrates this approach.

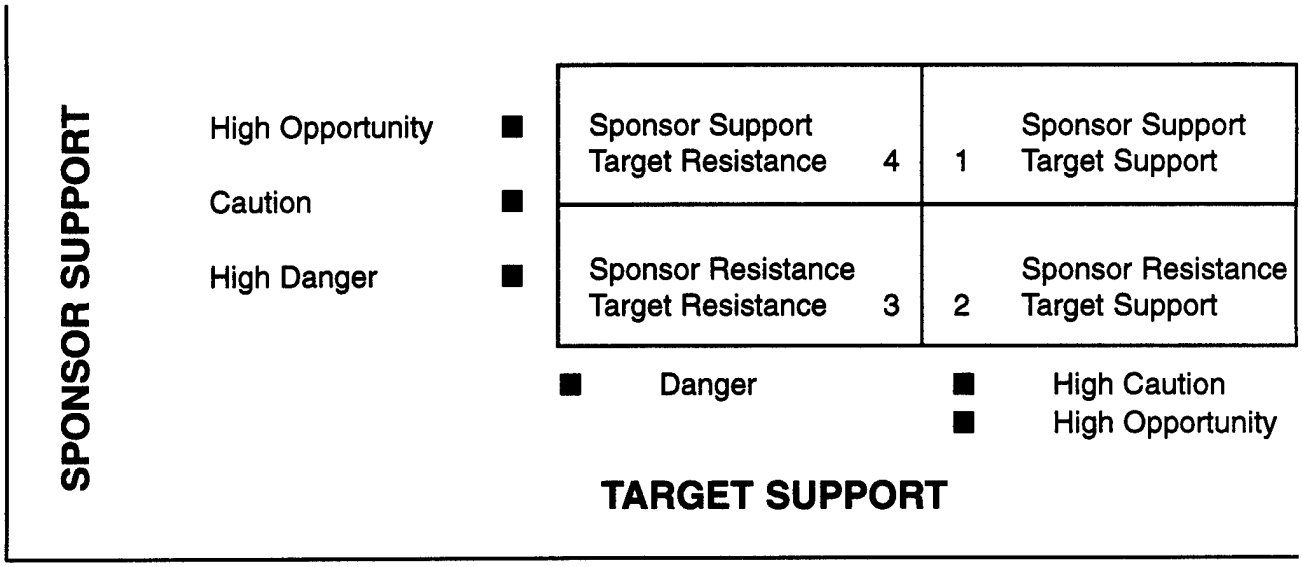

Figure 6-3. Analyzing Barriers

23 *Excellence in Government,* David K. Carr and Ian D. Littman, Coopers & Lybrand, 1990.

Figure 6-3 is a matrix illustrating four situations involving sponsors of change and targets of change. The grids indicate the relative degree of risk versus opportunity with respect to sponsors and targets and the change issue.

For issues that map into quadrant 1 (high opportunity for both sponsors and targets), change management is relatively simple. The change should be received well and the necessary resources for successful implementation provided.

For issues that map into quadrant 2 (high opportunity for targets and high risk for sponsors), this is little chance that the change will be accepted, or successful if it is. The remedies are to educate or replace sponsors, or prepare for failure. It may seem odd that a sponsor would resist the change. This is an example of "lip-service" where sponsors may say they want the change but, in reality, they don't.

For issues that map into quadrant 3, there is no hope of proceeding with the change. Failure is assured.

For issues that map into quadrant 4, the changes can be forced, but at great expense. For instance, many regulations and mandates fall into this quadrant.

6.3.2 Prepare Strategies for Overcoming Barriers. The general approach to dealing with change management is to strive to develop and associate opportunities and rewards for both sponsors and targets for every change management issue.

Another technique is to use force field analysis. Force field analysis is described in Section 10 of this guide. This technique graphically illustrates the forces lined up in support of a proposition (a change in this case), and the forces lined up in opposition to the proposition. Once the array of forces is understood and matched head-to-head, strategies for removing the most important negative forces, and reinforcing the most positive forces can be developed. Force field analysis helps the change management team win the war at the possible expense of losing a battle or two. The technique is a great help in preparing for negotiations and issue resolving conferences.

Carr goes on to suggest three additional strategies to be used in sequence for influencing the target population to accept and support a change proposition.

- Wedge strategy, which is designed to convince targets that the AS-IS situation is no longer desirable:
  - Explain the problems and opportunities
  - Validate that the old way worked in times past
  - Present the vision for the change
  - Specify the necessary changes
  - Make it uncomfortable to continue resistance.
- Transition strategy, which initiates change and builds momentum for continuing with it:
  - Reinforce why the change is necessary
  - Look for opportunities to gain small successes
  - Provide accurate and timely supporting information
  - Involve the target in planning actions
  - Allow the target to *ventilate* minor grievances
  - Focus on the future state—the vision
  - Reward those who support the change process
  - Assign targets to key responsibilities
  - Provide targets with resources to facilitate the change process.
- Magnet strategy, which focuses targets away from the transition state and on the future state:

- — Show sponsor commitment
- — Increase rewards for moving forward
- — Make it easier to move toward the change than to stay in place or regress.

When this task is complete, the change management team should have a well-developed plan and strategy for dealing with, overcoming, or sidestepping all barriers to organizational change management.

6.3.3 Identify Process-related Training Requirements. The chief enabler at successful organizational change is a well-conceived training program that is ongoing over the entire change period. Initial training will focus on awareness, attitude adjustment, and concepts. As the project nears the implementation phase, training will begin to focus on skill development.

The responsibility of the change management team is to identify the training requirements with as much specificity as possible with respect to learning objectives, job skills, competencies, training audience categories, estimated number of students by category, and timeframe. With this information, training support personnel can work with change management team members and functional sponsors to develop or acquire the required training courses. Section 12 of this guide has more information on training support.

6.3.4 Develop Organizational Change Management Plan. The change management plan should be developed according to the following outline:

- Change requirement and description
- Objectives and goals expressed in performance terms
- Action plan for achieving the objective with schedules and milestones
- Resource allocation plan for supporting the change process
- Communications plan
- Issue resolution plan.

The change management plan will be a synthesis of all the change elements developed in tandem with the process improvement team. As the improvement project moves into the enterprise engineering phase, the change management team will monitor progress and make changes and adjustments as necessary. As possible, the training plan should be included in, and synchronized with, the change management plan.

6.3.5 Review and Approve Organizational Change Management Plan. This plan like all others is forwarded to higher authority for review and approval. Unlike many of the other plans though, this one will be continuously revised and updated as the process improvement project moves through the enterprise engineering and project execution phases. Once the plan is approved by higher authority, it becomes part of the input to the enterprise engineering phase.

Addendum

Figure 6-4 shows examples of cultural changes derived from a DoD publication. The DoD publication that this figure is based on is not known. The figure was reproduced in *Excellence in Government*, by David K. Carr and Ian D. Littman.

Category	Previous State	New Culture
Mission	Maximum return on investment Management by objectives	Ethical behavior and customer satisfaction; continuous improvement
Customer requirements	Incomplete understanding of customer requirements	Systematic approach to satisfy internal/external customers
Suppliers	Unidirectional relationship	Partnership
Objectives	Short-term objectives with limited long-term perspective	Long-term goals; Short-term objectives
Improvement	Acceptance of variability; Assigning blame the norm	Understanding and continually improving the process
Problem solving	Unstructured individualistic problem solving/decision making	Participatory an cross-functional problem solving/decision making
Job and people	Functional, narrow scoped; management controlled	Work teams, integrated functions; cooperation
Management style	Uncertain objectives which instills fear of failure	Open style, clear objectives, encourage teamwork
Role of manager	Plan, organize, assign, control, and enforce	Communicate, consult, delegate, coach, remove barriers
Rewards and recognition	Pay by job; few team incentives	Individual and group recognition and rewards, negotiated criteria
Measurement	Orientation toward data gathering or problem identification	Data used to understand and continuously improve process

Figure 6-4. DoD Examples of Cultural Changes

SECTION 7. PHASE 2C: TECHNOLOGY CHANGE MANAGEMENT

While many useful and rewarding process improvements can be achieved apart from any consideration of technology enablers or information system betterments, true or radical reengineering efforts invariably depend on exploitation of available or emerging information technology capabilities. The effective use of advanced technology can dramatically enhance an organization's ability to achieve major or even breakthrough improvements in all four measurement categories.

- *Fitness-for-Purpose* - Technology provides the means to deliver superlative customer service by enabling organizations to easily and inexpensively customize services and products that will match exact customer needs and requirements.

- *Conformance-to-Standard* - Technology enables the achievement of exacting quality standards resulting in dramatic decreases in error rates, rejects, and waste.

- *Process Cycle Time* - Employing technology is virtually the only way to reduce the operational time it takes to produce a unit of output. Advanced technology makes it possible to automate production while delivering seemingly customized products and services.

- *Process Costs* - While employing new technology always requires initial investment and start up costs (as well as risk), the return on investment can often be measured in orders of magnitude, especially in service-based processes.

Technology, carefully evaluated, prudently selected, and wisely implemented, enables radical business process reengineering. The key word is enables. This means that technology is not something that is considered after processes are reengineered. Rather, consideration of technology capability drives the development of the new process design. Therefore, the time to consider technology issues begins with process visioning, continues through process redesign (construction of the TO-BE model), and becomes a major component of the Functional Economic Analysis (FEA) decision package.

The other side to technology consists of the existing technological platform that supports current business processes. While it is possible that current capability is not fully utilized to support process requirements, it is more probable that existing technology is obsolete and a detriment to process improvement. In this case, existing technology represents a barrier to process improvement that must be overcome just like organizational barriers exist to thwart process improvement efforts.

It is not always easy or even possible for functional elements to distinguish enabling technology from inhibiting technology. There are issues of technology integration, migration or transitional systems, interoperability, and compatibility that are well within the realm of the technical elements. Such issues are best handled during the enterprise engineering phase of the Framework Methodology. Functional elements must focus on what they want in terms of technological capability expressed in terms of measures, then let the technical elements decide how to achieve the desired results. If existing technology can be reworked or reconfigured to obtain these results, so much the better.

There are also the elements of cost and risk that must be addressed with respect to technology. That a technological investment may return many times its investment becomes moot if the initial investment funds cannot be obtained. Intolerance for high risk may prohibit an investment in new technology even if the funds are available or could be made available. Functional managers will call upon the services of financial analysts and engineering consultants to aid in making investment decisions.

Finally, technology change management must be integrated with organizational change management, and both must be compatible with the objectives of the redesigned business process. New technology is often frightening to employees and managers alike. There is both a learning curve and an acceptance curve. Since most people cannot accept something they don't understand, and will not learn something they don't accept; these curves must be traveled in parallel, and the journey is not usually as smooth or as fast as we would like. And some people may never arrive at the desired destination.

Existing rules and regulations may be more of a barrier to technology insertion than organizational or cultural issues. Rules and regulations are oriented to a command and control working environment, while many of the emerging technologies are designed to enable empowered work teams to focus on serving customer requirements. Empowered work teams depend upon a free flow of information across the business process and increased accountability and decision making authority. Functional managers engaged in process reengineering must work with higher authority early in the process redesign effort to ensure that overly restrictive (or obsolete) rules and regulations are suitably adapted in line with planned technology capability. There are numerous examples of situations where new process designs had to be intentionally crippled so that the process operations could conform to rules and regulations that no longer provide customer or business value-added benefits.

Current technology capability invalidates much, but not all, of the rationale behind functional or stovepipe organizational structures. Apart from the technological capability that now exists, there was no reasonable way in the past to manage work in large organizations other than through the functional model. That the terms cross-functional work teams, or concurrent engineering, or computer integrated manufacturing even exist is an acknowledgement that we now structure work around current organizational impediments and accomplish results in spite of the functional orientation that still thrives in most large organizations.

It is clear that the forces of change are moving organizations irrevocably toward a horizontal or process management orientation. It is also clear that technology is the change engine behind this movement, since it is technology that makes the new work paradigm possible. Furthermore, people do not willingly abandon that which they have prospered from (in this case functional management structures) apart from crisis. This represents a strong argument to consider not only the process improvement potential of technology insertion but also its potential to disrupt the organizational status quo. In other words, technology insertion is far from being solely a technical or cost consideration. The human and organizational issues of technology insertion must be considered fully and in tandem with the pure capability or cost issues.

Before relating the methodology steps in this phase of the Framework Methodology, it is important to establish the overall objectives of considering technology as an enabler of business process reengineering. There appear to be three major, time-phased objectives in the new organizational paradigm that depend in large measure on the effective use of technology enablers:

- Creating high-performance, cross-functional work teams focused on providing quality and service to both internal and external customers.
- Establishing a highly integrated enterprise centered around core business processes supported by interoperable information systems and enterprise-wide shared data.
- Achieving the attribute of the virtual corporation or extended enterprise made up of intimate (but flexible) supplier and customer partnerships that are intensely customer driven and highly responsive to any changes in the external environment whether those changes are socio-economic, geo-political, market-oriented, or competitive.

It should be clear that these overriding objectives are sequential. It is not possible to achieve the state of being a virtual corporation unless the enterprise is well integrated internally. And it is not possible to do that unless the restraints of the functional straightjacket are loosened via the creating of empowered work teams. It should also be clear that not all enterprises will move through this progression at the same time or at all. But it is difficult to see how any enterprise will continue to exist if it remains resistant to achieving even the first objective in this progression.

Since these objectives do represent a progression, and most organizations embarking on reengineering efforts have not yet fully achieved the first one, this phase of the Framework Methodology is focused on using technology enablers to achieve the objective of establishing high-performance, cross-functional work teams.

The objectives for establishing a work team concept are the following (with an emphasis on the technology implications):

- Restructure business processes to enable work sharing by providing streamlined communications and information on demand
- Eliminate unproductive (non-value added) activities due to excessive oversight that can be replaced with more controls being integrated into work processes
- Establish work group computing that enables teams to collaborate on the creation of work products including products, documents, specifications, and designs utilizing all available media: text, data, voice, graphics, and images
- Institute a more efficient division of labor using such technological tools as work flow analysis, groupware, office automation, document creation software, and other productivity tools
- Increase information flows and data sharing across business processes to lessen the effects of hierarchical or functional segmentation
- Improve decision making capability by providing rule-based decision support tools and expert systems capability.

The technological platform or infrastructure must support all business processes, not just the particular process being redesigned. It is the job of the technical change management team to mediate between the technical elements responsible for the technical infrastructure and the process improvement team to ensure that technology changes or insertions do not disrupt overall operations.

At the conclusion of this phase, the technical change management team will have produced a plan that aligns process improvement with potential technology enablers and addresses known technological barriers to implementing redesigned processes. The results will be incorporated into the Functional Economic Analysis decision support package. As the improvement project moves through the enterprise engineering and project execution phases, the change management team will coordinate technology-based actions with process improvement actions.

The technical change management phase of the Framework for Managing Process Improvement is supported, in part, by the following resources:

- F/MPI Management Briefing on Technical Change Management
- F/MPI Technical Change Management Tutorial

The techniques (described in Section 10) most useful in this phase include the following:

- Benchmarking (best practices)
- SWOT Analysis
- Cause and Effect Diagram
- Force Field Analysis

- Pareto Analysis
- Economic Analysis

7.1 Step 13: Assess Technical Capability

Streamlining business processes by eliminating non-value activities and costs (picking the low-hanging fruit) can be accomplished apart from technical considerations. But beyond that process improvement level, it is critical for the process improvement team to understand the status of the current technical assets that support the targeted business process. This data provides a baseline from which to plan, design, and acquire technical betterments that will enable or support process improvement efforts.

Once the change management team understands the strengths and weaknesses of the existing technological plant, it becomes easier to identify and categorize potential technological changes. In this context, technology can include platforms, applications, information systems, and communications systems of all types. The most expedient classification scheme would place these assets in one of four categories:

- Existing technology is adequate and will support potential process improvement efforts
- Existing technology needs upgrades to support potential process improvement efforts
- Existing technology is obsolete and must be replaced
- There is no existing technology of the type required to support potential process improvement efforts.

When the tasks in this step are complete, the change management team will be positioned to identify and prioritize a series of technological changes needed to support planned process improvements.

The following tasks are performed in the assess technical capability step:

- Review Process Improvement Plan Technical Implications
- Assess Current Technical Status (Strengths/Weaknesses)
- Assess Emerging Technologies v Process Requirements
- Document Technical Status
- Review and Approve Status Report

7.1.1 Review Process Improvement Plan Technical Implications. At various checkpoints in the reengineering phase, the change management team should pause to evaluate the technical implications inherent in evolving process redesign elements. Many of these elements were introduced in Section 5.2.10 Identify and Document Technology Issues. Each potential technology change or insertion needs to be reviewed in terms of the existing information technology architectures. This can be a difficult task because of the natural change resistance factors that will be present in the technical organizations.

Some of the considerations the change management team should address are listed below. The question to be asked and answered (with respect to the current infrastructure) is—will the potential process improvement:

- Change the way data and information is collected, entered into systems, filed and referenced? Will document scanners replace key entry? Will bar coding be used to track material and documents? Will single point of entry sourcing be used?
- Require new or different processing algorithms such as if-then-else rule-based systems, fuzzy logic, object oriented procedures?
- Need new decision-making techniques or software such as information-, knowledge-, experience-, or intuition-based systems?
- Make use of emerging document managing systems that provide sophisticated techniques for capturing

and producing integrated text, data, image information? Will laser generated forms replace standard print forms?

- Provide paper-less procedures to replace paper-intensive business procedures? Will data be encoded using magnetic strips, bar codes, smart cards, or optical devices?

- Depend on integrated text, data, voice, graphic, and imaging systems for any part of the design?

- Require relational data bases, repository systems, re-use libraries, or sophisticated keyword-in-context retrieval systems?

- Incorporate distributed computing principles such as wide-area data communications, satellite communications links, video teleconferencing, e-mail, or remote access to data bases?

- Use work flow or work group computing techniques to support empowered cross-functional work teams?

- Depend upon networked software such as groupware, computer-aided drafting and design software, meeting or conference facilitating software?

- Incorporate sophisticated security, access, and accountability algorithms to monitor or control business related decision making?

- Require graphic user interface (GUI) software, customized computers or interface equipment, analogue to digital transducers, built-in measuring or monitoring devices?

- Self-learning systems with built-in menu, help, hypertext, and other learning aids?

The list above is far from exhaustive and obsolete the day it is written, but it does convey the importance of having a change management team monitor process improvement efforts on a continual basis to identify the implications of potential technology enablers for process improvement.

Each potential enabler must be considered in light of the existing technological base and the impact such technology could have on the existing base. This process ultimately contributes reliable data that can be used in the decision-making process that determines the feasibility of acquiring new technology in support of improvement objectives.

7.1.2 Assess Current Technical Status (Strengths/Weaknesses). The information systems or information technology organization in every large enterprise is always a work in process. At any point in time, there are systems operating beyond their useful life cycle, productive systems doing their intended job, high-maintenance systems barely keeping up with business requirements, systems being developed, systems being shutdown, and new systems being installed. Few organizations will admit to having up-to-date architectures, systems templates, and sound configuration management documentation. Tracking information technology assets is a formidable task in large organizations with geographically dispersed facilities.

With this in mind, it is still important to understand the strengths and weaknesses of the current technological infrastructure in organizations with extensive business processing projects underway. (Strengths represent potential process improvement enablers that may suffice for supporting meaningful process improvements.) This often happens when technology developed to support one area of the business can be readily adapted to support other areas.

Weaknesses represent barriers to process improvement that may set limits on how much improvement can be accomplished without substantial investments in new technology or redeveloped information systems. Weaknesses are often represented by legacy systems built on yesterday's technology that still serve vital business purposes. Years of poorly documented maintenance actions may make it impossible to replace such systems one component at a time.

Whatever the situation, it is important to fully evaluate the strengths and weaknesses of the existing technological plant with respect to new technology that may be required to support potential business process improvements. This analysis should extend to the capabilities of the technical staff to support desired improvements as well as their capacity to do so in light of current and continuing responsibilities and assignments. The technical divisions invariably represent a bottleneck that restricts the amount of technical support available for process improvement efforts. This is not a criticism, merely a fact. It's been said that making major changes to the technical infrastructure is equivalent to rebuilding an airplane while it is still flying. This is in recognition of the fact that computer operations cannot be shut down to incorporate major changes.

7.1.3 Assess Emerging Technologies v Process Requirements. The technical change management team can provide a valuable service to process improvement teams by continually tracking new developments in the technology world and assessing their potential use in enabling process improvements. It is likely that the functional elements engaged in process improvement have neither the time, the resources, nor the background to do this. Some of the emerging technologies that are candidates for enabling process improvement include those on the following list.[24]

- Computer-aided Design
- Groupware
- Document Management
- Point-of-Sale Terminals
- LAN/WAN Networks
- High Resolution Printers
- High Capacity Storage
- Document Scanners
- Smart Cards
- Wireless Technology
- Graphics Technology
- Object Orientation
- Geographic Systems
- Paperless Manufacturing
- Online Research Services
- Customer Service Technology
- Client/Server Technology
- Relational Data Base
- Voice Recognition
- Built-in FAX Capability
- Pen/Touch Notebooks
- Advanced Fiber Optics
- Videoconferencing
- Data/Video Compression
- Virtual Reality/Simulation

The reader is also urged to obtain a copy of Business Week's special 1994 bonus issue entitled: "The Information Revolution: How digital technology is changing the way we work and live," for an informative presentation of emerging technologies. The article beginning on page 52, "The Enabling Technologies" is especially relevant to the present discussion.

As with much of technology, it is not just the base technology that leads to breakthrough business process performance but the way different technologies are combined in innovative ways. Many of the base technologies listed above and described in the referenced article are not very exciting until they are used together in new and different applications.

By not including technology specialists in their brainstorming sessions on process innovations, process improvement teams run the risk of missing golden opportunities to radically transform business processes. Most often this will happen through ignorance of the meaning and potential application of emerging technologies in various combinations. A second possibility is that the process improvement team is not aware of technology that has been successfully used in other areas of their own enterprise and which could easily and inexpensively be adapted to serve their processes.

7.1.4 Document Technical Status. Once the above tasks have been completed in this step of the methodology, the technical change management team should prepare a status or readiness report. This report will note the areas and issues of most

1 "24 Breakthroughs That Are Changing the Way We Live and Work," William J. Cook anbd Warren Cohen, U.S. News and World Report, May 1, 1994.

concern with respect to technological change and process improvement. It will highlight areas of strength and weakness in the current technological infrastructure as it pertains to on-going process improvement efforts. It will also isolate and describe the most promising new technologies that may find application in process improvement efforts. In this way, it serves as a heads-up notice to the technical elements for demands, requirements, or requests that may be forthcoming from the process improvement effort.

The report will also be used later in this phase of the methodology to develop an action-oriented plan to enhance existing technical enablers, remove technical obstacles, and lower barriers to change that may emanate from the technical elements. The report should also be used by the process improvement team itself to adjust process design, wherever possible, to take advantage of technical strengths and avoid or minimize the impact of existing technical weaknesses.

7.1.5 Review and Approve Status Report. The status report should be reviewed and approved (validated) by the process improvement team and technical managers who are associated with the process improvement effort or who may be impacted by process improvement developments. If the report indicates a probable potential for incorporating new or emerging technologies in process redesigns, it may be appropriate to have outside experts (vendors or consultants) in these technologies also review the report. Misunderstandings of the potential application of new technology should be discovered as early in the process as possible to avoid serious and potentially expensive problems later in the improvement methodology.

7.2 Step 14: Identify Technical Change Requirements

The previous step in this phase produced an assessment or status report on the current situation in the technological infrastructure with respect to process improvement efforts, and a study of potential technology enablers to process improvement.

This step will result in a technological impact statement that defines the specific systems and platform areas that have to be addressed to support the potential requirements of the reengineered process. These requirements will be defined in the Process Improvement Analysis Report produced in Step 7, Conduct Improvement Analysis. The technological impact statement produced in this step will also include an analyzed list of technical enablers for use by the process improvement team in Step 8, Redesign/Reengineer Process. The final change management plan will be produced in the next step in this phase.

Ultimately, the organization needs to have a clear, consistent architectural framework for incorporating business process requirements. If such a framework does not exist, process improvement efforts will soon overwhelm the technical staff and overload the technical infrastructure. Even if it does exist, it may need to be modernized to accommodate the rapid pace of change that follows business process reengineering efforts. The following material in this introduction to Step 14 is derived from *Paradigm Shift: The New Promise of Information Technology.*[25]

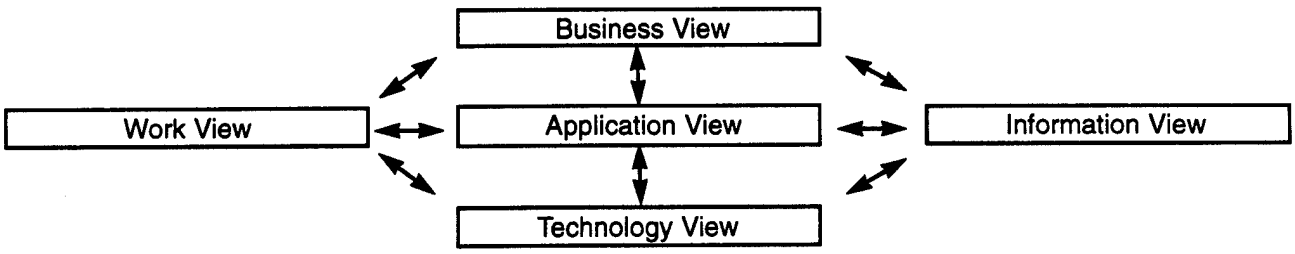

Figure 7-1. Architectural Views

25 *Paradigm Shift: The New Promise of Information Technology*, Don Tapscott and Art Caston, McGraw-Hill, 1993, Chapter 10.

Tapscott posits that the architectural framework consists of five components:

Each view incorporates several principles which when taken together provide a complete framework for supporting business process reengineering efforts. The principles are as follows:

1. **Business View:**

   - *Customer Focus.* All architectural decisions will support the delivery of customer-oriented systems that are responsive to customer demands, adaptable to changing markets, promote high quality, and are easy to use.

   - *Consistency.* Wherever we have common requirements, we will treat them in a consistent way.

   - *Modularity.* We will develop architectures based on modular components with standardized interfaces to support flexibility and usability.

   - *Openness.* We will choose components and associated standards to increase the possibility of using industry standards with a preference for vendor-neutral implementations.

   - *Cost of Compliance.* Compliance with architectural standards may incur higher up-front costs than non-compliant solutions, but will pay off in the medium to long term.

   - *Measurement.* Measuring the use and performance of the architectural components will be included as part of the requirements.

2. **Work view:**

   - *Accessibility.* We will provide the necessary accessibility to authorized users to meet their requirements for various functions at different work locations.

   - *Information Capture.* Information should be captured in computer-readable form as close to the source of origin as possible, including external sources.

   - *Information Exchange.* Once captured, information should be stored and exchanged using electronic means such that manual transcription and reentry are avoided.

   - *Common User Interface.* Wherever possible, the various applications and tools should present a common look and feel to avoid confusion and reduce or eliminate user training.

3. **Application View:**

   - *Simplicity.* We will avoid developing applications that are overly complex by separating functionality into basic and operational modules and by managing information rather than process.

   - *Reusability.* We will support the sharing and reuse of common application modules or components across development projects and use common environments to increase reusability.

   - *Distribution.* We will place the applications (tools) and associated information as close as possible to the point of use to address the required level of sharing.

- *Replication.* Where distribution results in replication of common applications in multiple work locations on local technology platforms, we will manage the compatibility of these software packages to maintain integrity and support a common architecture.

- *Methodology.* We will use a common development methodology to manage the application portfolio and development environment, including the means of providing shareable components.

4. Information View:

- *Security.* Protection of confidentiality and privacy of information will be included in all architectural considerations.

- *Multiform.* We will develop architectures and resulting systems to manage information in all its forms (data, text, sound, image, and video).

- *Data Definitions.* All information will be subject to data administration to ensure common definitions and provide for consistency of use.

- *Stewardship.* Responsibility for data integrity of various information subjects will be assigned to particular business units, and they will assume obligations for making this information available to other authorized users.

5. Technology View:

- *Diversity.* We will use the best type of technology platforms for the intended purpose while reducing the diversity of different technologies within a single type of platform, in preference to one common standard per platform type.

- *Interchangeability.* We will choose and implement technology components such that we have the option of interchanging vendor products for functional, performance, or cost reasons with no or minimal disruption to the technology service.

- *Workstation Orientation.* We will utilize intelligent multifunctional workstations as the exclusive or primary means of delivering functionality to end users.

- *Network Orientation.* We will attach all workstations directly to the network, either locally or through wide area networks (wired or wireless) with secure communications linkages to all required servers.

It should be clear from studying the principles above that there is a definite and critical relationship between the elements of the information infrastructure and the objectives of process reengineering. Architecture is the means of aligning the reengineering with information technology in a way that creates or preserves interoperability which is the basis for evolving to the integrated enterprise. Technical change requirements must be filtered through the lens of architecture if lasting progress is to be made.

The following tasks are performed in the Identify Technical Change Requirements step:

- Review Process Improvement Recommendations
- Identify Technology Best Practices
- Evaluate Technical Change Requirements
- Develop Time and Cost Estimates

- Perform Technical Impact Statement
- Review and Approve Technical Impact Statement

7.2.1 Review Process Improvement Recommendations. At this point in the methodology (see Step 7), the process improvement team will have identified multiple improvement opportunities, many of which will have technology implications. The technology change management team reviews these recommendations to determine the potential impact on the existing information infrastructure as well as the relationship of these potential changes to the architectural principles which should govern all change management actions.

Each recommendation in the report should be classified according to the severity of its impact on the existing technological infrastructure. Later in this step, this data will be used to construct the technical impact statement (see 7.2.5).

Suggested categories include the following although the actual classification scheme should be worked out with the technical elements.

- **Architectural Impacts:**
  - — Conforms to current approved architectures
  - — Requires variance to current approved architecture
  - — Requires new architectural development
- **Infrastructure (operational) Impacts:**
  - — Hardware platforms
  - — Communications platforms
  - — Systems software implications
  - — Data base
  - — Application systems
  - — User interfaces
- **Platform (capacity) Impacts:**
  - — Within the capacity of existing platforms
  - — Requires upgrades to existing platforms
  - — Exceeds existing and current planned capacity
  - — Requires new platforms
- **Personnel Impacts:**
  - — Within skill base of current staff
  - — Requires additional training for current staff
  - — Requires access to technical expertise
  - — Requires new staffing

Classification of potential impacts on the technological infrastructure is the first step in constructing a project slate that will be used to guide activity in the enterprise engineering phase of the methodology. The project slate cannot be completed until after the review and approval of the Functional Economic Analysis.

7.2.2 Identify Technology Best Practices. In any large organization, there should be several, if not many, examples of best practices with respect to technology utilization. Often, a process improvement team will be unaware of what other functional groups are doing. The technology change management team should function as an internal consulting group facilitating the exchange or sharing of technology innovations throughout the organization.

Examples of best practices in technology utilization might include any of the following categories:

- Personal computer applications developed by functional staff
- General purpose data bases
- Installed new technology such as CD-ROM or character recognition
- Pilot or prototype systems based on reengineered processes
- Innovative training systems on technology
- Centers of expertise on new business methods

Large business units may give some thought to developing an internal best practices data base and providing access to it throughout the unit. External benchmarking is also recommended for investigating how other organizations assimilated new technologies and found innovative uses for them. This type of benchmarking can be performed outside the confines of a specific process improvement effort. Attendance at trade shows, membership in user groups, use of on-line networks such as Internet and Compuserve, subscriptions to best practices data bases, and access to a good technical library are other techniques that can be used to track technology best practices on a continuing basis.

The objective of the technical change management team should be to become highly proactive in consulting with process improvement teams on the potential uses of new and emerging technologies while at the same time maintaining an effective interface with the organization's technical elements.

7.2.3 Evaluate Technical Change Requirements. Once the above two tasks have been completed for a given process improvement project, the technical change management team is ready to work with the technical elements to define specific requirements and specifications for potential technology betterments in support of process improvement objectives. This consists of consolidating all the information related to proposed technology changes gathered from the process improvement team, consultation with technical elements on architecture and infrastructure issues, and reviewing information gathered from external sources.

The result should be a short (2 to 3 page) description of the requirements to support each change element. At this stage in the methodology, these should be developed and maintained in draft form. Some items will be dropped from the list after further investigation, and new information will be added as it becomes available. As the process improvement team approaches the time to develop the final Functional Economic Analysis (FEA) decision document, the technical change requirements developed in this task will be incorporated into the final technology change management plan. At this time, however, these change requirements should be considered work in process.

7.2.4 Develop Time and Cost Estimates. Using the results from the previous task, the technical change management team can begin to collect time and cost estimates related to proposed technical changes and innovations. This data will be needed by the process improvement team members as they develop their FEA. The process improvement team will be able to capture time and cost estimates as they relate to the business process but, in most cases, will not be qualified to estimate the time and costs directly associated with technology decisions. By having the technology change management team develop these estimates, the confidence factor in the FEA will be that much greater.

7.2.5 Perform Technical Impact Statement. With all the above data gathered, the change management team is positioned to prepare the technical impact statement (TIS). This statement patterned after an environmental impact statement required for construction projects performs the same service. It describes the impacts on the existing technological infrastructure that will occur if the slate of technical improvements is approved for implementation. The technical impact statement goes beyond simple time and cost elements (although this data is included) and describes the overall effect of the change effort. The TIS focuses on non-economic decision support data and indirect costs associated with technology insertion or upgrades to existing plant and equipment. Such factors are usually not part of the FEA which is focused more on the business process itself than the shared infrastructure needed to support the recommended changes and improvements.

The following areas may be included in the TIS:

- Physical facilities including power supplies, HVAC, wiring, and cables
- Systems architectures, configurations, and templates
- Platforms including hardware, communications, and systems software

- Peripherals and interfaces
- New applications systems and data base support
  - — Specification and design
  - — Development and testing
  - — Implementation and deployment
- Legacy systems modifications
- Migration systems integration
- Compatibility and interoperability
- Operations and maintenance
- Service, customer training, and customer support
- Staffing and staff training
- Rules and regulations
- Policy and procedures
- Administrative support systems and services
- Supplier relationships
- Procurements
- Contracts
- Budgets and funding

Capacity planning

Measures

7.2.6 Review and Approve Technical Impact Statement. The TIS is submitted to higher authority for review, validation, and approval. Due to the fact that technical infrastructure is a shared resource, the TIS may include one or more process improvement projects that depend upon shared resources.

7.3 Step 15: Develop Technical Change Management Plan

After the technical impact statement has been reviewed and the process improvement team has completed Step 8, Redesign/Reengineer Process, the formal change management plan can be completed. The technical change management plan will be one of the inputs to enterprise engineering along with the FEA and organizational change management plan. It will be the role of the process improvement team during the enterprise engineering phase to integrate all three change plans.

The formal plan for instituting technical changes must include a strategy for overcoming technical barriers and human resistance to change. The plan should also include a synopsis of likely staffing, training, and development requirements.

The following tasks are performed in this step:

- Design High-level Technical Models
- Identify Barriers to and Implications of Change
- Develop Strategies for Addressing Barriers
- Identify Technology-related Training Requirements
- Develop Technology Change Management Plan
- Review and Approve Technology Change Management Plan

7.3.1 Design High-level Technical Models. In Paradigm Shift, Tapscott says the following about technical models or architectures:

> By using a generic set of requirements and solutions, it is possible to develop a conceptual-level architecture that can be used to both foster understanding about the enabling effects of IT and begin the migration of the technology infrastructure itself.

Tapscott goes on to describe three elements that make up the technology component of the general architecture:

- *Application environments.* Application environments are prepackaged groupings of procedures which have a natural affinity. By thinking in terms of application environments, it becomes possible to set expectations for business process improvement that leverages investments in technology across a broad range of business processes with high degrees of interoperability. Some of the possible application environments include the following:

- Data entry
- Inquiry processing
- Expert systems
- Document processing
- Storage and retrieval
- Image processing
- Video processing
- Electronic mail
- Enhanced telephony
- Videoconferencing
- Transaction processing
- Decision support
- Real-time control
- Electronic publishing
- Graphics processing
- Sound processing
- Hypermedia processing
- Voice mail
- Shared-screen conferencing
- Broadcasting

- *Technology environments.* Technology environments are services required to support an application environment. Common technology environments include the following:

  - User interface management
  - Information management
  - Transaction management
  - Operating systems
  - Communications

- *Technology platforms.* Technology platforms are the facilities required to support information technology applications. Platforms are engineered around a standard set of hardware, communications and systems software options. Possible classes of platforms include the following:

  - Mainframes
  - General and special purpose minicomputers
  - Intelligent workstations
  - Work-group servers
  - Department servers
  - External servers
  - Local area networks
  - Local switching networks
  - Value-added wide area networks

Technology change management teams working with systems architects and engineers can work together to develop standard solution sets made up of various combinations of the elements in the technical architecture. These solution sets can then be offered as potential technology enablers to process improvement teams. Because the solution sets represent customizable re-use models, great economies of time and cost can be realized while offering powerful technology tools to improvement teams.

7.3.2 Identify Barriers to and Implications of Change. The technology change management team should also work to identify barriers to change or more precisely, barriers to technology insertion in support of process improvement objectives. Common barriers include the following.

- Legacy systems that still serve vital functions and can only be replaced at great time and cost
- Obsolete technology including low-powered personal computers
- Low capacity or non-existent cabling to support interconnected work-group computing local area networks
- Platforms running various types and levels of system software that make interoperability problematic
- Lack of defined architectures to guide technology insertion
- Lack of technical support personnel or skill deficiencies
- High-maintenance installations that have little resource for new development or new technology insertion

7.3.3 Develop Strategies for Addressing Barriers. Each barrier should be evaluated in terms of specific process improvement opportunities with respect to technical requirements. The change management team must work with the technical elements to develop strategies for removing barriers to process improvement. In those cases where barriers cannot be eliminated, alternative means of satisfying process improvement objectives must be found.

It should be noted that in some cases, migration systems plans may be in place which require the elimination of functional barriers to change and improvement. The technology change management team may find itself working in reverse so to speak.

7.3.4 Identify Technology-related Training Requirements. Organizations engaged in process improvement and technical architecture development should consider developing a learning architecture designed with the same care as other architectures. The concept of behavior modification discussed in Section 12 in this guide is an excellent technique for training on technical matters. But for this, or any other technique such as just-in-time learning, or multimedia-based learning to be most effective, there must be an overall strategy in place. This strategy can be effectively represented in models and matrices that take into account process or functional responsibilities associated with process improvement projects.

However approached, training requirements are co-equal to process, organizational, and technical requirements with respect to process improvement. The training implications of all technical decisions should be considered concurrently with the technical decision.

7.3.5 Develop Technology Change Management Plan. The change management plan should be developed according to the following outline:

- Change requirement and description
- Objectives and goals expressed in performance terms
- Action plan for achieving the objective with schedules and milestones
- Resource allocation plan for supporting the change process
- Communications plan
- Training plan
- Issue resolution plan.

The change management plan will be a synthesis of all the change elements developed in tandem with the process improvement team. As the improvement project moves into the enterprise engineering phase, the change management team will monitor progress and make changes and adjustments as necessary.

7.3.6 Review and Approve Technology Change Management Plan. This plan like all others is forwarded to higher authority for review and approval. Unlike many of the other plans though, this one will be continuously revised and updated as the process improvement project moves through the enterprise engineering and project execution phases. Once the plan is approved by higher authority, it becomes part of the input to the enterprise engineering phase.

Addendum

The figure on the following two pages lists thirty principles or ways information technology can enable or influence process and/or work reengineering. Change management teams may find this a useful starting point in their search for ways to spark creative thinking among process improvement teams.[25]

25 See Paradigm Shift, Pages 213-218.

	IT-Enabled Work Reengineering
1	Work systems will have a customer focus. Internal tasks that do not contribute to meeting cusomter needs will be minimized.
2	In work reengineering programs, the focus will be on improving and changing the business not just the organization.
3	Work activities and processes will be performed in parallel.
4	*Whole* jobs with attendant responsibilities and commitments will be created.
5	The role of management is to support those who are dealing directly with customers—the front line.
6	Individual contributors will be able to play more than one role.
7	All management support information will be captured as a by-product of doing work and not as an additional set of activities.
8	*Virtual functions* will be created independent of location.
9	Information will be available to answer customer inquiries at all times.
10	Processes will be designed for flexibility.
11	Where possible, work activities will be broadened to include all tasks that involve meeting a local or enterprise goal.
12	Hierarchical bureaucracy will be eliminated.
13	Redundant activities will be searched and destroyed.
14	Saved time will be reinvested and tasks delegated.
15	Shadow functions (unproductive activities such as telephone tag, waiting for meetings to start, looking for things) will be eliminated.

Figure 7-2(a). IT-enabled Work Reengineering

IT-Enabled Work Reengineering	
16	Shadow records (unproductive copying and filing) will be minimized.
17	Miscommunications will be minimized.
18	Media transformations will be minimized.
19	Controlled access to source information will be provided.
20	Information relays will be reduced.
21	Coordination of work processes will be automated.
22	Backup resources of people and information will be established.
23	Any individual will be able to communicate with any other through participation in the corporate network.
24	Systems required for high performance work will be available to users.
25	Jobs will be clearly defined.
26	Focused job training and knowledge-based support will be provided creating a working-learning environment.
27	Compensation will be linked to competency and to accomplishment rather than to position in a hierarchy.
28	There will be no layoffs.
29	The old will not be eliminated until a suitable new alternative has been forged.
30	The protocols for client/server organizational structures will be continuously defined and redefined.

Figure 7-2(b). IT-enabled Work Reengineering

SECTION 8. PHASE 3: ENTERPRISE ENGINEERING

It is important to understand that at the beginning of this phase of the methodology, nothing of major significance has happened in the real world of business and functional operations. Costs have not been reduced, cycle time has not been decreased, quality and service have not improved. What has happened is that the process improvement team has identified a series of process, organizational, and technical changes that should lead to quantifiable improvements in overall process performance **if and when** this series of changes is implemented.

In essence, the work to this point has resulted in what may be called an *architectural rendering* of the intended new process. Work performed in this phase of the methodology is analogous to developing blueprints and constructing system components. Work in the next and final phase is concerned with installation, assembly, and deployment of the engineered process and supporting systems.

If the new (TO-BE) process designs require other than trivial changes in the information and communications systems infrastructure that supports the process under study, those information and communications systems must be reengineered. Since such changes and improvements will always impact people and the way in which they work together, the organizational components must also be reengineered consistent with process and technological improvements. We term this phase of the methodology *enterprise engineering* because changes to the technical and organizational infrastructure in support of (or to enable) new process designs will invariably impact the entire enterprise.

Therefore enterprise engineering is always a cross-functional endeavor. Success requires the active participation of functional staff, technical staff, and human resource and organizational specialists. Ideally, a process owner has been designated to lead this cross-functional effort to ensure that the needs of the enterprise as expressed in terms of mission, goals, and objectives are foremost in the minds of the enterprise engineering team.

The inputs to this phase consist primarily of the following:

- Approved Functional Economic Analysis (FEA) case for action
- Technological Change Management Plan
- Organizational Change Management Plan
- TO-BE Activity and Data Models.

While the inputs listed above will contain specific requirements for enterprise engineering, it is helpful for the improvement team to maintain focus on the general objectives for process reengineering. Specific process, technical and/or organizational requirements or specifications that seem to lead to changes that are counter-productive to achieving the general objectives should be questioned or challenged. These general objectives are:

- Develop a process management concept that focuses efforts on achieving superlative customer quality and service.
- Exploit the capabilities of work-group computing in support of cross-functional work teams.
- Streamline processes to remove or reduce non-value added activities, cycle time and costs.
- Utilize technology innovations that leverage work team effectiveness through information sharing and peer-to-peer communications.
- Reduce the adverse effects of stovepipe management structures by delegating decision-making authority to the lowest levels possible consistent with maintaining accountability.

- Integrate computing environments across the organization to eliminate or reduce harmful redundancy and excessive infrastructure costs.

- Integrate data, text, voice, and image within a program of enterprise-wide information resource management.

- Extend process management and value chain concepts beyond organizational boundaries to establish effective supplier and customer partnerships.

- Maximize utilization of electronic commerce throughout and beyond the organization.

Because individual process improvement efforts are focused on a particular process, subprocess, or collection of activities, it is entirely possible that improvements in one process area of the enterprise may conflict with improvements planned for other process areas to the detriment of the enterprise as a whole. This phase of the methodology is concerned with maintaining an enterprise focus to ensure that all process improvement projects contribute to enterprise goals and objectives.

Therefore, it may be necessary to challenge elements of an approved change program if implementing those elements would have detrimental effects in other areas of the enterprise. Enterprise engineering work teams must develop and maintain an enterprise perspective while engineering elements of a specific process improvement project. The list of global enterprise objectives above provide some criteria for maintaining the necessary perspective.

Enterprise engineering is concerned with establishing technical platforms in support of process information and communications requirements. These platforms include computing and communications hardware, systems software, data structures, application systems, and end-user facilities. Platforms may include any combination of mainframe, minicomputer, workstations, and personal computer configurations. Enterprise engineering includes the activities of specification, design, development (and/or procurement), testing with respect to all systems components. Specific components may be procured from commercial sources (Commercial Off-the-Shelf [COTS]), government sources (Government Off-the-Shelf [GOTS]), developed in-house, or developed under contract. Systems integration is a major function of enterprise engineering.

Of particular concern in enterprise engineering is the selection or development of migration systems to replace existing or legacy systems that are ineffective from a functional perspective and/or are expensive to operate and maintain. In some cases, migration systems designation and the decommissioning of related legacy systems may be accomplished with little or no functional involvement. This is generally true when legacy systems are highly redundant in their features and functions.

In most cases, however, the move to migration systems will necessarily require significant functional user involvement and cooperation because of the probable impacts and disruptions on functional processes and work procedures. It is best to combine the establishment of migration systems with a reengineering project but this is not always possible due to conflicting priorities and available resources.

In any case, it is in the enterprise engineering phase of the methodology that all such issues are dealt with and resolved. The extent that enterprise-wide models exist, technical architectures are in place, and configuration management is practiced will determine the complexity of enterprise engineering activities and the probabilities for success from an enterprise perspective.

The enterprise engineering phase of the Framework methodology is supported, in part, with the following resources:

- F/MPI Management Briefing on Enterprise Engineering

- F/MPI Enterprise Engineering Assessment

- F/MPI Enterprise Engineering Tutorial
- F/MPI Enterprise Engineering Evaluation Worksheet
- The DoD Enterprise Model White Paper
- Corporate Information Management for the 21st Century: A DoD Strategic Plan. Enterprise Integration: Implementing Strategy
- Tactical Integration Plan
- Migration Strategy Template
- Rationale for Integration Checklist for Migration Assessment.

The techniques (see Section 10) most useful in this phase include the following:

- Brainstorming
- Nominal Group Technique
- Activity Modeling
- Data Modeling
- Program Decision Process Chart
- Cause and Effect Analysis.

8.1 Step 16: Configure Technical Platform

In the era of stand-alone (stovepipe) systems and the deployment of islands of technology, it was not necessary to have an enterprise view of the technical platform consisting of the totality of computer and communications boxes and their associated systems software. Systems did not "talk" to each other, data was not shared across systems boundaries, and the processes such systems supported were not integrated at the functional level. Hardware platforms were selected or designed to optimize the requirements of the specific application or function they were intended to support. The situation was further exacerbated by the lack of interoperability across vendor lines. There were few technical or industry standards in place and the standards that did exist were compromised by vendors to maintain "account control" by making it difficult or impossible to connect equipment in a multi-vendor fashion.

The conventional wisdom in this era was that first an organizational unit defined application requirements, then selected appropriate applications software or custom built their own, and finally selected the hardware that would best support the intended application. Exercising this principle resulted in multiple redundant systems in an organization, heroic efforts to exchange data between disparate systems, endless conversions and upgrades, high application maintenance costs, and severe impacts on systems users who had to contend with multiple interfaces to systems. Furthermore, the nature of these systems reinforced functional or stovepipe organizational structures by making information a scarce resource that served to maintain the power structure within the organization. The systems themselves contributed to the erection of barriers between functional units and inappropriate inter-organizational rivalry to the detriment of the organization's customers.

In the present era, the emphasis is on managing information and communications as a corporate resource. As such, the technical infrastructure must be engineered to support the enterprise as a whole. This means that information systems must (at the same time) support both process requirements and corporate requirements. It is the task of the enterprise engineering team to make this happen.

The key words in this era are interoperability; integrated voice, data, text, and images; shared data; salability (personal computers to mainframes); client/server architectures; expert systems, and intelligent user interfaces. Architecture and configuration management is the means of achieving a technical platform that serves both process and corporate needs. Functional managers must be aware of the need to view the technical platform as a shared resource rather than a private information reserve. Occasionally, compromises will be necessary.

The rate of change in the technological arena is staggering. Personal computers costing a few thousand dollars have the processing and storage capability of computer systems that filled rooms only a few short years ago. It is difficult even for technical professionals to keep up with the advances

being made on a daily basis. Yet functional managers must play a significant role in technology management both from a process perspective and a corporate perspective. Functional managers can best be considered as customers of their technical suppliers and should strive to work in partnership with the technical elements.

The DoD Strategic Plan calls for the implementation of a flexible, efficient, world-wide computer and communications infrastructure. The objectives in the Strategic Plan related to this goal include the following:

- Apply policies and programs to guide infrastructure development and modernization through standards-based architectures
- Strengthen the management of information technology assets in conformance with architectural and configuration management principles
- Ensure that the computing and communications infrastructure can evolve to meet the processing and support requirements of DoD information systems
- Benchmark the infrastructure against best commercial practices and performance measures
- Improve software practices through software process management, software metrics, software engineering environments, and software reuse
- Evaluate new technologies to identify opportunities for significant cost savings or improvements in mission effectiveness.

The following tasks are performed in the configure technical platform step:

- Review Approved FEA Package and Supporting Documents
- Review Technical Change Management Plan
- Assess Current Status and Capabilities
- Design Hardware Systems Support Requirements
- Design Communications Support Requirements
- Design Network Support Requirements
- Design Systems Software Requirements
- Document Technical Platform Requirements
- Review and Approve Platform Requirements.

8.1.1 Review Approved FEA Package and Supporting Documents. Even in the absence of business process improvement, the technical infrastructure is subject to continuous improvement and modernization. This activity is needed to continuously improve the effectiveness and efficiency of the technological plant. The drivers for this activity are primarily advances in technology combined with the tendency of legacy systems to become obsolete and/or expensive to maintain over time. Much of this modernization can be accomplished with little or no involvement of functional elements.

Assuming that continuous improvement of the technological plant is taking place, a business process reengineering (BPR) project represents a serious disruption from the perspective of the technical staff. Major BPR projects will almost always require significant changes in the technical platform to accommodate improvements in functional processes. The technical staff must find a way to engineer a technical system that can be integrated into the existing technical platform which itself is in a continuous state of flux.

An approved Functional Economic Analysis (FEA) business case is the formal trigger for initiating design changes in the technical platform. The FEA and supporting documentation provides most of the data needed by the technical staff to evaluate change requirements, and begin the process of designing engineering changes to the technical platform in order to accommodate the functional or business needs expressed in the FEA. The first task in the enterprise engineering phase

then is to hold a conference to review the intents, purposes, and requirements expressed in the FEA along with the implications to the existing technical platform.

This conference will include functional, technical, and configuration management personnel. At the time a particular FEA is approved, there may be other approved initiatives underway with respect to a given technical platform. If so, a way must be found to coordinate the requirements of multiple technical change programs and rationalize any existing or potential conflicts. At all times, the requirements in support of a business process must be considered along with the corporate requirement for integration and interoperability. The project cannot go forward until all conferees agree on a course of action with respect to the approved FEA and other initiatives currently underway or planned.

8.1.2 Review Technical Change Management Plan. While the FEA is related to a particular business process improvement project, the Technical Change Management Plan is related to the information infrastructure as a whole. A continuously maintained technical change management plan provides a useful means of rationalizing the requirements of multiple FEAs with the need to build and maintain a corporate information infrastructure. This document can also be used to coordinate the requirements expressed in FEAs with the on-going continuous improvement program performed by the technical staff.

Therefore, Technical Change Management Plan can be viewed as an engineering change order control vehicle to ensure that there is an orderly and rational plan of action with respect to the technical plant. Other key documents related to this task include:

- The DoD Enterprise Model
- Standard technical architectures
- Configuration management plans
- General requirements in support of the Corporate Information Management (CIM) initiative.

Together, these documents help ensure an orderly transition to a technical infrastructure that supports corporate objectives and requirements as well as the information management requirements of specific business processes. The following diagram (Figure 8-1) illustrates this concept.

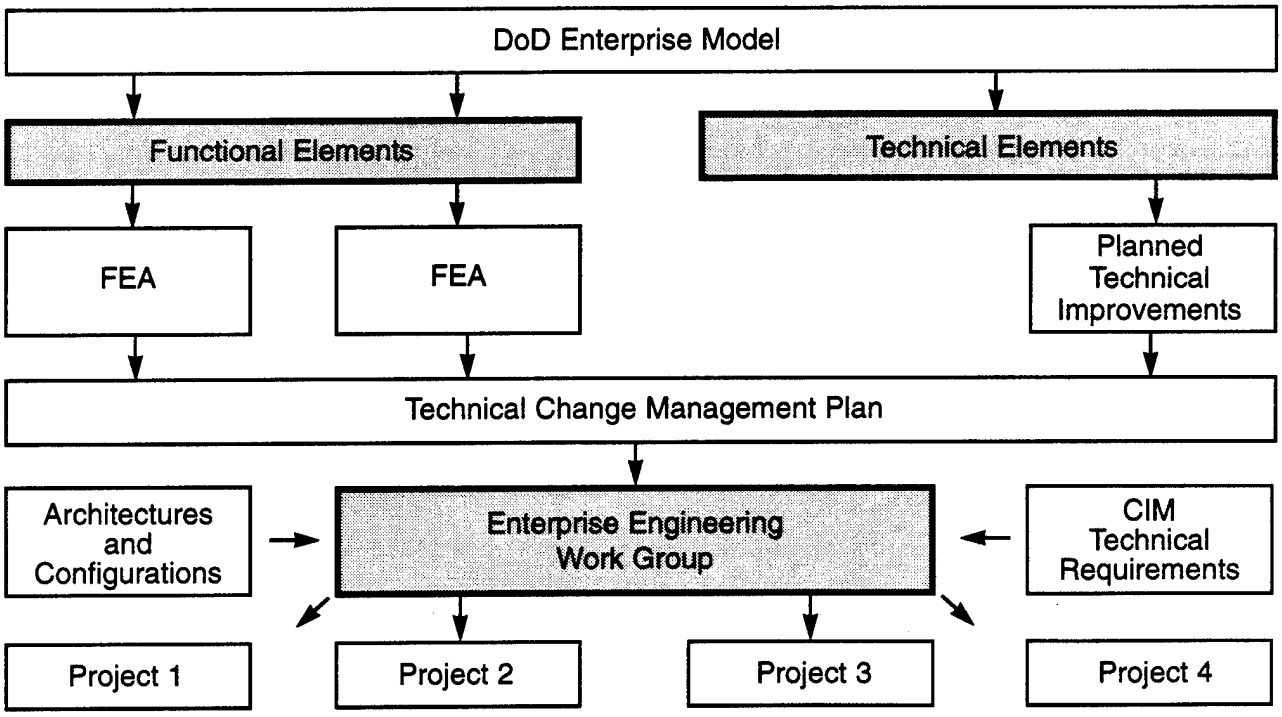

Figure 8-1. Inputs to Enterprise Engineering

As shown in Figure 8-1, the DoD Enterprise Model is the reference document for all improvement projects whether triggered by functional or technical elements. The Technical Change Management Plan integrates all current FEAs with each other and with planned technical improvements initiated by the technical elements. The enterprise engineering work team forms life cycle improvement projects using the Technical Change Management Plan, standard architectures and configuration management requirements, and the general technical requirements expressed in the DoD 8020 document series (CIM initiative). Projects 1 through 4 represent the slate of approved projects within an established development cycle.

This task is primarily concerned with addressing two of the four technical infrastructure values and risks associated with life cycle and on-going technical improvement projects.[26]

- Strategic Information Systems (IS) Architecture
- Requirements Definition Uncertainty.

Strategic IS architecture evaluates the degree to which all projects are aligned with overall information systems plans as expressed in the documents shown in figure 8-1. To overlook the importance of rationalizing all proposed projects in accordance with standard architectures and configurations is to perpetuate a functional or stovepipe view of the information systems resource. With few (if any) exceptions, all projects should be in conformance with standards.

Requirements definition uncertainty addresses the reality that with change comes uncertainty. Planned technical improvements are essentially concerned with productivity. The business view of the process in question does not change, but the means of supporting that business process through IS improvements does change. FEAs address the situation where the business process itself is undergoing change, and the IS support system must change to accommodate new business requirements.

Parker and Benson suggest six levels of risk assessment associated with project work:

Level 0: Requirements and specifications are firm and approved. The impact on technical areas is straightforward. There is a high probability of no radical changes to the technical infrastructure.

Level 1: Requirements and specifications are moderately firm. The impact on technical areas is straightforward. There is a low probability of radical changes needed in the technical infrastructure.

Level 2: Requirements and specifications are moderately firm. The impact on technical areas is straightforward. There is a reasonable probability of radical changes needed in the technical infrastructure.

Level 3: Requirements and specifications are moderately firm. The impact on technical areas is straightforward. There is a high probability of radical changes needed in the technical infrastructure.

Level 4: Requirements and specifications are not firm. The impact on technical areas is complex. There is a high probability of radical changes needed in the technical infrastructure.

Level 5: Requirements and specifications are unknown. The impact on technical areas is complex. There is a high probability of radical changes needed in the technical infrastructure.

26 Information Economics, Marilyn M. Parker and Robert J. Benson, Chapter 14.

8.1.3 Assess Current Status and Capabilities. Information systems agencies can be viewed as production-oriented departments concerned with delivering established information products and services to business units. Every request (project) for changes (improvements, enhancements, new capabilities) delivered to information systems agencies has the potential to disrupt current operations. According to Parker and Benson, change requests impose two additional risks:

- Technical Uncertainty
- Risk to the Integrity of the corporate Information Systems Infrastructure.

Technical uncertainty can be expressed as the impact the proposed changes will have on the existing capabilities of the IS function. These risks can be expressed in the form of four questions:

1. To what degree will the proposed project require new skills on the part of the technical staff and management? For instance, if the requirements expressed in an FEA specify client/server architectures, are the technical elements skilled and experienced in this technology?

2. To what degree will the proposed project require new hardware and communications platforms and what is the level of risk associated with this new technology? For instance, if the requirements expressed in an FEA specify CD-ROM equipped workstations, how will this impact current hardware platforms?

3. To what degree will the proposed project require new systems software? for instance, if the requirements expressed in an FEA specify expert systems interfaces, how well can the technical elements respond?

4. To what degree will the proposed project require new applications software? Can this requirement be satisfied with off-the-shelf products or will a development project be required? What is the estimated degree of complexity associated with this application requirement?

The risk to the corporate information systems infrastructure addresses those issues related to the overall technical environment. This category of risk (and cost) is associated with non-project investment necessary to accommodate one or more proposed projects. Again Parker and Benson suggest a rating scale to help in infrastructure change management.

Level 0: The proposed project can use existing services and facilities. No investment in IS prerequisite facilities like database management is required. No up-front costs not directly a part of the project itself are anticipated.

Level 1: The proposed project will require one major infrastructure investment such as a new user interface. The associated up-front infrastructure investment is relatively small.

Level 2: Small changes in several elements of the computer service delivery system are required. Some up-front investment is necessary to accommodate this project. Some later investment for subsequent integration of this project into the mainstream of the IS environment will be necessary.

Level 3: Moderate changes in several elements of the computer service delivery system are required. Some up-front investment is necessary to accommodate this project. Some later investment for subsequent integration of this project into the mainstream of the IS environment will be necessary.

Level 4: Moderate changes in several elements of the computer service delivery system are required in

multiple areas (i.e. hardware, networks, database systems). Moderate up-front investment in staff, software, hardware, and management is necessary to accommodate this project. This investment is not included in the direct project costs, but represents IS facilities investments to create the needed environment for the project.

Level 5: Substantial changes in several elements of the computer service delivery system are required in multiple areas (i.e. hardware, networks, database systems). Considerable up-front investment in staff, software, hardware, and management is necessary to accommodate this project. This investment is not included in the direct project costs, but represents IS facilities investments to create the needed environment for the project.

As this task is performed, it is likely that adjustments may be necessary in one or more of the elements or documents shown in figure 8-1. For instance, when a project is assessed with respect to current IS status and capabilities, the estimated degree of cost, risk, and complexity may require a change either to the request itself (FEA) or to one or more of the standard controlling documents or plans (current approved IS architecture). The important point is that work cannot proceed beyond this task with any certainty of success until all current change requests are assessed with respect to the current technical situation, and all required adjustments and/or accommodations are reviewed and approved.

The end result of performing tasks one through three in this step is a prioritized, time-phased, risk-assessed, fully costed project slate that has been reviewed and approved by proper authority; and one that can be staffed with available or planned resources. It can be seen from this discussion that an approved FEA does not necessarily guarantee project implementation within the proposed timeframe (or at all) apart from a thorough analysis and assessment from a corporate perspective.

At this point in the framework methodology and for the remaining steps in the enterprise engineering phase, the controlling document is the approved information systems project which is related to one or more FEAs and technical improvement initiatives referenced in the Technical Change Management Plan. While project work proceeds, organizational and technical change management teams working with functional elements assure coordination with functional management and business process improvement teams. When this is done well, the changes in the business process itself and the organizational infrastructure that supports the business process will be related and coordinated with changes to the underlying technical infrastructure.

This means that while the technical teams are building new information systems support for reengineered business processes, functional leadership and staff are preparing for the necessary changes in policy, procedures, management, staffing, and training. This is critical especially when the impending changes to the business process will be felt outside the organization by suppliers and customers.

8.1.4 Design Hardware Systems Support Requirements. The starting point for designing hardware systems in support of technical change requirements is the established geo-technical architecture along with existing configurations (deployed technical assets). As the enterprise engineering team proceeds with this task, they will strive to accomplish several related objectives[27]:

- Link technology investments to strategic goals. If the previous steps in the framework methodology have been successfully followed, this objective

27 Information Payoff, Paul A. Strassmann, Chapter 14.

should easily be achieved. However, technology changes rapidly, and new developments may suggest adjustments in the design of hardware systems to achieve unanticipated improvements with respect to support of corporate or strategic goals.

- Maximize the use of existing or deployed assets unless there is a compelling business reason to procure new hardware. Compelling reasons include requirements expressed in FEAs and the avoidance of maintenance and operational costs associated with obsolete technology.

- Look for ways to use innovative technologies in support of project requirements. For instance, the requirements of a project might be satisfied by procuring either desktop or laptop personal computers. It may be that laptops with cellular modems might provide a greater return on investment, offer more flexibility for users (i.e. support distance learning techniques), and simplify maintenance and support requirements.

- Avoid investing in technology that limits growth. Look for hardware systems that are scalable (easy to upgrade), conform to industry standards, support a broad range of systems and application software systems, can easily be linked with wide area and local network and communications systems, employ user-friendly interfaces, and encourage creativity and innovative uses.

As stated earlier, conventional wisdom suggests that hardware decisions should follow application decisions. That is, hardware systems are subservient to application decisions. This thinking was appropriate in the age of functionally developed (stovepipe systems) before the concept of a technical infrastructure in support of corporate-wide objectives was fully developed.

In the present era, it makes more economic and business sense to develop a corporate-wide platform that emphasizes interoperability and data sharing. This necessarily makes application decisions subservient to hardware and systems software decisions. Fortunately, the rapid progress in standards, off-the-shelf applications, and multi-vendor hardware environments makes this a non-issue from the technical perspective, but not always from the political perspective.

Therefore, enterprise engineering teams must design the hardware platform to accommodate both the corporate-wide mission and the business process mission simultaneously; while technical and functional leadership work together to overcome the political challenges. Assuming technical architectures and effective configuration management are in place, hardware decisions are restricted to the following questions:

- What computer platforms are authorized?
- Which one(s) is most appropriate for our needs?
- How many units do we need over and above existing inventory?
- What are the required capacity and performance requirements?
- What features and functions do we need?
- Where should the units be located (deployed)?
- How will we service and support these units?

8.1.5 Design Communications Support Requirements. There is no question that communications in all of its forms: person-to-person, person-to-machine, and machine-to-machine is the most important and perhaps least understood facility within the information infrastructure. All systems modernization efforts whether initiated as a business improvement project or a technical improvement project must give considerable weight to the problems and opportunities associated with effective communications. With the advent of Integrated Systems Digital Network (ISDN) techniques and the concept of the *Information Highway*, communications capability is one of the (if not *the*)

paramount consideration in enterprise engineering work.

There is a de-facto requirement for data sharing and interoperability throughout the enterprise whether expressed or implied in all FEAs and other requirements documents. Enterprise engineering teams must ensure that all improvement projects make optimum use of available (upgradable to impending) communications technology in support of specified and potential communications requirements.

Along with technical architectures and configurations developed by the enterprise itself, international (dejure) standards such as the *Open Systems Interconnect* (OSI) model provide the context for developing communications capabilities in support of project requirements. The OSI model provides a layered series of protocols needed to establish effective communications support across all hardware vendor equipment lines. The highest layer in the model provides for a wide range of end-use applications such as message transfer, file transfer, e-mail, document management, and a host of others. In the not-too-distant future, we cannot expect the OSI model to accommodate all forms of data interchange (text, voice, data, and image), all media (copper, cable, fibre optic, satellite, microwave, infrared), embedded language translation (i.e. French to English), most office automation services, and other features in the evolving information highway metaphor.

As with hardware components, the communications element of the technical infrastructure is a corporate asset and, with few exceptions, the needs of the enterprise take precedent over conflicting process-related requirements and specifications.

8.1.6 Design Network Support Requirements. In this document, network support is restricted to apply to workgroups and functional or cross-functional teams as in *Local Area Network* (LAN). In other words, network support is provided to workgroups within the context of the established technical infrastructure which includes all communications capability.

Business process improvement or reengineering invariably involves the concept of empowerment as it applies to employee focus. For employees to be empowered to support internal and external customer relationships and effectively participate in supplier partnerships, a teamwork or workgroup environment is usually called for. Workgroup members must be able to communicate with each other (e-mail), exchange files and documents, input and access data needed to serve customer requests and service requirements, route work tasks to available staff, share work tasks such as report preparation, and jointly participate in functional application processing (client/server modalities). Workgroups supported with effective local area networks and client/server applications exhibit flexibility, innovation in response to customer situations, entrepreneurship (taking responsibility), and responsiveness (taking action).

The enterprise engineering team must use its technical expertise to find innovative methods for applying network support for workgroups. Often, a functionally-driven process improvement team will not have the knowledge or experience to design process improvements that will take full advantage of network capabilities. At the same time, the enterprise engineering team must ensure that network solutions in support of business process requirements are fully compatible with the corporate technical infrastructure to maximize the possibilities for continued enhancement and integration with other business functions. As with communications in general, network support must be constructed following corporate and industry standards making full use of commercial and government off-the-shelf capability.

Specific network values include:

- Features and functions with respect to application requirements
- Performance with respect to installed or planned hardware components
- Availability including service, training, and support
- Cost both in terms of the network products and infrastructure
- Ease of operation with respect to typical user characteristics

- Ease of management both functionally and technically.

8.1.7 Design Systems Software Requirements. Systems software exists to control computer and communications hardware components and systems. It provides the interface from user applications to the features and functions of the hardware platform.

Systems software includes the following types. Please note that the meaning of the acronyms listed is immaterial to this discussion.

- Computer operating systems such as DOS, UNIX, and MVS
- Communications control programs such as TCP/IP and SNA
- End user or 4th generation languages such as FOCUS and SAS
- Programming languages such as COBOL and Ada
- Utilities such as file, document, and protocol converters.

Choices in systems software selection and/or specification are determined by standard architectures. Indeed, one of the primary purposes of architecture is to ensure that machines work together, provide for shared resources, and support all current and anticipated application requirements. Enterprise engineering teams must resist pressures to acquire non-conforming systems software solely to support the requests of a single user, function, or business process.

Non-standard systems software is often associated with specialized commercial application software systems. In other words, to use the application, the organization must introduce a *foreign* or non-standard systems software component into the technical infrastructure. It is impossible to overestimate the future problems and their inherent associated costs associated with violating architectural standards. One of the primary problems may well be loss of interoperability and difficulties in sharing data.

If the application software in question is important and exclusive enough to warrant violating architectural standards, then it is imperative that the architectural standards be changed or modified prior to introducing the requested application and systems software into the technical infrastructure.

Given this discussion, it is the duty of the enterprise engineering team to make appropriate systems software design decisions in support of functional requirements based on established architectural standards.

8.1.8 Document Technical Platform Requirements. At this point in the methodology, the enterprise engineering team has analyzed all approved functional and technical requirements for information systems support, evaluated established architectural standards and models with respect to these requirements, assessed the current geo-technical architecture and configuration mappings, and designed the appropriate technical platform to accommodate both corporate and business process requirements and specifications.

It is now necessary to document the recommended platform design changes, additions, and modifications into a technical business case that supplies appropriate decision making criteria to technical review boards such as the Configuration Control Board. As noted above, the requirements specified or recommended in this document will be in support of an infrastructure project which will support one or more approved FEA or technical improvement initiatives. In practice, the results of this step will be combined with the outputs of the next two steps in order to provide a complete package of technical specifications including platform, application, and database elements.

In most cases, the required document will be called a Tactical Integration Plan reflecting the importance of maintaining the integrity of the technical infrastructure as new technical capability is developed in support of business process improvements. The Tactical Integration Plan is prepared under the direction of a Technical Integration Manager and will be fully described in step 20 in this document.

8.1.9 Review and Approve Platform Requirements. The Technical Platform Requirements Plan or Technical Integration Plan is intended for the review of designated audiences which may include any of the following:

- OSD Principal Staff Assistants
- Functional Activity Program Managers
- Cross-Integration Assessment Council
- Configuration Control Board
- Functional Information Managers
- Other designated agencies and review boards.

Following review and approval of this plan and the components described in the next two steps of the methodology, the project may proceed to steps 19 and 20 which result respectively in an implementation plan and a migration and integration plan.

8.2 Step 17: Develop Application Systems

The technology infrastructure exists to support applications that serve or advance corporate interests as expressed by the organization's mission, goals, and objectives. Each application has a purpose that justifies its existence. That purpose must result in a benefit/cost ratio greater than 1.0. That means that the life cycle costs to specify, design, build, operate, and maintain the application (including that application's pro-rata share of infrastructure costs) must be less than the value of the benefits returned to the enterprise. In other words, each application in the enterprise's portfolio of applications is (or should be) justified by good business management principles including return on investment (ROI) calculations.

While this is a simple concept, the problem is one of accurately estimating life cycle costs, and then ensuring that the application project is within budget through all phases in its life cycle. Risk and uncertainty (as well as poor project management and performance) are the factors that contribute most to project failures. The degree of risk and uncertainty depends in part on the class of application system required. There are three principal classes of application systems:

- Transaction Processing Systems (TPS)
- Process Control Systems (PCS)
- Decision Support Systems (DSS).

Transaction (TPS) systems have the highest risk associated with them. This is because the objective of a TPS is to maximize automation and minimize or eliminate human involvement in a relatively uncontrolled human environment. This means that a TPS must enforce an organization's policies, procedures, and business process requirements, with respect to the application, in their entirety, recognize and respond to every conceivable error condition, and be easily and quickly modified when the business process is changed. Purchasing is an example of a TPS. Electronic Data Interchange (EDI) can fully automate this process.

Process control (PCS) systems have the next highest risk associated with them. The lowered risk is due to operating in a more stable environment and being subject to continuous monitoring. While process control has generally been associated with material handling, manufacturing, and assembly, it is increasingly being applied to service-based or office processes. Work-flow management is an example of this trend.

Decision support (DSS) systems entail the least risk and uncertainty because they are designed to operate under human control and are generally less proceduralized. DSS are often available as off-the-shelf commercial products while the other two types of systems are usually custom developed.

Parker and Benson suggest the following risk levels with respect to providing application systems in support of business process needs:

Level 0: Programs exist with minimal modifications required.

Level 1: Programs are available commercially with minimal modifications, or programs available in-house with moderate

modifications, or software will be developed in-house with minimal complexity.

Level 2: Programs are available commercially with moderate modifications, or programs available in-house require extensive modifications, or software will be developed in-house with minimal design complexity but moderate programming complexity.

Level 3: Software is available commercially but the complexity is high, or software will be developed in-house and the difficulty is moderate.

Level 4: No package or current in-house software exists. Complex design and programming are required, with moderate difficulty.

Level 5: No package or current in-house software exists. Complex design and programming are required, even if contracted outside.

It should be obvious that as the level of risk and uncertainty increases, the potential benefits of having the application program should be correspondingly higher to justify the added risk.

Tapscott and Caston[28] offer several application development principles that can lower risk and increase potential benefits:

- *Simplicity.* We will avoid developing applications that are overly complex by separating functionality into basic and optional modules and by managing information rather than process.
- *Reusability.* We will support the sharing and reuse of common application modules or components across development projects and use common environments to increase reusability.
- *Distribution.* We will place the applications (tools) and associated information as close as possible to the point of use to address the required level of sharing.
- *Replication.* Where distribution results in replication of common applications in multiple work locations on local technology platforms, we will manage the compatibility of these software packages to maintain integrity and support a common architecture.
- *Methodology.* We will use a common development methodology to manage the application portfolio and development environment, including the means of providing shareable components.

By comparing these principles with the risk levels described above, it can be seen that the effect of following the principles is to reduce the level of risk associated with providing application programs and systems.

This step of the methodology is performed in parallel with the previous step and the next step. This is because of the relationships among platforms, applications and data. This especially applies to the first three tasks in each of these steps.

The following tasks are performed in the develop application systems step:

- Review Approved FEA and Supporting Documentation
- Review Technical Change Management Plan
- Assess Current Capabilities

28 Paradigm Shift, Don Tapscott and Art Caston, page 245.

- Design Application Support Systems
- Develop Application Support Systems
- Unit-test Application Support Systems with Data Base
- Document Application Support Systems
- Review and Approve Application Systems

8.2.1 Review Approved FEA and Supporting Documentation. Application software exists to serve the needs of business processes. The needs of business processes are specified in a Functional Economic Analysis (FEA) and supporting documents. A fully developed TO-BE activity model provides the basis for developing application program specifications and designs. Therefore the starting point for all application development is a review of the FEA package.

The FEA package also provides a vehicle for supporting effective communications between functional and technical personnel. It provides a means of assuring that application development activities are linked to business and process objectives, and a means of establishing measures to monitor progress. Finally, the FEA package is the basis for developing prototypes that can be used by functional staff in specification, design, and development and testing activities.

8.2.2 Review Technical Change Management Plan. The FEA package, case for action, or business case is specific to a single business process improvement initiative. In a functional (stovepipe) application environment, the FEA would suffice as guidance for technical personnel to begin systems development. In a cross-functional environment striving to develop an enterprise-wide technical infrastructure emphasizing interoperability and data sharing, there must be a coordinating vehicle to ensure that all application development supports enterprise objectives. This coordinating vehicle is the Technical Change Management plan.

The change plan (see figure 8-1) provides a means of coordinating application development across functional units. The change plan will include or reference the application architecture which portrays the portfolio of enterprise applications. (The application architecture is developed as part of business systems planning as described in Phase 1 of the framework methodology.)

Based on a review of the plan, functional and technical people working together can agree on reasonable compromises in application development which can benefit the enterprise as a whole. The plan can also suggest areas where software reuse or module (object) sharing is appropriate.

8.2.3 Assess Current Capabilities. Unfortunately, most large organizations have done a poor job of maintaining control over their inventory of application modules, programs, and systems. Furthermore, application maintenance and enhancement activity over time corrupts software (and/or software documentation) and reduces the opportunity for reuse. Industry authorities agree that less than 20% of information systems budgets are expended on new development, and some organizations spend virtually 100% of their budgets on maintenance activities.

Where the principles of application portfolio management described above are followed, the application portfolio represents a tremendous asset to support application development by increasing software sharing and reuse.

The emphasis on sharing and reuse can provide a stimulus for the information management agencies to improve application portfolio management.

Available or procurable application software assets should be used to the fullest extent possible to lower the risks, costs, and response time factors of providing needed application support. This may mean that functional elements may need to make compromises in their business processes or procedures that conflict in minor ways with software features and capabilities. This is especially true in the case of commercial application packages. Assessing current capabilities with respect to new application requirements is therefore a critical and rewarding task.

8.2.4 Design Application Support Systems. Modern application program and systems design calls for active participation of functional personnel in the design process. This participation is usually in the form of rapid prototyping. Prototyping answers the end user's legendary lament about application systems design: "I don't know what I want but I'll know it when I see it." Rapid prototyping uses various combinations of the following tools:

- Screen painters that allow users to develop their own interfaces and preferred method of entering and viewing data and information.
- Report generators that allow users to specify what data they want from the system and how they want that data displayed.
- Menu builders that allow users to develop the features and functions they want in their system, and their preferred means of navigating within the system.
- Fourth-generation (4GL) languages that allow users to develop the procedures and algorithms they want in the new system. In conjunction with sufficient data base support, 4GLs are so powerful that in some cases the prototype is sufficient to support process needs and no formal system need be developed.
- Executable specification languages that have the capability to generate software instructions that make up significant components of the final system. In some cases, code generation along with software reuse can substitute for formal application system development.

Prototyping recognizes that application software development is essentially an interactive process requiring the business process knowledge of the functional user and the technical expertise of the system builder. With prototyping, neither party has to make assumptions in the other party's area of responsibility. As Kenmore S. Brathwaite says in *Information Engineering Concepts:* "One demonstration is worth two volumes of specifications." Once a prototype is evaluated, there are five possible courses of action. The prototype can:

- Be refined, retested, and reevaluated
- Be used to drive formal requirements analysis
- Be used as a model for conceptual systems design
- Serve as input to detailed design
- Serve as design input to formal application software development.

If the development organization is committed to object-oriented information systems and has established a useful library of models, prototypes developed using object orientation methods can usually be extended into working systems even in the case of complex transaction processing systems.

4GLs can be used throughout the specification, design, prototyping, and development stages of a project, and there is a wide variety of 4GLs available. Some are more suited for prototyping activities while some can substitute for or enhance the capabilities of delivered decision support systems.

Application design also includes the concept of evaluating off-the-shelf commercial or government systems as a replacement for in-house or contracted systems development. During the evaluation period, the design team tries to find application systems that come closest to meeting the requirements set forth in the FEA within the context of the Technical Change Management Plan. If candidate systems are found, the team assesses whether changes to the software or changes within the business process itself must be made in order to use the candidate system. This is another reason that it is important for functional users to participate in the design task.

Computer-aided Software Engineering (CASE) tools are available which automate the systems design process. Such tools generally work off a repository system and/or automated dictionary/ directory system that contains design rules, business

process activity models, data administration, and data structure information. Some case tools can be used to develop working prototypes.

8.2.5 Develop Application Support Systems. Once the design team comprised of functional and technical personnel are satisfied that the prototype captures the essence of the required application system, development (or construction) can proceed. Note that in the absence of a prototype, the design team would have developed detailed design specifications for the desired system. It should be noted that the risk and uncertainty levels are higher for this method of design.

Development can consist of any one or a combination of the following development techniques:

- Write application code using a procedural programming language such as Ada, COBOL, or Basic.
- Write application code using a sophisticated 4GL (non-procedural) language such as FOCUS, SAS, or even spreadsheet macros.
- Use object technology to develop reusable software building blocks that can be assembled into finished application systems. Note that non object-oriented coding techniques can be used to develop reuse modules, but the success rate to date has been disappointing.
- Contract (out-source) application development to a systems house.
- Purchase commercial off-the-shelf (COTS) packages and modify as required.
- Purchase COTS packages and adapt the business process so that it can use the software package as is.
- Locate and acquire government off-the-shelf (GOTS) packages and modify as required.
- Locate and acquire GOTS packages and adapt the business process so that it can use the software package as is.

Please note that the options listed above are presented in reverse order of preference with respect to risk, cost, and response time for delivery of the finished system. One critical decision point related to all application development is after installation service, maintenance, and support. This question should be considered at the time the development option is being selected. Whomever writes or modifies software code becomes responsible for its maintenance throughout its life cycle! In general, the less code written in any organization, the better. It's interesting to note that DoD spends $42 Billion for software acquisition.[29]

8.2.6 Unit-test Application Support Systems with Data Base. Application systems are developed in sections or modules corresponding to major features and functions in the business process. It is also necessary to develop so-called *housekeeping* routines that take care of internal programming, utility, and user interface functions. These modules and routines are developed in a sequence that aids the unit testing effort.

A unit test is a test of a program module or routine. As each module or routine is developed, it is tested against mechanical, logic, performance, fit, and finish criteria. To test a module, it must have access to test data residing in a real or simulated data base and/or file system. As each module passes its tests, it is shelved until enough modules are completed to form a subsystem. As subsystems are completed and tested, system tests are conducted. Subsystem and system tests are described later in the methodology.

Functional users and members of the process improvement team must participate in the unit testing process. While technical personnel can discern and correct mechanical, logic, and

29 *National Defense,* November 1994, page 7.

performance errors and discrepancies; only functional users can adequately judge the fit and finish (usability) features of the application system. The earlier in the develop and test cycle such discrepancies are located, the less risk to a successful development effort.

The design prototype can also be used during unit testing to aid in detecting omissions in module functionality. Such omissions will not always be evident in unit testing. It is difficult to find a problem in a function that was never coded in the first place. This is another reason function or end users must participate in unit testing.

8.2.7 Document Application Support Systems. Documentation has historically been a weak link in information systems agencies. In some cases, the required documentation is never written, or it is poorly written. In many cases, maintenance, problem-resolution, and enhancement activity to the code itself is never reflected in the original documentation for the software module. This means that the integrity of the documentation is destroyed over time. In more than a few cases, systems documentation becomes lost, destroyed, or even stolen.

The solution to the documentation problem is to use software development and test tools that automatically generate the necessary documentation as development proceeds. Later, when code is changed, the documentation is automatically updated to reflect the change. A repository, dictionary, and/or directory system can also be used to control documentation. As a last resort, audits can be used to force good documentation management.

Functional managers and process owners should make it a point to demand a copy of all application and data base documentation that affects their area of responsibility. As maintenance and enhancement activity takes place on software code related to business functions, these managers and owners are in a position to enforce good documentation management principles.

8.2.8 Review and Approve Application Systems. Application systems are developed following standard methodologies. At the completion of each phase or milestone in the development project, reviews and audits are held. The final review consists of acceptance tests conducted by the end user or customer of the system.

Throughout the entire application fulfillment process, software quality principles should be followed. Functional users, managers, and process owners should participate in the quality management and assurance process as equal partners with the technical elements. This concept is fully a part of the CIM initiative.

The American Society for Quality Control (ASQC) maintains that the following objectives should be part of every software development effort:

- Plan a software development project by setting objectives and quantitative software quality goals.
- Establish quality control monitoring techniques.
- Understand what defines good engineering practices for ensuring software quality, verification and validation, and increased productivity.
- Define and design implementation plans for a software quality assurance program based on international and government standards and best commercial practices.

When these principles or objectives are understood and followed, in-process reviews (IPRs)and audits tend to be routine and uneventful—just as they should be.

8.3 Step 18: Develop Data Base Structures

Because the information infrastructure consists of platforms, applications, and data base

structures designed to work together to satisfy enterprise and functional user requirements, portions of step 18 is performed in parallel with steps 16 and 17. The reader is reminded that the 25 steps in the framework methodology are not necessarily performed in sequence. In some cases, steps are performed iteratively, and in other cases, not at all. The project manager has full discretion on the use of the methodology to guide process improvement projects.

By the mid 1960s, several concepts related to data and information began changing the nature of application development in industry and government. The first concept was that of an *entity.* An entity is a person, place, thing, idea, concept or event. An entity can be represented by a data element (or item) and stored in a computer file system. The second concept was that of *attribute.* An attribute is a fact about, or characteristic of, an entity. The third was that every enterprise deals with a **finite** number of entities and attributes which can be predetermined by conducting a formal business systems analysis. The fourth was that a *relationship* exists among entities that depends on the nature of the enterprise and its business processes; and these relationships can be defined and stored just like entities. The fifties concept was that data are independent of the application programs developed to support business processes.

We have the principle that data is a corporate asset, and like all assets, data must be properly managed. Data base structures were developed and data base management systems became available to aid in leveraging the data resource for the benefit of the enterprise as a whole. An important corollary to the principle that data is a corporate asset is that organizational units do not own the data they create, but rather must share it with all other units which have a legitimate need to access it. Access, privacy, and security rules are part of data base management.

If it is true that there are a finite number of data elements that can be defined for a given enterprise, and if the enterprise develops and maintains data bases that contain these data elements, then it follows that any number of application programs and systems can be constructed to make use of the data resource without the need to create new data elements or data base structures to contain them. An application program or system is said to *have a view* of the data base that is sufficient to satisfy application requirements. Therefore, this step of the methodology is (or should be) concerned with constructing an appropriate view of the data base rather than creating a new data base.

Functional managers and users construct their view of data when they build their TO-BE data models. These data models are part of the FEA documentation package. From these data models, data base analysts can ensure that the required data does exist, and can engineer a view that will support the needs of the application. The view is represented by special systems software that is used by all application programs to interact with the corporate data base.

The corporate view of data is represented in the enterprise model. In fact, the DoD Enterprise Model defines the large groupings of data (called subject data bases) that are needed to carry out all defined mission areas in DoD. Therefore all application programs and systems developed under the enterprise concept will use portions of one or more subject data bases to satisfy business process application requirements.

Data base technology has been evolving for approximately 40 years. During this period of time, four major classes of data base systems have been developed. Each succeeding class has proved to be better suited to serving overall corporate needs. However, all four classes are still in use. Figure 8-2 shows these classes.

Business systems planning (described in phase 1 of the framework methodology) is concerned with developing the *data architecture* for the enterprise. As noted above, this can be done apart from any particular application considerations. The data architecture is the representation of the enterprise model with respect to data just as the application architecture is the representation of the enterprise with respect to applications. The relationship between business processes and data and business processes and applications is notated in the *information architecture.*

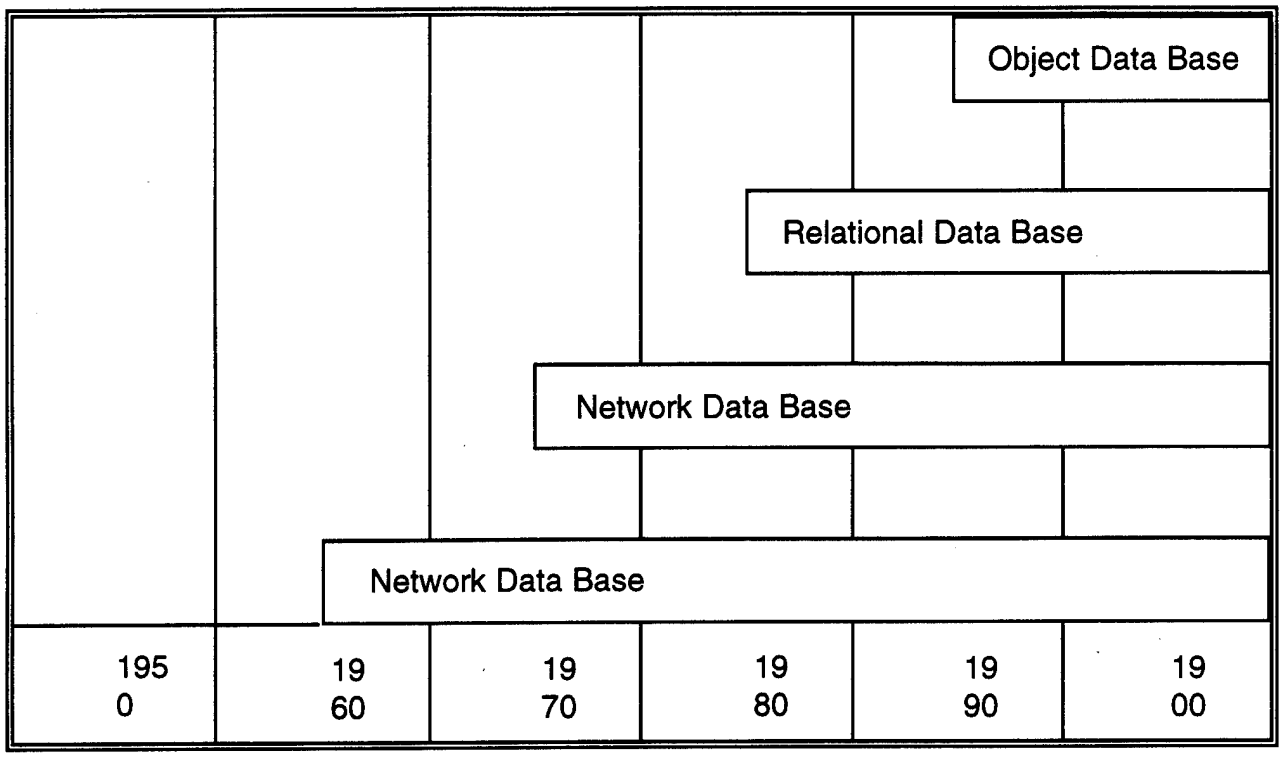

Figure 8-2. Generations of Data Base Systems

Data naming standards and definitions are generally stored in a special purpose data base called the *repository* or data *dictionary*. If this facility also identifies where specific data elements can be found in the corporate data base, the repository or dictionary is said to be a *directory* also. Functional process improvement teams should have access to repository information while they are constructing their TO-BE data models. This way the improvement team can use standard naming conventions for their data elements and attributes. This saves considerable time and also improves communications with data administrators and data base administrations who are charged with the responsibility of support functional requirements for data.

In summary, functional managers and users, and members of process improvement teams are not concerned with building data architectures, data bases, or data repositories, dictionaries, and directories. These are facilities that are provided by the technical staff for use by functional elements. Functional personnel describe their data requirements in the FEA and supporting documents including TO-BE data models. These data models are then turned over to technical teams who ensure that the required data will be made available in the proper formats to support business process and application systems requirements. Data models themselves are stored in repositories to facilitate access by technical staff as well as other functional elements.

The following tasks are performed in the develop data base structures step:

- Review Approved FEA and Supporting Documentation
- Review Technical Change Management Plan
- Assess Current Capabilities
- Perform Data Base Administration Activities
- Design Data Base Structures
- Unit-test Data Base Structures with Application Software
- Document Data Base Structures
- Review and Approve Data Base Structures

8.3.1 Review Approved FEA and Supporting Documentation. The approved FEA along with its supporting documentation specifies the data requirements to support a business process improvement project. The Data Management Plan and TO-BE data models are the principle documents concerned with data. These documents should have been prepared using data architecture and repository reports as reference material. If the enterprise has a well-planned, well-developed data base concept, more than 90% of the needed data elements and structures should already exist. If this is the case, all that will be needed is to develop missing data structures and then construct a user view of the data resource appropriate to the improvement project.

In some cases (especially with major process reengineering projects), a more important consideration is the location and distribution of data to support innovations associated with the improvement project. For instance, a reengineered business process may require a client/server implementation to replace a mainframe/terminal application. When this is the case, the organization's geo-technical architecture will be used to help plan for data distribution and use. Data integrity, security, and privacy as well as concurrent data access become important considerations. Since distributing data has cross-functional implications, this is the most critical activity in this task.

This task is completed when both functional and technical elements agree on the basic requirements for data in support of the business process improvement project. Once this agreement is reached, data administration and data base management technical staff become responsible for putting the necessary facilities into place.

8.3.2 Review Technical Change Management Plan. Data is a shared corporate resource. This means that the requirements for data in support of a specific business process or application must be rationalized with the requirements for data for other processes and applications all the while maintaining the integrity of the data base system as a corporate asset. The Technical Change Management Plan is the vehicle for doing this. As described in the previous step, this plan consolidates the requirements associated with all active functional and technical improvement projects. This helps the technical staff ensure that a change in one area of the data base system in support of one improvement project will not adversely affect production data bases or changes being made in support of other improvement projects.

Functional and technical elements must work together to review the Technical Change Management Plan with respect to each improvement project. This is necessary because invariably, compromises must be made to maintain the integrity of the data base system from the corporate perspective. For example, one improvement project may call for relocating a class of data from one technical platform to another. But existing applications may require the data to remain where it is. Technical staff can always work out an acceptable solution providing they work closely with the functional elements involved in the change.

This task is completed when both functional and technical elements agree on a data deployment plan that is satisfactory for all concerned parties.

8.3.3 Assess Current Capabilities. In a well managed technical agency, all data structures, components, and platforms will be represented in the geo-technical architecture. This architecture show how all information resources are distributed and deployed. The geo-technical architecture should also indicate which business processes and supporting applications use components of deployed resources. In other words, the geo-technical architecture is a guide to understanding the interoperability and data sharing characteristics of the information management resource.

All changes to the geo-technical architecture as a result of approved functional and technical improvements must be carefully considered to eliminate the potential problems associated with making structural changes in an operational facility. Again, variances and compromises may be necessary to maintain the integrity of the corporate information resource as well as reduce the probability of waste and redundancy of technical assets. Functional and technical elements must

work together throughout the first three tasks in this step.

This task is complete when functional and technical elements are in full agreement as to how to proceed with making changes and enhancements to the data resource to support the requirements of all approved improvement projects in the context of maintaining a corporate focus on the data resource.

8.3.4 Perform Data Base Administration Activities. Once plans are in place and all conflicts related to the data resource are resolved, the next task is to complete data administration activities. Data administration is considered to be the custodian of the data resource and performs a stewardship role in making data resources available to all authorized components in the enterprise. Data administration is concerned with data as a corporate resource, while data base administration is concerned with the physical storage, structure, and distribution of data.

Data administration is charged with the responsibility of maintaining the integrity of the DoD Enterprise Model with respect to the data resource, and ensuring that the strategic plan for data management is carried out. Data administrators also serve as the interface between functional users and data base administration. Specific data administration functions include the following:

- Assisting functional users in constructing effective data models and defining or selecting entities, attributes, and relationships
- Defining data base security, privacy, and integrity rules
- Providing effective means of accessing data bases especially in client/server environments and with the use of 4GLs
- Overseeing the development and maintenance of data repositories, dictionaries, and directories.
- Providing logical data base designs (user views)
- Conducting data base audits to ensure that the integrity of the data structures is maintained and that adequate audit trails and backup and recovery schemes are in place
- Ensuring that data base performance characteristics are adequate with respect to process requirements and customer expectations
- Define and enforce data entity, attribute, and relationship naming conventions, primary and secondary access rules and keys, and edit and validation rules
- Provide and/or conduct functional training in data base management concepts and facilities, and provide end user consulting, facilitation, and support.

In organizations moving to object orientation, data administration will assist in the definition and structuring of objects in the data base. Data base objects are far more robust than data tables used in relational data bases, and record structures used in network and hierarchical data bases.

This task is complete when data administration reviews and approves the data management plan and certifies that all standards and conventions are being observed in data models and user views; and that all security, privacy, and integrity safeguards are in place.

8.3.5 Design Data Base Structures. The outputs of data administration are stored in repositories, dictionaries, and directories and as documentation. Data administration is said to work with *metadata*, which is data about data. *Data base administration*, however, is concerned with managing the actual instances of data entities, attributes, and relationships. From the outputs of data administration, data base administrators oversee the construction and distribution of data bases, the management and use of specialized data base management system software, and the development of software components that represent data base views, and with using a variety of data base utilities

to maintain the integrity and performance characteristics of the facility.

In general, functional users do not work directly with data base administrators except to consult on specific data base related situations. It is helpful, though, for functional elements to understand what data base administrators do. The functions of data base administration include the following:

- Structuring data and loading (populating) data bases with all instances of data entities, attributes, and relationships
- Distributing data bases according to the geo-technical architecture and data management plan
- Restructuring or reorganizing data bases in support of improvement projects
- Calculating data storage requirements and ensuring adequate capacity to support process and application requirements
- Selecting access paths to data structures and providing utilities or routines as necessary to provide access
- Monitoring the performance of the data base and taking appropriate action to maintain performance standards especially for on-line access and transaction systems
- Enforcing data *normalization* rules to prevent data base anomalies from occurring that may compromise data base integrity.

Data *normalization* is concerned with following certain rules in structuring data bases to eliminate unnecessary data redundancy, prevent corruption of data structures, and ensure that structural relationships maintained in the data base reflect reality.

Data base administrators are also called upon to construct test data bases that can be used with prototypes and as test beds for unit and systems testing during application development.

Data base administration is an on-going activity but there are two checkpoints that are important from a process improvement perspective. The first is when data base administration is able to construct a suitable data base to support prototyping activities. The second is when data base administration is able to construct a fully tested production data base in support of an operational application system.

8.3.6 Unit-test Data Base Structures with Application Software. Task 8.2.6 in the previous step calls for unit testing of application modules or programs. This is the complementary task that provides a test data base to support unit testing. While the application program is being tested for structural and logic errors, data base administration is testing the data base structure as well. In general, during this task, all elements of the data base can be tested except for performance under load conditions.

Functional users are generally not concerned with developing test data bases to support unit testing except in the capacity of review and validation of test data base results.

8.3.7 Document Data Base Structures. Because the data base system is a critical corporate asset, it is imperative that all documentation related to the data base system be accurate and up-to-date. Fortunately, most data base management software generates documentation as a by-product of construction and maintenance activities. If a repository or dictionary system is in place, all activities with respect to metadata management will also be automatically documented. In addition, if the repository and or dictionary system is *active* with respect to the data base system, the software ensures that the structures defined in the dictionary system are exactly the same as the structures existing in the data base files.

Functional elements are generally not concerned with this task other than to reference the

documentation associated with repositories, dictionaries, and physical data base systems. Functional users may want to assure themselves that all referenced documentation is indeed accurate before using such documentation in their business process improvement project.

8.3.8 Review and Approve Data Base Structures. The final task in this step consists of a formal review and approval of the actions that will be taken with respect to data administration and data base administration to provide data resources in support of business process improvement projects within the context of maintaining an enterprise view of the data facility. This task can be performed following concurrently with acceptance of the results of unit testing of all application software in support of improvement projects.

Figure 8-3 is an extension of figure 8-1 and shows the relationships of the steps in enterprise engineering. After the completion of steps 8.1, 8.2, and 8.3 for all current projects, improvement projects are ready to move to the implementation step. At this point, an acceptable course of action has been engineered, and it is time to prepare the organization for implementation and deployment of the reengineered business process and associated technical changes.

As figure 8-3 illustrates, step 8.5 is the point at which all current efforts are consolidated with respect to changes in the technical infrastructure. The CIM objectives of enterprise modeling, interoperability, and shared data require this synchronization point so that changes can be made in the technical infrastructure without jeopardizing operational systems. This implies some degree of batching changes and enhancements so that coordination can be maintained.

8.4 Step 19: Construct Information Systems

This step is concerned with constructing an operational information system in accordance with the approved FEA and within the context of the technical change management plan. The modules and programs developed earlier are assembled into a working system and tested against a representative test data base. At this time, all changes in the organizational change management plan are reviewed and revised as necessary to conform with

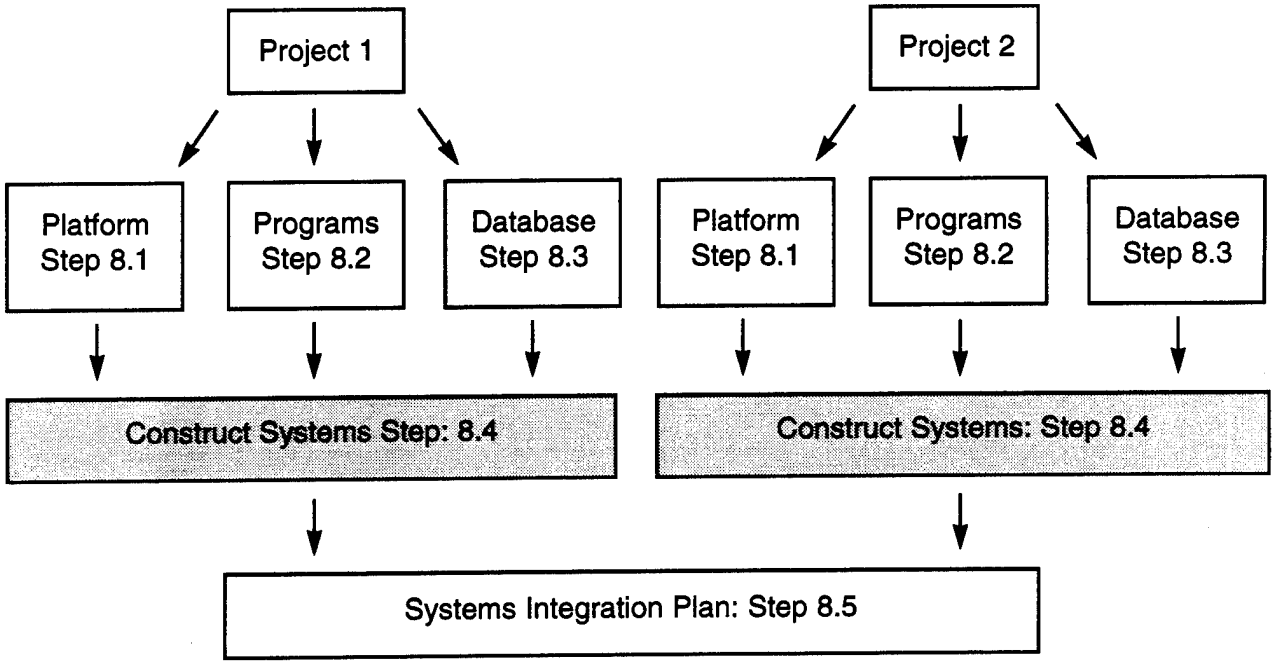

Figure 8-3. Step Relationships in Enterprise Engineering

the way the information system will operate. Organizational changes can be in the areas of management, structural alignment, formation of work teams, customer/supplier partnerships, and recognition and reward systems, Policies, procedures, special forms, and report formats are developed which bring the process in alignment with the information system.

At the completion of this step, a full systems audit will be performed, and extensive customer acceptance tests will be completed. After acceptance, the finished system will be ready for integration activities and deployment. Integration activities are performed in the next step in the enterprise engineering phase, while deployment is conducted in the next phase of the methodology—Project Execution.

The reader is reminded that a technical change management plan is one of the documents that guides information system specification, design, and development in support of FEA requirements. One of the key purposes of the technical change management plan is to address migration and integration issues early in the systems development process. Therefore, when this step is completed and the system moves to the next step—systems integration—most of the issues associated with legacy systems, migration systems, and integration and interoperability will already be resolved.

Systems construction is primarily the responsibility of the technical staff. But functional staff including process owners, improvement team project managers, and key functional users must be fully involved throughout the construction process to ensure that expectations will be met and discrepancies discovered as soon as possible. Many project failures including cost overruns and untimely delivery can be traced to the non-involvement of functional elements in systems construction.

The following tasks are performed in the construct systems step:

- Prepare Test/Pilot Site for Systems Assembly
- Load Test Files and Data Bases
- Assemble and Test Application Systems
- Develop Draft Information System Manuals
- Conduct Initial Training
- Conduct Acceptance Trials
- Develop Data Acquisition Plan
- Review/Revise Organizational Change Management Plan
- Develop Final Documentation Package
- Acquire/Develop Functional/Technical Training Systems
- Conduct Systems Audit and Acceptance Tests

8.4.1 Prepare Test/Pilot Site for Systems Assembly. The first task in systems construction is to prepare a test or pilot site suitable for assembling the final information system and completing all test activities. The test platform should be as representative as possible of the hardware and communications systems that will be utilized or deployed during systems installation.

If some components of the platform will not be available due to procurement situations, physical site, or technical problems, arrangements can usually be made to borrow, rent, or lease equipment. Such arrangements can be made with other agencies, service bureaus, third-party lessors, or with the equipment vendor. If any part of the specified platform will not be available during this step and portions of system assembly and test must be simulated, the project manager must schedule additional time in the deployment (project execution) phase of the project for final testing and error correction.

While much assembly and testing can be performed on workstations equipped with computer-aided software engineering (CASE) tools, final acceptance can never be granted until tests are completed on a live platform.

8.4.2 Load Test Files and Data Bases. Systems assembly and testing must be performed using statistically valid test data. This data must be stored in file and data base structures that match data base specifications. If test data bases cannot be

constructed by extracting data from live or production data bases, then representative test data must be generated. Software utility programs exist to facilitate this effort. The technical staff should make every effort to acquire production quality data prior to final systems audit and customer acceptance testing. If this is not possible, then the project manager must allocate additional test time during the installation and deployment phase of the project.

Often production quality data is not available at this stage of systems development either because it does not exist, exists but is not structured as data base specifications call for, or has not been *scrubbed.* Scrubbing refers to the process of reviewing existing data and reformatting it for use in a new information system. Existing data may be corrupted (invalid), unnormalized (ambiguous), wrongly formatted, contain redundancies, missing search and access keys, and/or missing critical attributes needed in the new information system. Data scrubs can be laborious and time consuming operations when high volumes of data are involved.

Even when good data is available for information system assembly and test, it may not be available in production quantity. This means that accurate capacity and performance tests cannot be reliably performed. Again, if this is the case, additional test time must be allocated prior to installation and deployment. Some information systems perform well under test conditions, but fail under production conditions.

8.4.3 Assemble and Test Application Systems. This is usually the most time intensive task in systems construction. All of the components, modules, objects, and programs developed and unit tested earlier must now be assembled and tested as subsystems and systems. At this time, application software is tested in a live systems software environment and under production platform conditions. During this period, functional users will be called upon to review and validate features and functions of the information systems once they pass initial tests by the technical staff.

Most information systems are assembled according to the system of menus that will be in place when the system is finished. Assuming good design, each major and most minor features and functions can be tested independently. This is especially true in client/server application environments or when object oriented systems are being developed.

A well designed assembly and test plan will call for common or high use components (or subsystems) to be assembled and tested first, followed by assembly and test of software that supports little used or special purpose features. It is also helpful if the assembly and test plan correlates to the natural sequence that end users will employ when they are using the system. This way, users can better relate information systems features to the business process operations they support.

A systems test checklist will include at least the following elements:

- Who is responsible for testing/validating a subsystem/system?
- What data is needed for the test and where does it enter the system?
- What inputs/triggers are needed and what is the source?
- What resources/components will this test exercise?
- What outputs/screens/responses are required?
- What acceptance/validation criteria will be used and who provides?
- Who is responsible for review test results and granting acceptance?

8.4.4 Develop Draft Information Systems Manuals. Good practice calls for the development of supporting documentation in parallel with the development of information systems. This ensures that the documentation is done and done right. Better practice calls for the development of supporting documentation *before* information systems development which allows the documentation to serve as a validation mechanism. As stated earlier many software engineering and test tools provide at least some documentation as a by-product. In any case, functional users should insist on the presence of an acceptable documentation plan as part of the systems construction process.

In general, three classes of information systems related documentation are required:

- *Systems documentation.* This is the documentation needed by technical staff to maintain, support, repair, and enhance all hardware, software, and data base components of the information system. It is in the interests of functional users to know that such documentation will be in place to support maintenance and customer service activities.

- *Operations documentation.* This is the documentation needed by operations and production staff to support production activities. Of special importance is the documentation needed to support network and communications services in support of the information system. This class of documentation also includes that needed to support such utilities as file backup, restore and recovery operation, and audit and performance measurement operations.

- *User documentation.* This is the documentation needed by functional users, internal and external customers, suppliers, and other stakeholders affected by or supported by the information system. Great strides have been made in recent years in improving the utility and maintainability of user documentation. Multi-media, hypertext, on-line contextual help systems, CD-ROM, and user friendly user texts are becoming common.

A final consideration for functional users in this task is to ensure that a program of document maintenance will be in place so that documentation does not become obsolete or counter-productive due to changes in the information system.

8.4.5 Conduct Initial Training. Before functional users can fully participate in systems testing and acceptance, they must receive initial training in the use of the system. Since formal training programs cannot be put into place until the information system is complete and relatively stable, initial training is usually ad hoc or informal and conducted by members of the technical staff. Also, formal training systems development is expedited once documentation is in place.

The initial training task affords an opportunity to begin the formal training systems development process. Professional training systems developers should participate in initial training sessions in order to collect data useful for training system specification and design. (They should also work with the documentation staff for the same reason.) Training staff members should also work with users during the testing period to discover the elements of the system that may need special attention in training. Often a member of the training development staff serves as one of the members of the test and acceptance team to gain first-hand experience with the system.

Since initial training sessions are often incomplete or less-than-desirable, it is helpful at this time to institute a user help facility or telephone hot-line so that initial users can quickly get questions answered, problems solved, and provide useful input to the technical staff. Members of the documentation and training development staff should routinely receive a copy of all hot-line calls and responses, as well as all discrepancy reports.

The help facility or hot-line will be much more effective if it can be implemented using e-mail, groupware, or bulletin board facilities. This way, all communications are in writing both ways, and interested parties can easily be included as message recipients. In addition, these facilities offer a means of conducting ad hoc conferences to solve problems and address issues.

8.4.6 Conduct Acceptance Trials. At this point, in the construction step, the technical staff has made sufficient progress in systems assembly and initial testing to permit user acceptance trials to begin. Users have received initial training and at least some draft documentation and are prepared to effectively participate in testing and acceptance.

While initial user testing can be performed at any time, formal acceptance trials should only be conducted on a subsystem basis and in accordance with a formal and approved test plan. The test plan will include the features and functions to be tested; the validation criteria; sample outputs, screens, forms, and reports; and appropriate checklists. Since most information systems are designed to support various levels of users (managers, professional, clerical, customers, etc.) representatives from each group should participate in the testing process.

In addition to actual users, the test team should include at least one person who is trained and experienced in systems testing procedures. Such a person knows how to exercise all features and functions, simulate a wide range of error conditions, and intentionally *crash* a systemthings a typical user would not attempt to do.

Professional staff is also required to test the security, privacy, integrity, performance, capacity, backup, recovery, maintenance, and utility features of an information system.

A formal test program will include an extensive regression testing protocol to ensure that changes to components of the system will not invalidate previous tests on those components. Once subsystems are tested independently, they must be retested as they are assembled into higher level systems. The final acceptance test of the information system itself is conducted once all assembly work is complete, all major discrepancies corrected, and all minor discrepancies under control.

8.4.7 Develop Data Acquisition Plan. At this point in the construction step (or sometime during the acceptance trials), a data acquisition plan must be formalized so that by the time the information system is ready for installation and deployment, a fully populated, valid data base with all supporting files will be in place. The amount of time and labor needed to ensure production quality data will depend on the current situation with respect to existing (legacy) information systems, and the effectiveness of the data administration program as it affects the information system in question. The time period to complete this task can extend from several days to several months. An accurate estimate of the level of effort will be possible following a review of the data management plan produced much earlier in the methodology.

In general, the needed data will be available from one or more of the following sources listed in increasingly level of difficulty:

- An existing and compatible data base which can easily be converted to the format specified by data base administration
- An existing file system where data can be restructured into data base formats
- A disparate (dispersed) set of files which will require program support to reformat and restructure
- Manual records which will have to be scanned and scrubbed
- New data which will have to be located and encoded.

The time required to execute the data acquisition plan will depend on the format the data is in, the quality of the data, and the amount of data. In addition, new information systems are able to work with data in multiple media including voice and image where image can refer to video tape, film, photographs, charts and graphs, and computer generated images. The data acquisition plan must take requirements for multi-medial formats into consideration.

8.4.8 Review/Revise Organizational Change Management Plan. The organizational change management plan prepared earlier in the methodology was based on assumptions about how the improved (reengineered) process would work, and the features and functions of the supporting information systems. It is likely that at this point, given the progress made in implementing process and technical changes, that the organizational change management plan will need to be reviewed and revised to accommodate necessary specification

and design changes. Sufficient data should now be available by this point to allow the organizational plan to be refined to almost final form. Please note that the organizational change management plan will be used in the project execution phase as a guide to making organizational changes needed to support the reengineered process and all supporting information systems.

Some of the areas in the plan that may have been affected by progress to date include the following:

- Policy, procedures, directives, and other guidance documents
- Management roles, responsibilities, and span of control
- Management controls and performance monitoring systems
- Audit, oversight, and inspection protocols
- Departmental and work group organization and structure
- Work structure, work flow and work routines
- Facilities, floorplans, office arrangements, and support services
- Public relations publications and support services
- Employee qualification, hiring, and training requirements
- Upgrading employee technical skills (to use new systems)
- Job classification and job description documents
- Employee recognition and reward systems
- Employee and stakeholder transition and communications plans
- Customer service and support systems
- Supplier and other stakeholder support systems
- Total quality and continuous improvement program

This task is complete when functional management is assured that a workable organizational change management plan is in place (or will be in place) to support the installation and deployment of the improved business process and information systems support. Note that this is still a planning task. The implementation of the plan will be during the project execution phase.

8.4.9 Develop Final Documentation Package. With acceptance trials complete or nearly so, and with an updated organizational change management plan, it is possible to develop the final documentation package that supports both the improved process and the new information system.

Draft information systems manuals can go through final updates and edits in preparation for supporting the project execution phase. Because additional changes to the information system can be expected during the installation and deployment period, creating excess inventory should be avoided.

Documentation related to process operations and related organizational support functions can now be written and tested. Documentation will be needed for most of the items noted in the previous task. As with systems manuals, final updates and edits can be expected during the project execution phase.

This is also the time the technical staff should be assembling the technical documentation related to all components of the information system that will be needed for trouble-shooting, maintenance, and continuous enhancements.

Personnel responsible for preparing the final documentation package should do their job as if they were contractors expected to turn over an acceptable documentation package to the customer. Functional management should insist on adherence to good documentation standards even in the technical areas.

8.4.10 Acquire/Develop Functional/Technical Training Systems. With a functioning system, organizational policies and procedures specified, and a documentation package in final editing stages, the training activity can acquire or develop the necessary training packages to support the new business process and its related information system support components. The training system should be scheduled for completion in time to support installation and deployment activities. Since

deployment will most likely be phased, the initial installations can serve as a final test site for the training program.

At this time it is also possible to estimate how many trainees will go through the training program, their locations, and the time frame for completing training. With this information, training system planners can estimate resource requirements, number of instructors or facilitators, out-sourcing needs, and materials costs. This data will be used in the next phase to plan the training delivery program.

Consideration should be given to using media-based training and distance learning concepts where practical or as a supplement to instructor-based training. All training techniques and methods should have a *hands-on* component so training audiences can develop skills in working in the new process and with the new information systems that support them.

8.4.11 Conduct Systems Audit and Acceptance Tests. With all elements of the information systems support in place including training courses and documentation packages, functional users can conduct a final audit and perform final acceptance tests. Once the information system is certified by the functional elements, the project can move to the next step—Design the Systems Migration and Integration Plan.

8.5 Step 20: Design Systems Integration Plan

The construction of information systems is a risk-filled, expensive, complex undertaking. This is true even in a strict stovepipe organizational environment. When the objectives of interoperability and enterprise-wide data sharing (enterprise integration) are added, information systems projects become even more complex. The fact is that information systems are built one at a time according to specifications whether the approach used is traditional (waterfall method) or rapid prototyping. The initial objective must be to deliver an acceptable information system to the customer on time and within budget. This alone is a most challenging objective and seldom realized in all aspects. Once that objective is accomplished, efforts can be undertaken to integrate that information system into the technical infrastructure in such a way that enterprise-wide objectives including, but not limited to, interoperability and data sharing can be realized.

The existence of enterprise models, standard architectures (information, application, data, and geo-technical), and rigorous configuration management helps ensure *up-front* that information systems designs are such that effective integration can be accomplished in a reasonable manner.

The enterprise model is developed based on an organization's mission, vision, goals, objectives, values, beliefs, and strengths. It is a function of business oriented model. Standard architectures are developed based on an organization's current inventory of machines, applications, and data. AS-IS architectures describe the *legacy* systems and components that provide a base for improvement and enhancement. TO-BE architectures define the vision of what the technical infrastructure is to become. Configuration management helps ensure that progress from the AS-IS to the TO-BE is consistent. *Migration systems* provide a means of moving in an orderly fashion from the baseline or legacy environment to the objective or TO-BE environment. In DoD, the TO-BE environment is one of open systems and enterprise-wide support.

It is *critical* to note that the enterprise model and technical architectures are built apart from business process reengineering and information systems development projects. This implies that both reengineering and systems development are expected to conform to the requirements of models and architectures, not the other way around.

Information systems development can proceed in any one of three ways:

- A legacy system can be upgraded to provide new features and functions needed to support a reengineered business process. However, if major changes are made to a business process (radical reengineering), it is highly doubtful that a legacy system can be improved enough to support the new process. It is usually more cost-effective to start over.

- A designated migration system can be redesigned to support the reengineered business process. This is more likely to succeed if the designed migration system is identified before an FEA is prepared. It must also be remembered that a migration system usually is designed to replace two or more legacy systems. This means that updates to a migration system to support one reengineered business process cannot be such that the migration system will cease to adequately support its other business processes. For this reason, it is best to reengineer all business processes concurrently that are sharing a migration system. If this is not feasible, extreme care must be exercised during the systems construction and integration.

- A new information systems project can be authorized that will build information systems support for a business process from the ground up. If this path is selected, it is best to assess the possibility of the new system replacing one or more legacy and/or migration systems. The danger here is that the project will become too complex which implies much more risk than may be acceptable.

The problem of systems integration can be simply defined. An organization has an existing technical or information systems infrastructure. It also has a model which presents a vision of how the enterprise desires to function. All new information systems must be made part of this technical infrastructure while satisfying enterprise model objectives.

There are three ways this can be done:

- The new information system can be installed but not connected or associated with existing information systems. This means that the objectives of interoperability and data sharing cannot be met. This is, in fact, how most large organizations have added new systems to their inventory over the last few decades.

- The new information can be installed and interfaces can be built, as necessary, to other existing information systems. This often provides some measure of cross-function interoperability and data sharing, but not at the enterprise level. Over time, this arrangement usually degrades as interfaces are added and modified. Maintenance costs rise dramatically, and it becomes difficult to enhance systems because of the number of interfaces that may be affected.

- Each new information system can be integrated into the technical infrastructure such that data created by the new system can be shared with all other information systems, and the new system's functionality can be made available in all related business or functional areas. The term *integration* means to combine separate elements in such a way that they function as a whole. This is, of course, the preferred method, but it often delays information systems deployment while the integration activities are being performed. If the new information system is already behind schedule by the time it gets to the integration step, pressures to forego integration can be severe.

Technical staff can often make significant improvements in the technical infrastructure, especially in the area of cost, independently of either process or organization. For instance, if an enterprise has five separate accounting systems supporting five separate accounting organizations, it is likely that technical staff can combine these into one accounting system that supports all five organizations. This can often be accomplished apart from involving any functional staff. Of course, there will be little if any improvements seen at the business process level, but significant cost savings may be realized by the technical

organization. In other words, designating migration systems and decommissioning legacy systems can be done apart from business process reengineering. When it can be done, it should be done.

In summary, an enterprise-wide objective is to modernize the DoD information infrastructure to support the objectives of the DoD Enterprise Model as expressed in information systems support requirements for improved or reengineered business processes. The most effective way to do this is to build information systems that support business requirements then integrate them into the existing information or technical infrastructure. Over time, the technical infrastructure will migrate toward an enterprise-wide objective of open systems, shared data, and interoperability.

The Assistant Secretary of Defense for Command, Control, and Intelligence has established 12 objectives for moving the DoD toward an integrated enterprise state. The accomplishment of all of these objectives depends, in least in part, on constructing sound cross-functional information systems based on end-to-end process management which can be integrated into an enterprise-wide technical infrastructure. Please refer to *CIM for the 21st Century: a DoD Strategic Plan* for more detailed information about these objectives.

- Aggressively pursue process changes in DoD operations that will yield improved efficiency and effectiveness
- Implement reengineering on a sustaining basis so that it is responsive to the guidance and priorities of the Department's leadership
- Derive standard definitions of data on an aggressive schedule
- Establish strong management of data quality, including data availability, integrity, accuracy, and security
- Eliminate unnecessary duplicate systems and migrate toward a common baseline of information systems
- Implement enhanced information systems that incorporate reengineering results as well as standards based technology
- Implement a computer and communications infrastructure that is transparent to the application software residing on it
- Establish technical policies and standards based on open system architecture to guide implementation of the infrastructure
- Integrate technical programs, particularly cross-functionally, so that barriers such as data sharing, transfer and interoperability are identified and removed
- Integrate end-to-end functional processes to achieve greater effectiveness and efficiency
- Ensure that the corporate-wide information management structures are put in place and can support the DoD's information needs for the 21st century
- Establish CIM policy to guide CIM implementation by communicating and clarifying goals, objectives, methods, and procedures.

Tapscott and Caston offer these objectives for achieving enterprise integration. As can be seen, the need for enterprise integration in DoD and the objectives needed to achieve this are consistent with efforts in the private sector.

- Establishing new service levels for increased customer satisfaction and loyalty. *Public sector enterprises may want to substitute "support" for "loyalty."*

- Creating new business opportunities through the extension of existing product and service offerings or the development of new ones
- Streamlining organizational procedures and achieving of synergy through logical applications integration.
- Lowering unit costs of computer and communication systems through the sharing of common architectures and delivery systems
- Leveraging experience from all areas of systems applications to address common needs
- Developing an infrastructure to support increased decentralization and autonomy
- Establishing a basis for quickly reacting to changing customer demands and business developments.

The following tasks are performed in the design systems integration plan:

- Design Platform Integration Plan
- Design Data Base Integration Plan
- Design Application Systems Integration Plan
- Review IS for Conformity with DoD Enterprise Model
- Identify and Resolve Cross-Functional Process Issues
- Identify and Resolve Interoperability Issues and Concerns
- Develop Revised (TO-BE) Architectures
- Update Defense Data Repository System
- Develop Transition/Migration Plan
- Conduct Pre-installation and Deployment Conference

8.5.1 Design Platform Integration Plan. The most basic form of integration is performed at the hardware platform or machine level. Hardware and communications equipment represent an expensive resource with an ever decreasing useful life cycle. It is imperative to achieve minimum unplanned redundancy and maximum utilization of this vital resource. This can be accomplished through the use of effective planning, efficient design, standard architectures, and strict configuration control. Through the acceptance of international standards, and the trend toward multi-vendor environments, we are fast approaching an era where data systems and applications will be fully independent of hardware devices. This will make it possible to support a wide variety of applications within the same physical plant.

Studies have shown that most computer and communications equipment is underutilized by functional organizations which means that investments in increased productivity are not returning the hoped for benefits. There is a growing trend to out-source computer facility management and operations to service bureaus who make it a business to fully utilize their resources.

Functional management who directly or indirectly fund technological investments should make every effort to assure an acceptable return on investment for computer and communications platforms. One way to do this is to insist on the use of international standards, open systems, and off-the-shelf products whenever and wherever possible. The use of specialized platforms is only warranted where an overwhelming benefit can be obtained. The platform plan provides a vehicle for ensuring responsible acquisition and wise use of platform resources.

8.5.2 Design Data Base Integration Plan. Data is the life blood of an organization and enterprise integration can only be achieved to the extent that the organization can create and sustain enterprise-wide data sharing. Data administrators, data base administrators, and data base technicians are charged with the responsibility to support specific application data requirements within the context of enterprise-wide data sharing. Modern data base technology and the acceptance and use of industry standards for data base management have solved most of the technical problems associated with creating and maintaining shared data systems. If there are any weaknesses, they are in the data administration area.

Functional managers can facilitate the development of the shared data resource by supporting data standardization, building solid data models, working cooperatively with data administration, and forging strong cross-functional (process-based) agreements with their peers. Object-oriented data base technology holds the most promise for facilitating the construction of shared data bases. Functional managers should support the transition to this technology.

Functional managers should also deal aggressively with data ownership issues. To the extent that data can be *owned*, it is owned by the organizational unit that creates it. But, one of the rules of data management is that data should only be created once at the logical point of entry into the enterprise. This means that unless an organizational unit intends to use only the data it itself creates, it must have access to data owned by other organizational units in order to perform useful work. This implies a responsibility to share data freely if the mission, goal, and objectives of the enterprise are to be met. Once this concept is fully supported by all functional management, the road to building enterprise-wide shared data bases is greatly facilitated.

8.5.3 Design Application Systems Integration Plan. Integration at the application system level is enormously difficult to achieve apart from reengineering the processes and functional organizations involved as part of the integration effort. This is especially true when trying to integrate a new application into one or more existing application systems that have a history of maintenance and enhancement actions over a long period of time. Except in the most disciplined technical organizations, documentation for existing systems is missing or suspect, patches to software code may be difficult to understand, and the original programmers may no longer be with the organization.

As anyone with a programming background can attest, a change to a single line of software code can cause unexpected and difficult to resolve errors. Also, every time a line of code is changed, it is prudent to retest all elements of the information system that may be affected by the change—a time-consuming and costly process.

As object-oriented programming becomes established, effective software reuse libraries come into use, software engineering practices are enforced, and enterprise-wide data bases are in operation; the problem of integration at the application level will be facilitated. Maintaining current information and application architectures also facilitates application system integration.

As noted earlier in the methodology, technical organizations can often consolidate two or more existing (legacy) application systems into a modernized migration system apart from functional organizational involvement. For critical production systems, this must be done following strict project management precepts so as not to adversely impact the availability of legacy systems to serve functional needs.

Functional managers should make it a point to be aware of all changes (including migration systems efforts) planned for information systems that are in place to support their business processes. They should also insist on a rigorous test program as part of change or improvement efforts to minimize the possibility of disruption to their business operations.

8.5.4 Review Information Systems for Conformity with DoD Enterprise Model. The DoD Enterprise Model is meant to be an integration document. As such, it should be referenced before, during, and after integration efforts at any systems component level. All changes and enhancements to the information infrastructure should advance the enterprise toward achieving enterprise model and strategic planning goals and objectives.

The DoD Enterprise model is a representation of the activities and data of the entire Department currently needed to accomplish the defense mission, from planning to acquisition and logistics support to warfighting. The model includes all the top level processes and standard data interfaces for every

DoD major mission and function. it provides a common basis for enterprise-wide coordination and collaboration.

As senior managers plan innovations and improvements to their activities, they will use the model to identify specific points where they interact with other parts of the Department. These interactions can be any or all of the current or proposed platforms, data representations, or application systems. This knowledge will enable them to plan changes in concert with other managers to ensure that they:

- Manage strategic changes from a DoD-wide perspective by measuring the impacts across the Department and selecting *globally optimal solutions*
- Obtain quality, affordable products and services (platforms, data bases, application software), when and where needed (geo-technical architectures) to perform their individual mission
- Share common processes, data, and support mechanisms, rather than duplicate them.

Once mission and function activity and data models are developed and approved, they become a part of the DoD Enterprise Model. The entire Department has access to these models. They provide a baseline for specifying functional and systems interfaces, identifying and evaluating the impacts of the changes to one mission or function on other missions and functions, and developing improved processes, platforms, data structures, and application systems that will lead to greater integration, interoperability, flexibility, effectiveness, and efficiency in the Department of Defense.

Thus, the DoD Enterprise Model provides a standard reference for helping to ensure that DoD goals and objectives are achieved with respect to functional and technical activities.

8.5.5 Identify and Resolve Cross-Functional Process Issues. The time to recognize and deal with cross-functional problems, issues, misunderstandings, and disagreements is prior to systems installation and deployment. Once the installation period begins, solving cross-functional problems is magnified by the effort to complete installation and bring a new system on-line. Prior to installation, only the technical staff and a few functional people are involved. After the installation period begins, hundreds if not thousands of people are involved in the new system.

Issues are generally the result of misunderstandings and/or ineffective communications at one or more stages of the project. They also surface when some unplanned event or situation impacts the project, especially the scope or quality components of the project. Issues are difficult to anticipate unless extensive and open communications take place in the early stages of a project with all project principals and concerned parties.

The following procedure should be used to resolve issues associated with the impending new system:

- Describe the issue as fully and completely as possible
- Identity all project principals and concerned parties that are impacted or affected by the issue. Identify technical or professional experts who can be asked to help resolve issues
- Gather all data related to the issue including assumptions, constraints, possible alternative approaches, and associated risk data
- Assess the impact of each issue on project success
- Schedule and conduct a series of meetings with involved parties. Each meeting should have a clearly defined objective staged as follows:

- Fact gathering to develop all sides of the issue
- Presentation of alternative resolutions
- Discussion of potential outcomes from each alternative
- Selection of an alternative
- Assignment of roles, responsibilities, and action items

- As necessary, issue appropriate change orders

- Track each issue as a suspense item until all action items have been completed

- Close out issue, update documentation as needed, and notify all personnel affected by implementing the issue resolution.

8.5.6 Identify and Resolve Interoperability Issues and Concerns. In contrast to the cross-functional issues discussed above, there are often technical issues that are related more to infrastructure issues than to functional or operational issues. These come about because there are often several technical approaches possible to achieve desired outcomes. Often technical issues are matters of preference based on the background and experience of the involved parties. To head off or resolve such issues, strong project leadership is called for.

Usually, technical issues can be resolved by referring to the enterprise model, standard architectures, and configuration management guidelines. In all cases, the overarching objectives of providing an enterprise-wide technical infrastructure should take precedent over technical solutions weighted to a particular functional area or technical problem. In the fury of trying to implement systems, there are pressures to make expedient compromises in order not to delay projects. Such compromises usually end up causing problems downstream that are considerably more difficult and expensive to solve. Project managers and leaders should be aware of this axiom: There is never time or money to do it right the first time, but there is always time and money to do it over.

8.5.7 Develop Revised (TO-BE) Architectures. Once the information systems project is approaching the installation and deployment stage, and after all critical functional and technical issues have been addressed and resolved; all technical models, standard architectures and configuration, and repository records should be provisionally updated based on the new system. This can serve as a final audit of the impact of the new system on the technical infrastructure. If the TO-BE architectures appear to be in conformance with DoD mission, policy, goals, and objectives, the project should move forward. If conflicts or anomalies are detected, they should be addressed and resolved before the project moves forward.

8.5.8 Update Defense Data Repository System. The final technical task prior to installation and deployment is to update all technical documentation as required especially that documentation residing in the Defense Data Repository System (DDRS). It is vital that installation and deployment teams have accurate and up-to-date documentation to guide them through the installation period. Because the repository is one of the tools to facilitate the Department's objectives of achieving interoperability, other projects need timely access to information about all new systems.

8.5.9 Develop Transition/Migration Plan. The transition/migration plan may be considered to be the input to the project execution phase described in section 9 of this guidebook. It should contain all of the technical data needed by the installation/ deployment project manager to develop the project execution plan. Please note that there are several other documents that are also needed to construct the project execution plan, but this one is primarily technical in nature.

The complexity of specific Automated Information Systems (AIS) integration efforts will differ greatly from one integration project to another. An integration effort may be as simple as authorizing users of existing or legacy systems to begin preparations for moving to the migration system or new information system. Or it may entail a significant development effort to enhance the selected migration application to provide the processing capabilities of all existing legacy

applications. It may even require the move to an entirely new AIS for which there is no migration system established.

The transition plan needs to address security, privacy, integrity, accessibility, and availability with respect to technical facilities and controls. Integrating AIS often raises technical issues concerning how two or more functional areas can interact with a single application system and/or shared data base. These concerns may not be evident while constructing an AIS for a single functional area, but become significant issues during AIS integration.

The following issues should be addressed in the transition/migration plan. With these issues defined and resolved, it is possible for the project to proceed to the installation and deployment phase with a higher level of confidence in its success.

- Application Integration:
  - Are the functional capabilities of the application well-documented
  - Are the functional requirements of involved legacy system users accounted for in the transition to the migration or target system
  - Are all required changes, modifications, and enhancements in place so that operations will not be disrupted during changeover?
- Data Integration:
  - Are all requirements for data integration accounted for
  - Are utilities in place to effect the conversion of legacy system data to the migration or target system
  - Are arrangements in place to scrub or reformat legacy data as necessary to support the requirements of the new system
  - Are criteria in place to validate or audit converted data, and is a program in place to reconstruct invalid data?
- Platform Integration:
  - Are arrangements in place to acquire or relocate all needed hardware components including communications facilities
  - Have capacity calculations been made to ensure that hardware facilities can support expected storage and processing loads
  - Are arrangements in place to acquire, upgrade, or create needed systems software components including utilities
  - Have all hardware and systems software support and maintenance requirements been documented?
- Security, Privacy, and Integrity:
  - Are specifications in place to control access to data and applications in compliance with all applicable security and privacy laws, regulations, and directives
  - Are specifications in place to ensure systems, data, and application integrity with respect to backup, recovery, and restore operations—especially in distributed applications and data environments
  - Have arrangements been put in place for secure storage and backup processing sites?

- Acquisition and Procurement:
  - — Is the status and schedule related to hardware, software, and services procurement consistent with planned installation and deployment requirements and schedules
  - — Has a backup plan been established to secure needed resources on a temporary basis until procured items have been delivered?
- Pre-installation Activities:
  - — Have arrangements been made to populate all data bases with production data
  - — Are arrangements in place to provide for parallel operations during the final testing phases of the project
  - — Are arrangements in place to provide for an orderly transition to the new system following parallel testing and completion of all system acceptance tests
  - — Are hardware, software, and support resources adequate to handle both operational systems and testing, parallel, and cut-over requirements for the new system?

8.5.10 Conduct Pre-installation and Deployment Conference. The final task in this step is to schedule and conduct a pre-installation and deployment conference. The purpose of this conference is to review the status of all activities and functions that must be completed prior to systems installation and deployment. All process, organizational, and technical plans, specifications, designs, and developments are reviewed for completeness and accuracy with respect to ensuring a successful installation.

The process improvement project to-date has generated a library of documents, models, spreadsheets, and narratives related to all aspects of the project. Some are manual, and some are automated. At this point, all of the components for the new system are in place including policies and procedures, data bases, application code, training programs, organizational change orders; but no actual changes to the environment have been made. It is important to realize that functional mangers, users, and customers have not yet seen any improvements or enhancements. Whether they will or not has a lot to do with the success of this conference.

All involved functional and technical elements should participate in this conference which is chaired by the designated project manager for installation and deployment. During this conference, the project manager is expected to satisfy him/herself that everything is in place to proceed to the next phase of the methodology.

It is likely that the pre-installation conference will take from two to five days depending on the extent and complexity of the project. The amount of documentation that has to be reviewed, the quality of this documentation, and the way it is organized will also determine the length of the conference. At the conclusion of the conference, the responsibility for the continuation and success of the project shifts to the project manager.

This completes the enterprise engineering phase of the framework methodology. During this phase, one or more information systems were constructed according to the requirements set forth in the FEA and its supporting documents. Provision was made to integrate the new information systems into the technical infrastructure in accordance with enterprise-wide models, architectures, and configurations. Preparations were made to transition to the next phase of the methodology—project execution. During the project execution

phase, all elements of process improvement described in the framework methodology will be brought together to effect a successful installation and deployment of the newly reengineered process, its supporting information systems, and necessary organizational and functional changes.

SECTION 9. PHASE 4: PROJECT EXECUTION

During the entire period of the process improvement project to this point, the organization has not benefited in any substantial way from the efforts of the improvement team. The business process has not changed except perhaps for some quick improvements or streamlining actions. The existing information systems are still in place. The organization is likely the same as it was at the beginning of the project.

By now the process team has designed the TO-BE process including activity and data models. The information system that will support the new process has been constructed and tested. The organizational change management plan has been developed and approved which means the new management structure, work methods, and work flows have been established. Documentation, including new or revised policies, directives, procedures, and forms are designed and ready to be deployed. Training systems are in place and tested, and the support structure for the reengineered process and its underlying information systems has been completed and tested at the pilot site.

The time is at hand to install and deploy the improved process throughout the organization. The entire installation and deployment process must be exceedingly well planned and flawlessly executed. Any critical problems at this stage can disrupt business operations, confuse and frustrate stakeholders, and result in irreparable harm to the enterprise as a whole. Most reengineering projects that ultimately fail, do so because of poor project planning and execution.

Once the new process is deployed along with its information systems and organizational changes, the project enters the operation and maintenance stage. During this stage, performance is continually monitored to ensure that the process is meeting all business objectives on a continuing basis. Maintenance activities are performed as a result of operational feedback, problems, and the emergence of exceptional conditions that were not considered during the earlier phases of the project. Training programs are conducted as necessary to train new personnel including new customers and partners. The operation and maintenance stage continues for as long as the process is required to support enterprise mission, goals and objectives.

Continuous process improvement (CPI), which is another term for total quality management, should be institutionalized and practiced to continue the progress made during process reengineering. Few business situations are static so there are always opportunities to make minor improvements that over time result in major benefits. Also, it is unlikely that the formal process improvement project was able to foresee or consider all operating conditions. Finally, CPI as an institution keeps process employees focused on the customer and meeting business objectives as well as interested in their work assignments. New products, services, and methods typically result when organizations practice CPI. One consumer products company in Ohio typically gets 4000 new ideas each year from their employees related to building the business and providing customers with new and interesting products.

The project execution phase of the Framework methodology is supported, in part, with the following resources:

- F/MPI Organizational Change Management Tutorial
- F/MPI Case Study in Change Management
- Project Manager's Handbook written by Robert J. Davis
- The DoD Enterprise Model White Paper
- DoD Enterprise Integration: Implementing Strategy

The techniques (see Section 10) most useful in this phase include the following:

- Affinity diagramming
- Relationship diagramming
- Force field analysis
- Process Decision Program Chart
- Tree Diagrams

- Program Evaluation and Review Technique (PERT)
- Gantt charts
- Cause and Effect charts

9.1 Step 21: Develop Installation/Deployment Project Management Plan

The installation and deployment plan is critical because this is the stage of the improvement project that involves the most people—many who are being introduced to the improved process and new information systems for the first time. Deployment generally covers a lot of geography up to and including the entire world. Because many of the elements of the project are coming together for the first time, it is also the most complex part of the project and has the highest risk of failure. Every element of project execution is time critical, resource consumptive, and costly to redo in the case of serious problems.

For these reasons, it is important to construct a project plan that spans the entire installation and deployment phase. Essentially, a project plan lays out the installation and deployment phase as a series of interrelated tasks. Some of these tasks are performed sequentially while others can be performed in parallel. Each task will have a deliverable, start date, duration, cost, and resource assignment. In addition to tasks, there will be milestones indicated that provide checkpoints to gauge project status. The essence of project management is to break down a large project into a series of tasks that can be closely managed. If each task completes on time, within budget, and at the expected quality level, then the project will complete on time, within budget, and at the expected quality level.

Projects can easily be laid out using commercial off-the-shelf project management software that will run on any personal computer. The software allows the project manager to construct a PERT chart that provides a graphical representation of all tasks in the project and the way tasks are related to each other. The series of tasks that make up the *critical path* are those that if not completed on time will delay completion of the project. Other tasks are said to have slack time which means there is some allowance for slippage without jeopardizing the project completion date.

PERT is an acronym for Project Evaluation and Reporting Technique. PERT was developed by the U.S. Navy during World War II to facilitate submarine construction. Project manager software provides a variety of report formats that can be used to control project progress. Project management software is especially helpful when elements of the project are dispersed geographically. The PERT chart and other related reports can be maintained on a network of computers so that all project participants can access the latest project information.

Important as the project plan is and the software that contains it, nothing is more important that project leadership. The following eight principles are proven for effective project leadership.

1. *Own the project but share the success.* A project manager must be totally committed to the success of the project. When things are going well, the project manager must publicly credit others. when things are not going will, the project manager must assume the responsibility and increase efforts to get the project back on track.

   - Acknowledge in meetings and status reports the contributions that others make to task and milestone completion.
   - Do not publicly blame others for project problems. Accept the responsibility then work directly with others to correct project discrepancies.
   - Understand and respect the fact that there is a high ego involvement in project work: yours and everyone else's. Avoid letting egos get in the way of project performance.

2. *Delegate responsibility but maintain control.* A project manager must delegate responsibility for task completion and apply

the principle of *inspect what you expect.* Everyone concerned with the project must understand and accept their role and the impact of their assignments on the project as a whole.

- Ensure that project plans clearly designate the responsibility for task completion.
- Size tasks (duration and cost) so that they represent a reasonable but visible level of effort. If tasks are too small, they will not get enough attention and may be "forgotten." If they are too large, they may overwhelm the responsible person.
- Inspect task progress on a weekly basis. More frequent attention leads to *micro-management*, less frequent attention risks schedule and cost overruns.

3. *Provide the project vision but manage the task at hand.* The project manager must ensure that all project participants understand the mission and purpose of the project in the context of process and information systems. At the same time, projects are completed successfully by completing each individual task successfully.
   - Ensure that each person responsible for a task understands the relationship of that task to succeeding tasks and to the project as a whole. Use the PERT chart as a motivation tool.
   - Get a reputation for insisting that each task be completed on time and within budget and at an acceptable quality level. Focus on tasks as soon as they begin to deviate from plan.
   - Manage tasks on the critical path at a higher level than other tasks. Make sure that responsible persons know whether their task is on the critical path.

4. *Expect the unexpected but pursue perfection.* A plan is a navigation aid. It tells you when you are off-course so that you can make necessary corrections before you crash into the mountain. Poets may be able to move mountains but most project managers can't. It's usually best to fly around or over them.
   - Ensure that your project plan highlights high-risk tasks so that you can give special attention to them.
   - Think through the possible and probable contingencies associated with high-risk tasks so that you have a head start on taking action when problems and issues occur.
   - Identify and assess issues and problems as soon as you become aware of them. Develop a *mini-plan* to address the obstacle. Pursue the resolution of an issue or problem on a daily basis. This is one time that micro-management is called for.

5. *Balance oral and written communications.* Oral communications are based on trust and automatically involve a higher level of risk than written communications. Written communications are time-consuming and can create a perception of distrust if inappropriately used.
   - Build trust by using oral communications on matters related to non-critical tasks with individuals who have proven to be trustworthy.
   - Confirm assignments and understandings in writing that are related to critical or high-risk tasks.
   - Commitments and actions related to significant issues and problems must be tracked in writing to ensure clear communications and enhance confidence levels by those affected by the issue or problem.

6. *Acknowledge project complexity but champion simplicity.* Project are by definition complex. The purpose of using effective planning tools is to break a large project into a series of relatively simple tasks that can be successfully managed. Any project can be decomposed into a series of sub-projects, tasks, and activities. Use this fact in developing your concept of management. The way you make a complex project simple is by clearly setting expectations, delegating authority and responsibility, and holding individuals accountable for results. Micro-management converts the simple to the complex.

   - Executive managers should be concerned only with milestone performance and issue resolution.
   - Project managers should manage a project as a series of tasks by treating each task as a unit of work with a defined objective that relates in some way to other tasks.
   - Task managers should manage each assigned task at the activity level with an emphasis on quality work performed on time and within budget.

7. *Balance project details with overall project objectives.* The test of all project related actions is *does this action contribute to the attainment of a project objective?* If not, why are you doing it? One of the principle reasons project managers fail is that they allow themselves to become immersed in details and busy work that have no apparent project purpose. While it is hard to drain a swamp when the alligators are snapping at your heels, if your objective is to drain the swamp, don't get sidetracked by going on an alligator hunting expedition.

   - Don't over-plan projects by working at too detailed a level. Combine or divide tasks such that all tasks in your project are in the range of one week to one month in duration. Let the person responsible for the task manage the performance of the detailed activities in that task.
   - Don't micro-manage task work. You might just as well wear a big sign that says: "I am insecure as a project manager so therefore I don't trust you, nor do I have confidence in your ability to complete assignments."
   - Think through a project when you are planning it. Re-think it at every major milestone. A good swamp drainer would have made sure that the alligator situation was contained before getting into the water.

8. *Be action oriented but maintain perspective.* Not everything that happens on a project demands your immediate and concentrated attention. Don't set a pattern of trying to solve everyone's project problems because then, everyone will come to you with all of their problems. Learn the phrase: "Figure it out!" This allows you to conserve your time and energy for critical situations that do require your full attention. Know the differences between acting, reacting, and pro-acting.

   - Act on such project elements as organizing, planning, delegating, tracking, and controlling the project at the task level, not the activity or detail level.
   - Re-act on issues and problems associated with critical or high-risk tasks immediately.
   - Pro-act on coordination and communications so that you can stay ahead of the project.

The following tasks are performed in the develop installation/deployment project management plan:

- Review Approved Project-related Documents
- Construct Project Management Plan

- Secure Review/Approval of Project Management Plan
- Execute Project Management Plan

9.1.1 Review Approved Project-related Documents. At this point in the improvement project a number of documents have been prepared, reviewed, and approved. All approved documents are input to project planning. The principle documents are strategic and business plans, the FEA and supporting documents, the technical change management plan, organizational change management plan, transition plan, and implementation plan. In addition, all the information systems documentation about platforms, data bases, and application software are applicable. Finally, architectures and configurations are needed to develop the installation and deployment plan.

Ultimately, the project manager must determine what has to be done, when it has to be done, how success will be measured, how much funding is available, and what resources (human, machine, and facilities) will be provided. This information should be contained in the documents mentioned above. Clarification and additional information will be needed which is why project planning is a team activity.

The important thing for the project manager to realize is that the project plan is a translation of all project requirements into a series of related task assignments with deliverables or milestones, budgets, schedules, and quality objectives. In other words, building the project plan requires putting all of the input documentation into a form conducive to management and control.

Since the project has taken some months to get to the project execution phase, it is likely that some of the documentation used as input is out-of-date, incomplete, or just plain wrong. Project managers should seek clarification on any element of documentation that seems suspicious. Once the project plan is developed and approved, it becomes the responsibility of the project manager to achieve success. It will be too late to blame execution problems on poor input documentation.

9.1.2 Construct Project Management Plan. From the input documentation, team meetings, conferences, research and investigation, the project manager constructs the installation and deployment plan using project management techniques and software packages. There are six critical elements in the project plan:

- *Work Breakdown Structure (WBS).* The WBS consists of all the tasks that must be completed during the installation and deployment period. The WBS indicates the sequencing or ordering of all tasks and shows which tasks are on the critical path, which tasks must be completed before others can start, and which tasks can be completed in parallel. The critical path consists of all tasks which have zero slack meaning that a delay in completing any one of them will delay the project.

- *Cost Breakdown Structure (CBS).* The CBS shows the budgeted funds for the completion of each task in the WBS. Because tasks will cross organizational boundaries, the CBS can be used to ascertain each department's share of installation and deployment costs. The CBS also provides an effective means of managing project costs.

- *Schedules and Milestones.* Tasks are arranged in a graphical format plotted against time. Each task will have a planned start time and may have early and late start times corresponding to the slack time built into the schedule. Each task will also have a planned duration and planned complete time and may have early and late complete times. At certain points in the project plan, milestones will be indicated which provide one or more critical deliverables and/or a formal review and evaluation point.

- *Resource Allocation Matrix (RAM).* Tasks require resources which may be any combination of work hours, skills, equipment, and facilities. Each resource has a cost associated with it. The RAM

shows in matrix format which resources are required for which tasks and how long those resources will be required. The RAM helps managers anticipate and plan for needed resources so that the project can remain on schedule.

- *Contingency Plans.* All projects are subject to unanticipated delays, problems, and events. Every unexpected *glitch* will affect schedules, costs, and/or project quality. Good project management calls for contingency plans to be put in place especially for high-risk tasks. The minimum reasonable cost contingency is 15% of overall planned costs. Some high-risk tasks will require a higher contingency, some routine tasks may not require any cost or schedule contingency. All tasks on the critical path should have contingencies in place for unforeseen events. Most often, this means that reserve resources should be in place as needed.

- *Reporting and Meeting Strategy.* Projects are essentially exercises in effective communication and coordination. This requires a planned program of planning, status, and issue resolution meetings combined with regular and exceptional reporting and tracking activities.

Each installation and deployment project will be unique which is why constructing project plans is so important. At best, general planning guidelines can be established which indicate the type of tasks that should be considered when constructing the project plan. The following areas are generally part of any installation and deployment program:

- Equipment Deployment (Computer, Communications, and Peripherals)
- Facilities Acquisition and Refurbishment Including Electrical and HVAC
- Fixtures and Furnishings Acquisition and Placement
- Health and Safety Provisions
- Remote Site Support including Traveling and Living Arrangements
- Systems Software
- Data Acquisition, Conversion and Data Base and File Population
- Application Software (Acquired and Developed)
- Process Work Flows and Stakeholder Relationships
- Policy, Procedures, Directives, and Guidelines
- Manuals and Documentation Production and Distribution
- Staff Communications, Coordination, and Problem Resolution
- Employee Union and Regulatory Relationships
- Staffing, Classification and Job Descriptions
- Training Administration and Delivery
- Supervision, Reward and Recognition Provisions
- Organizational Realignment and Management Structures
- Security, Privacy, Integrity, Backup and Recovery Provisions
- Checkout and Acceptance Provisions
- Conversion, Parallel Testing, and Cut-over Provisions
- Installation and Post Installation Support
- Performance Measures and Measurement Systems
- Process/Information Systems Decommissioning and Salvage.

Most of these areas have been addressed at least in part in earlier phases of the project. But now, everything must be brought together as a complete system. Each of these areas must be reconstructed as a network of tasks with schedules, budgets, assignments, and contingencies. It can be seen that some of these areas such as equipment acquisition and facilities preparation may have long lead times. This means that project planning may have to commence during the enterprise engineering phase of the project. To facilitate such situations, project managers will generally divide the project plan into major phases. Earlier phases will be

planned in detail while later phases will be laid out in general and refined as the time to begin a new phase approaches. The major phases of an installation and deployment project are as follows:

- Pre-Installation Activities
- Installation and Checkout
- Initial Training, Operations, and Support
- Organizational Deployment
- Post-Installation and Deployment Activities.

Several techniques can be used by project managers to help ensure a complete and workable project plan. The most important is the Process Decision Program Chart (PDPC). This is an excellent tool for ensuring that all project elements have been accounted for and for contingency planning. This technique is briefly described in section 10. Additional information is readily available in most books on Total Quality Management practices. Other techniques such as those described in section 10 are useful during the project execution phase.

9.1.3 Secure Review/Approval of Project Management Plan. This is one of the most critical review and approval points in the entire Framework methodology. The project execution plan usually covers the widest geography, involves the most people, represents the costliest phase of the project, and is subject to the most complexity and highest risks. It is imperative that the plan be thoroughly reviewed and accepted by all parties involved in the execution phase of the project. It may take from two weeks to a month to complete project review and make necessary adjustments. The project manager should allow for the project plan approval cycle in the schedule.

If the project plan is developed in phases, it will be necessary to review each phase after detail project planning is completed. Since the project is planned in phases, each phase review will only require a day or two. Still, these review points should be planned with enough lead time to ensure that all responsible parties are available to complete their review in a timely fashion. Figure 9-1 shows how the project plan might look at the time of the first review and approval point. The Pre-installation plan is complete and detailed in all respects. The other phases are partially developed and reviewed as an in-process deliverable. As the Pre-installation phase nears completion, the Installation and Checkout phase must be complete, detailed, and ready for final review. This process continuous throughout the phases of the project.

9.1.4 Execute Project Management Plan. Once developed and approved, the project plan becomes the prime driver for all project installation and deployment activities. The project manager has four principle duties:

- Project performance tracking
- Carry out cyclical responsibilities
- Suspense management
- Response to external events.

Project performance tracking consists of ensuring that task work starts and completes on time, within budget, and at the acceptable quality level. All deviations to schedule, cost, and quality are handled as exceptional conditions which fall into one of three categories, each of which is handled differently:

- Crises
- Problems
- Issues.

Crises are unforeseen events that represent a risk to overall project goals and objectives. A true crisis impacts schedules, budgets, resources, and/or quality. Problems can be characterized as follows:

- Can be stated in objective terms
- Generally affects only one work-item or task
- Is a clearly defined obstacle to work-item completion
- Generally has one "best" solution
- Agreements on problem solutions are easy to obtain

Phased Project Installation and Deployment Plan				
Pre-Installation	Installation & Checkout	Initial Operations	Full Deployment	Post Installation
Areas Identified	Areas Identified	Areas Identified	Areas Identified	Areas Identified
WBS Complete	WBS Complete	WBS Complete	WBS Complete	WBS Started
CBS Complete	CBS Complete	CBS Complete	CBS Started	
Schedules & Milestones	Schedules & Milestones	Milestones Identified		
RAM Complete	RAM Complete	RAM Started		
Contingency Plan Complete	Contingencies Identified			
Reporting Strategy in Place				

Figure 9-1. Phased Project Planning Review Cycle

- Generally impacts costs, schedules or resources
- Generally does not impact project scope or quality.

An issue can be characterized as follows:

- Cannot be completely stated in objective terms
- Generally affects more than one work-item
- Is not a clearly defined obstacle to work-item completion
- Generally has several alternative resolutions
- Agreements on issue resolution are not always easy to obtain
- Can impact all project factors: costs, schedules, resources, scope, and quality.

Cyclical responsibilities include holding on-site inspections and conducting progress review and coordination meetings, and completing and distributing status reports. Project management system network maintenance is also a cyclical responsibility.

Suspense management consists of tracking problem solving assignments, issue resolution assignments and action item assignments.

Response items include data calls from higher headquarters, special meetings, outside inspections and tours, and handling local disasters and

unforeseen events such as floods, storms, riots, etc. that impact project performance.

At this point, the reader may want to review project management leadership qualities listed at the beginning of this phase. A full accounting of project planning, execution management, and tracking can be found in the Project Manager's Handbook listed in appendix B.

9.2 Step 22: Install/Deploy Information Systems

Systems installation and deployment is an exercise in precision coordination. With respect to the functional user, an information system installation is either a success or a failure. The new system works or it doesn't. That 99.9% of the system is working properly is of little concern if the 0.1% that doesn't disrupts operations, frustrates users, or adversely affects customers.

The most important part of a systems installation is the project execution plan developed in the previous step. If the plan is well thought out and well developed, one can reasonably expect that the execution of the plan will be within normal success limits. While there will be problems, unforeseen events and conditions, and issues associated with the new installation, these will likely be resolvable with reasonable effort and within contingency planning parameters of cost and time.

The most important principle governing systems installation is not to violate the installation plan unless it can be shown that the plan is deficient. Otherwise, the installation team will prove the axiom that *there is never time or money to do it right, but there is always time and money to do it over.* To avoid becoming trapped in this axiom, there must be milestones and checkpoints in the installation process to ensure that the installation is going as planned. Furthermore, the project manager must have the authority to halt the project if the conditions established for a given set of milestones and checkpoints have not been met. The *countdown* to installation must not resume until milestone and checkpoint discrepancies have been removed.

All components of the new information system should be in place, tested, and ready for installation. These components were developed during the enterprise engineering phase of the project. This means that the data base structure is established and a test data base is populated ready for systems testing. All application program modules have been developed and unit tested. Final or at least draft documentation is in place. A test program has been established that will test all features and functions of the system including its ability to recognize and trap all error conditions. Finally, initial training has been completed for those persons who will participate in the systems installation.

If a new information system is being installed to support a radically reengineered business process, it may be quite difficult to test the results produced with the new system against the results produced with the existing system. This concept is called *parallel testing* and works well when information systems are being upgraded or enhanced. It also works well in the case of migration systems replacing legacy systems with no major changes to the business processes themselves. But when the business process itself has been reengineered, it may not be possible to conduct parallel testing. When this is the case, greater care must be exercised during the systems installation and testing period to ensure that the new information system supports the way the new business process works.

When a new information system is going to be used in more that one geographical location, it is wise to restrict the installation process to a single site. When the new system is proven, it can then be deployed to all other planned sites. Deploying a poorly tested system is an extremely high-risk operation. In the private sector, there are case-studies of how failed deployment efforts have destroyed entire enterprises. The risk of this happening is greater when the new information system will be supporting a reengineered business process.

This step and the next step—deploy organization change management plan—are closely related. The usual procedure is to install the new information system and reengineered business process at the initial installation site, then incorporate all organizational changes in the change management plan once the new system and process are working well. Organizational changes must be installed, tested, and revised just as systems and processes must. However, during deployment, it is customary to install all elements at the same time. These are the elements of process, system, and organizational change. Because deployment is always associated with changes in the way people perform their duties and the way they work together, it takes some time for each new installation to stabilize. For this reason, it is often advisable to establish a deployment team that moves from installation to installation according to a phased deployment plan. The team is comprised of staff who can perform all installation tasks including training and intensive personnel support.

The tasks performed in the install/deploy information systems step are as follows:

- Select Initial Installation Site
- Install and Test Information Systems
- Implement Training Programs
- Conduct Parallel Test Program
- Secure Customer Acceptance
- Implement Transition (Cut-over) Plan
- Deploy Remaining Sites
- De-commission Obsolete Information Systems
- Conclude Information System Deployment Phase

The first five tasks in this step establish one working installation that has proved the operability of the information systems components, validated the change management plan, and passed all customer acceptance tests. Task 9.2.4—conduct parallel test program—is where all elements of step 23—deploy organization change management plan—are tested. Figure 9-2 shows the first five tasks of step 22—install/deploy information systems which are concerned with the initial installation of the new information system.

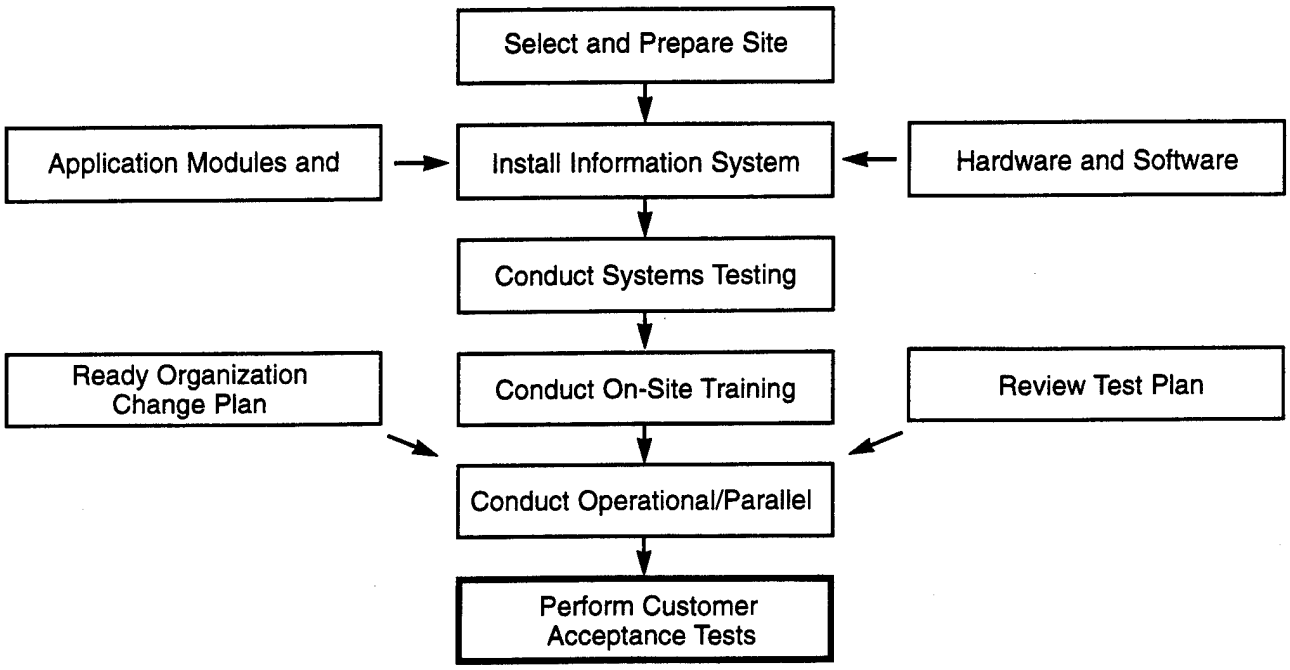

Figure 9-2. Install Information Systems

9.2.1 Select Initial Installation Site. The initial installation site must be selected and prepared with great care to help ensure successful systems deployment later on. The criteria for site selection include the following:

- Site leadership and management are committed to project success
- Site personnel exhibit high morale and are receptive to change
- The site is conveniently located relative to technical support
- The site performs at least 85% of the functions of the business process and new information system
- The site is representative of all planned deployment sites with respect to mission, goals, objectives, and business operations
- The physical facility is adequate for the new system and can easily accommodate the installation and test team
- The site offers or can accommodate administrative support personnel and has adequate communications facilities for voice, data, package delivery, and transportation
- Site operations can tolerate some disruption to normal operations during the installation and test period
- Customer acceptance of the new information system at this site will be recognized and supported by the majority of planned deployment sites.

The installation team must ensure sufficient lead time for procuring all systems components include computer and communications hardware, wiring and cables, and systems software. In addition, the site must be certified with respect to power, air conditioning, and ventilation according to hardware vendor specifications. If the site is in an area subject to power outages or fluctuations, adequate backup power supplies should be put in place so that testing is less likely to be disrupted.

9.2.2 Install and Test Information Systems. The first task after site selection and preparation is to install and test all hardware, software, and communications components and facilities. This phase of testing should be completed by the installation team and should not disrupt normal business operations at the site. It is best if site personnel are not involved in the installation and checkout process. This is because the typical problems encountered in the initial installation process may undermine the confidence of site personnel in the new system.

The install and test program will be quite similar to the component testing program performed in the enterprise engineering phase of the project. In fact, it is best if these tests are repeated verbatim during systems installation. This way, the installation team can assure itself that any new problems encountered are probably associated with the new variables introduced at the test site, not the information systems components as they left the enterprise engineering phase.

This task is complete when all features and functions of the system have been successfully demonstrated. This includes the following:

- All start-up, sign-on, password, and security features are functional
- All menu selections are active and branch to the proper systems component
- All screens can be brought up and add, change, and delete functions work
- All reports can be generated and major report options work
- All transaction types and codes are accepted by the system
- All codes and tables used in the system are populated and table maintenance procedures work

- All backup and recovery functions work
- All personal computers, workstations, and communications nodes can access the system as required
- Linkages and interfaces to other application software components including off-the-shelf software packages work
- The system works with all specified devices including brands and models of input/output devices, storage devices, communications devices, network devices (local and wide area), workstation devices, and linkages to other computer platforms.

It is normal to encounter even severe technical problems during the initial installation and systems test process. This may be the first time that the system is tested on the intended computer and communications platform and new variables are introduced that were not present during the enterprise engineering phase. For this reason, adequate time must be allotted for systems testing. If things go better than expected, the time can be profitably used to do more thorough testing.

What is not tested in this task is the logic of the application functions and the validity of the results obtained. For instance, this task will test that a particular report can be printed out, but it will not test the whether the data displayed in the report is valid or whether required data is missing. The logic and accuracy of the system will be tested later by site personnel who are expert in the business process and the functions the system is designed to perform.

Also, the installation team will not concern themselves with performance tuning during this phase of the project unless the performance is seriously below specification. Performance tuning is normally accomplished following operational and parallel testing and just prior to running final customer acceptance tests. The reason for this is that it does not make sense to tune the system until all errors uncovered by operational testing are corrected.

9.2.3 Implement Training Programs. During the later stages of the previous task, the training program developed to support the new information system should be delivered to site personnel who will participate in, or conduct the functional tests of the new information system. To the extent that it is possible, training should include hands-on experience with the new information system. This can be provided either by using the prototype system that was developed during enterprise engineering or by access to parts of the newly installed information system that appear to be working. Student feedback during training can often be helpful to the installation and test team. The more discrepancies discovered and fixed during installation and checkout, the less there will be during the operational testing period.

It is possible that the training systems developed (or being developed) for general deployment will not yet be ready at this time. This will probably be the case if some form of media training is involved. When this is the case, it may be necessary for members of the installation and test team (rather than training staff or contractors) to conduct the initial training. If this will be the case, time must be allotted in the installation schedule for this to take place.

The project team should be aware that the training system being used at this time is also undergoing final tests. If allowance is made to incorporate student feedback into refining training materials, the training program deployed with the accepted system will be that much better. Also, allowance should be made to test systems and operational documentation so that any discrepancies in these materials can be corrected prior to systems deployment.

9.2.4 Conduct Parallel Test Program. This task is one of the most critical in the entire Framework methodology. All of the work done previous to this task was done in preparation for operational and parallel testing. This is the first opportunity for all elements of the business process reengineering program and its underlying information systems

support to be tested together by the functional people who work in the business process. Also, during this period, elements of the organizational change management plan will be tested under operational conditions.

The success criteria for this task are the following:

- Successful systems level testing results by the installation team resulting in a system ready for operational testing
- A sound training program that prepares site personnel for working the process and using the new information system
- A thoroughly checked out organizational change management program plan ready to be phased into the initial test site
- A test plan with accompanying test bed that exercises all features and functions of the reengineered process and underlying information system
- A program of regression testing following all changes or fixes to any significant element in the process, information system or change management program.

The test plan must be carefully constructed so that it guides testing in a logical order with respect to the sequence of process operations and the structure of the information system. An information system is generally tested in this order:

- Data base records and tables
- Code and function tables
- Global functions such as input/output, screen generation, and data base access
- User sign-on, access and menu systems
- Mainline processing functions and routines including input edit, format, and data validation routines
- Secondary or ancillary functions and routines including exception handling
- Query logic and report generation routines and outputs
- Linkages to other application or packaged software programs
- Restore and restart operations with respect to operational data reconstruction.

All test sequences must be conducted following a refresh of the test data base so that consistency of operational testing can be maintained. All errors and discrepancies must be recorded, diagnosed, coded, corrected, and unit tested. Changes to information systems must be made on a scheduled batch basis followed by implementation of a regression testing program to ensure that new errors are not introduced in parts of the system already tested. Version control is an absolute must during this process.

When the entire system has been tested and all discrepancies removed, elements of the change management plan can be introduced to ensure that the new process and its information systems support is compatible with organizational changes, staff changes and assignments, work flow, and internal communications.

When this process is complete, then (and only then) can parallel testing commence. Parallel testing refers to the technique of running a new system side-by-side with the existing system that it will replace. The purpose is to ensure that the results obtained from the new system are consistent with the results obtained from the existing system for similar functions. In the case of new functionality, the results produced by the new system must be checked against the new policies, directives, goals, and objectives that led to the introduction of the new process and information system features. In most cases, the TO-BE activity and data models and the prototype system (if one exists) can be used to perform this type of validation.

The secret to controlling the operational and parallel test process is to ensure that the test plan and program contains checklists that reference every area of process changes and enhancements, organizational changes, and information systems functions and features. Checklists are formal documents that are time-stamped, coded by system version number, and signed by the responsible person. Errors noted on checklists should also be linked to program modification documents so that an audit trail exists relating testing, error detection, error correction, and regression testing.

When the test program is complete, all errors and discrepancies have been properly handled, and all regression testing activities have been completed, the installation team can turn their attention to performance tuning of the system. It is likely that the installation team working with technical support can optimize data base structures, tables, and records, enhance menu logic, and streamline internal routines that affect performance. Once performance tuning has been accomplished, a final test of the complete system must be performed, followed by efforts to clean up any documentation and training discrepancies that result from system or process changes.

9.2.5 Secure Customer Acceptance. Customer acceptance trials are only performed once the installation team has satisfied itself that the new process, all organizational adjustments and changes, and all information systems are ready for final inspection and acceptance. The overall goal of this task is to complete the customer acceptance trials with little or no new errors or discrepancies reported. In addition, this is a time for customers to identify potential enhancements that can be considered for implementation later on.

But because customer acceptance trials are a formal process, acceptance must be based on process and system specifications and criteria, not on the implementation of newly requested features and enhancements. The reason for this is that the entire test bed and test program was constructed based on approved process and system specifications such as those contained in models, plans, designs, and the FEA that authorized the new process and system. If new changes or enhancements are introduced into the system at this stage of the project, there is no assurance that such changes can be adequately tested. In any case, such action would invalidate the entire system, operational, and parallel testing program.

9.2.6 Implement Transition (Cut-over) Plan. Following formal customer acceptance, the transition plan previously developed is implemented. The transition plan governs all activities that allow the organization to change over to the new process and system. It is during this task that the organizational change management program officially goes into affect, and process stakeholders (especially suppliers and customers) are formally involved with the new system.

If the previous tasks in this step and the corresponding ones in step 23 have been faithfully executed, the transition should go reasonably well. However, the installation team and site personnel should expect some problems during this task. Some of these problems can be easily handled, but some may require rethinking parts of the new implementation. On rare occasions (providing the test program was rigorously carried out), the transition program may have to be halted until serious problems and issues are resolved.

In general, the project should be considered to be in the transition phase until one complete business cycle has been completed. This will most often equate to one month, with quarterly and annual functions performed at least once on a simulated basis. During the transition period, it may be necessary to *force* some exceptional conditions that rarely occur just to ensure that everything is in place to handle these exceptions. One example would be to stage a power failure to ensure that recovery procedures are effective.

9.2.7 Deploy Remaining Sites. Following a successful transition period, all remaining sites can be deployed on a scheduled basis by following an abbreviated installation and test process. The degree of site-specific testing and acceptance will depend for the most part on how similar each deployment site is to the initial site. The degree of similarity includes leadership, management, and

employee factors; organizational structure, policy, and procedure factors; product, service, and business process factors; stakeholder factors (especially suppliers and customers); and information systems utilization factors. The deployment team should also be aware of physical site characteristics that may have some bearing on successful and timely deployment.

In general, the information systems component will be the most stable and consistent over the deployed sites. The business process itself may require some adjustments or changes from site to site. But the organizational change management program may have to be implemented quite differently in each site. The only way to know these site-specific characteristics is to conduct pre-deployment visits, meetings, and assessments during the project execution planning step. Another benefit of this approach is that a preferred sequence of deployment will become evident.

One of the most important considerations of deployment as contrasted with initial site installation are all those decisions and actions that have lead time associated with them. Such items include site preparation, equipment procurement, shipment, and installation, organizational changes, training delivery, technical support, and transition planning. It is very important that the overall project management plan governing installation and deployment have well-developed lead time parameters built in to the PERT chart.

Timing will be affected by whether there will be one deployment team that moves from site to site, or multiple deployment teams. An additional consideration is how much of the deployment work can be performed by site personnel versus that which is to be performed by the deployment team.

9.2.8 De-commission Obsolete Information Systems. Following a successful transition period, the next task is to de-commission or scrap existing information system components. While hardware components can usually be salvaged or re-deployed, most other elements associated with the business process and underlying information system are simply scrapped. The following activities are performed during this task:

- Accounting, inventory, and maintenance records are appropriately updated
- Supplier agreements and contracts including leases, maintenance agreements, supplies contracts, and services contracts are properly handled
- Licensed software packages are properly disposed of
- Obsolete documentation (policies, procedures, handbooks, etc.), special forms, manuals, and training courses are scrapped
- Computer and communications equipment is scrapped, salvaged, or redeployed
- Obsolete data base and file records are archived or erased as appropriate.

9.2.9 Conclude Information System Deployment Phase. The final task in this step is to officially and formally terminate the installation and deployment stage of the project.

For the most part, this entails the following activities:

- Write the final installation and deployment report including lessons-learned and recommendations for future deployment efforts
- Archive installation and deployment related materials
- Release the installation and deployment team for return to their units or reassignment
- Institute planned technical and operation support services including telephone hotlines, bulletin board services, regular mailings, training services, and documentation distribution services.

This concludes the install/deploy information systems step.

9.3 Step 23: Deploy Organization Change Management Plan

Section 6 of the Framework methodology lays out the principles of developing an organizational change management plan. The Change Management Tutorial provides additional guidance on how to construct this critical plan. At this point in a reengineering project, it is time to implement the change management plan along with process improvements and new supporting information systems.

The literature makes clear that most failures associated with business process reengineering are a direct consequence of poorly developed change management plans, poorly implemented change management plans, or both. The most common reasons for these failures are lack of strong leadership in conjunction with poor communications with people who will be affected by the proposed changes to process, information systems, and/or organizational structure and operations. If the principles contained in section 6 and the Change Management Tutorial were followed to develop the change management plan, the implementation and deployment of the plan covered in this step of the Framework methodology will not carry the burden of trying to deploy a flawed plan.

Business process changes can be studied, analyzed, modeled, developed, simulated, and prototyped in a laboratory environment. Since most of the issues associated with process improvements are objective ones, rational, knowledgeable people can work out their differences with approaches and objectives. The same is true of information systems. But change management programs cannot be developed and tested in a laboratory environment. Organizations are too dynamic, and people are not easily analyzed nor can their motivations and future actions be reliably predicted or conditioned.

This means that the implementation of an organizational change management plan must be performed under actual operating conditions and progress must be monitored over time. Only then can the plan be demonstated to be viable.

Even the best of plans will need to be adjusted to accommodate the reaction of staff and stakeholders to the new organizational environment. This requires time for the new environment to settle in, skilled observation of the new dynamic trying to establish itself, reliable feedback from those affected by the change, and organizational-wide communications and cooperation to work out the problems and issues.

The Framework methodology calls for the initial deployment of the organizational change management plan at the time the enhanced process and new information systems are being installed for operational testing. For this is the first time that all elements of the new environment can be brought together and studied as a complete system. The organizational change management plan must be validated or revised as indicated before full-scale deployment can begin. It is absolutely critical that implementation of the change management plan be given as much or more attention as the new process and supporting information systems. As difficult as it can be to work out the problems with new processes and information systems, working out the problems with new organizational structures is much more difficult.

This indicates that one or more members of the installation and test team must be skilled in organizational dynamics and human resource management. The task of validating the change management plan must not be a collateral task assigned to technicians and business analysts. It also means that the leader of this effort must have access to site leadership and management throughout the initial installation and test period.

Unlike processes and systems that can be fully tested and validated once then deployed with little risk, every deployment site is a custom installation with respect to the organizational change management plan. This is especially true when deployment involves different regions of the

country, different components within DoD, or different operating environments. The composition of the deployment team should reflect this reality.

The following tasks are performed in the deploy organizational change management plan step:

- Issue Policy and Guidance
- Implement Transition Plan
- Deploy Implementation Plan
- Complete Organizational Realignment
- Changeover to New Process and Information Systems
- Monitor Change Process
- Adjust Program as Required
- Prepare Final Implementation Report
- Conclude Installation/Deployment Program

These tasks as described below assume that a well-constructed and approved organizational change management plan is in existence and compatible with the enhanced or reengineered business process. The principles and recommendations below are invalid if this is not the case.

9.3.1 Issue Policy and Guidance. The first task is to inform, then educate staff on the policy and guidance that will be put into effect with the enhanced process and new information systems support. It does little good to implement a business process that enhances customer service if the staff does not understand that improving customer service is the new policy of the organization. The staff also has a need to see how new directives, procedures, and methods will enable them to carry out the new policy.

Conversely, leadership and management will want to know if there are any flaws in the new policy and guidance that should be addressed before general deployment begins. The initial installation of the new process and supporting information system provides a laboratory for evaluating policy and guidance under operating conditions. Therefore, staff at the initial site should be empowered to evaluate policy and guidance as they try to employ it and recommend changes and enhancements. To a lesser extent, this will be true at every deployment site. It can be expected that as deployment continues, fewer problems with policy and guidance will be forthcoming.

The tendency for governmental organizations to *lock-in* policy and guidance before gaining operational experience with a new process and system must be overcome in the spirit of *reinventing* government. Otherwise inconsistencies or problems that arise during installation and deployment will be resolved by changing the process and/or the system rather than the policy and guidance *even when it can be demonstrated that the policy or guidance is what should be changed.*

9.3.2 Implement Transition Plan. The period of time that begins with the introduction of a new operating environment (process, system, and organization), and ends with the de-commissioning of the existing process and system is known as the transition period. This is a particularly trying period for organizations. The old environment (process, system, and organization) is still in place. The staff is trying to convert to a new environment. And as the installation proceeds, the staff is trying to operate in elements of the new environment.

The transition plan is primarily concerned with guiding staff and management through the installation and deployment process. In other words, it is people-intensive. The implementation plan described in the next task is concerned with the mechanics of making the transition and is focused on structural and operational issues.

There is probably no such thing as a *smooth* transition in this situation, but there is a very high risk of a complete failure to make the transition. The transition plan was developed earlier in the process and now it is time to put it into effect. Doing so will require forceful leadership, sensitive management, and excellent project management skills. People's lives and careers are being disrupted and personal and organizational stress will be at a maximum during the transition period.

Even a well-developed transition plan will need to be closely monitored during execution, and changed to fit events and circumstances as they occur. Normal resistance-to-change factors must be dealt with as they occur. Informal leaders must be recognized and supported as they emerge. Personal situations that develop must be handled confidently but with some sensitivity. The staff's awareness of how leadership and management perform during this period will be heightened and they will respond accordingly.

Project managers should continually observe the reaction of staff to the events taking place during the transition period. Arnold S. Judson[30] suggests the spectrum of behaviors toward change presented in figure 9-3. When positive behaviors are observed, they should be immediately recognized and rewarded. Neutral behaviors suggest that some form of coaching or counseling is necessary. Negative behaviors must be severely dealt with before they compromise the success of the project.

The initial site installation provides an opportunity to validate and improve the transition plan that will be used throughout the deployment period. However, it must be emphasized that each deployment site will be somewhat unique and will present its own set of problems and circumstances. This means that every site will require a customized transition plan deployment. To the extent that it is possible, the transition team should work with each deployment site in advance of installing the new process and information system. This way, obvious adjustments can be made to the transition plan for each site before the situation is complicated by the installation of the process and system.

9.3.3 Deploy Implementation Plan. The specific sequence of actions that must be taken to switch over to the new operating environment is contained within the implementation plan. A well-developed implementation plan will have actions, criteria, assignments, schedules, resources needed, and costs. It will also have milestones or coordination points to synchronize actions taken by different people. During the initial installation, problems with the implementation plan may be discovered, and enhancements to the plan may be recommended. Following each deployment, lessons-learned can be used to improve the plan still further.

One of the primary activities performed during implementation is training delivery to all staff and management involved with the new business system. Experience has shown that one of the most effective ways to train staff when major dislocations in work processes and organizational structure are involved is to require management and supervision to participate in training delivery. This is accomplished by first training management and supervision, then training them on how to deliver the training program (train-the-trainer), then having them deliver the training program to their own staff with the assistance of professional trainers.

The implementation of organizational changes must, of course, be coordinated with the implementation of process changes and new information systems. Unlike process and systems change schedules, the implementation of organizational changes must factor in the speed at which people can understand and assimilate changes that affect their work and their interactions with others. Allowances must be made for individual differences and circumstances if resistance factors are to be contained.

9.3.4 Complete Organizational Realignment. During the customer acceptance trials described in task 9.2.5, the final organizational environment must be established in preparation for switching over to the new process and system. Organizational and management structures should be in place, staffing changes should be implemented, employee assignments, both individual and team, should be established, and all support mechanisms should be ready to be activated.

8 Arnold S. Judson, *Changing Behavior in Organizations: Minimizing Resistance to Change*, Cambridge, Mass.: Blackwell, 1991.

The Spectrum of Possible Behavior Toward Change	
Acceptance	Enthusiasm
	Cooperation
	Cooperation under pressure from management
	Acceptance
	Passive resignation
Indifference	Indifference
	Apathy; loss of interest in the job
	Doing only what is ordered
	Regressive behavior
Passive Resistance	Nonlearning
	Protests
	Working to rule
	Doing as little as possible
Active Resistance	Slowing down
	Personal withdrawal (excessive absences)
	Committing "errors"
	Spoilage
	Deliberate sabotage

Figure 9-3. Spectrum of Behavior Toward Change

Procedures, methods, techniques, and tools for conducting business operations should be in place, and obsolete items disposed of. The objective is to have the organizational realignment complete by the time the customer acceptance trials are concluded. During this period, all remaining problems and issues should be identified, diagnosed, and resolved (or scheduled for resolution).

9.3.5 Changeover to New Process and Information Systems. This task coincides with task 9.2.6: Implement Transition (Cut-over) plan. This point in time is *T-0 (T- zero)* with respect to launching the new business system. Everything that can be done, has been done, and the organization begins operating in the new work environment. When possible, the changeover should be scheduled to coincide with a slack period in the business cycle. For instance, it is usually not a good idea to launch a new business system during budget preparation periods.

9.3.6 Monitor Change Process. It takes about six months for people to adjust to a new working environment following changeover. During this period of time, it is important to monitor operations and secure staff and stakeholder feedback. In all but the simplest of working environments, events and situations will develop that were not accounted for during the planning, design, and implementation stages of the project. These exceptional conditions should be monitored so that both temporary and permanent resolutions can be found.

Furthermore, employees are more likely to succeed in the new environment if they have the means to communicate their experiences and suggest improvements. This is often called *hand-holding* but it is quite important to the overall success of the project. Since some employees are not comfortable dealing with supervision in these matters, it is helpful if a member of the installation or transition team is available for employees to talk to.

9.3.7 Adjust Program as Required. Any reluctance to enhance elements of the improvement program whether process, information system, or organizational should be actively discouraged. In the information age, change is the norm. All enterprises are encouraged to become *learning organizations* where the potential is for each working day to be a little more effective and efficient than the day before. This can only happen when staff are encouraged to look for improvements and to expect that appropriate action will be taken when they do submit improvement ideas. It is even better when employees are empowered to make improvements within their authority as they see fit.

This can happen in organizations where policies replace rules, guidelines replace procedures, and education enhances training. When staff come up with new ideas, suggestions, and methods, there should be a provision to incorporate these into the overall improvement program and deploy the results as appropriate.

9.3.8 Prepare Final Implementation Report. Following the cut-over to the new environment, a preliminary implementation report should be prepared and submitted to designated review boards and agencies. About six months after an installation, a final implementation report should be prepared and submitted. This report should indicate as precisely as possible, performance versus plan. For the most part, the implementation report should reference the FEA which describes the benefits to be achieved in return for the investment to be made. Objective factors such as customer service, product quality, cycle time, and cost savings are the nucleus of the report.

While six month's worth of operations is not sufficient to demonstrate that the new business system fulfills all planning and design objectives, it should be sufficient to show trend data. Follow-up reports will confirm or deny the trends.

An important part of the implementation report is lessons-learned and suggestions for future improvements. When possible, it is also useful to capture stakeholder comments including those who are part of the process. The final implementation report should be a primary input to the next improvement cycle for the business process and underlying information systems.

9.3.9 Conclude Installation/Deployment Program. There must be a formal close to the installation and deployment stage of the project. In general, the installation period concludes about six months after the cut-over or until all customer acceptance documents have been signed. At this time installation and deployment teams can be officially closed out and all personnel not already relieved should be reassigned as agreed upon. At this time, the project enters the operations, maintenance, and enhancement stage which is on-going until the end of the process life-cycle. The most important aspect of this task is that responsibility and authority for the business system is transferred from the installation and deployment team to site management.

This concludes the deploy organizational change management plan step.

9.4 Step 24: Operate/Maintain Process and Information Systems

The purpose of process innovation or reengineering is to achieve a dramatic improvement in process performance in terms of quality, service, cycle time, and cost efficiency. If all has gone well in implementing the Framework methodology to this point, that objective has been achieved. This step is concerned with maintaining the improvements achieved and ensuring that the process does not degenerate in terms of the measures established to monitor process performance.

Processes can degenerate for several reasons. Conditions change constantly in the external and internal environment which can de-optimize process performance. Managers can fail to adequately monitor process performance and allow sub-standard inputs to contaminate process operations. Employees can lose their focus on providing superlative customer service and fall back into old work methods. Staff turnover in the absence of effective training and coaching practices can lower the organization's ability to perform at the level achieved by process engineering.

Process management is active, continuous, and rigorous. Performance measures must be monitored to spot exceptional conditions and negative trends. Customers (both internal and external) must be continually monitored to ensure that their needs and requirements are being met. Supplier partnerships must be pro-active to ensure that agreed upon input quality and service levels are maintained. Finally, employees must be fully engaged in process performance and empowered to take fast, resourceful action to prevent or solve process-related problems.

Process management is also concerned with maintaining an orderly environment that facilitates staff productivity. Resources are available as needed so that employees can do their jobs. Documentation is properly maintained. Data sources are available as needed. The work facility is clean, neat, comfortable, safe, and secure.

Finally, process management is concerned with maximizing communications within the enterprise so that everyone understands what is expected of them, how their individual and team performance measures up to expectations, and the consequences (good or bad) of their performance. Fear, uncertainty, and doubt have no place in an organization operating under good process management principles.

Information systems management with respect to operations and maintenance means that functional users and managers are active participants in all activities involving information systems support. The information system exists to support process requirements. There is no other reason for having one. Since functional managers are charged with responsibility for process performance, they are also responsible for ensuring that information systems support is focused on serving process requirements.

The following tasks are performed in the operate/maintain process and information systems:

- Operate Process and Information Systems
- Monitor Performance
- Identify/Classify/Resolve Problems and Issues
- Maintain Process and System Documentation
- Conduct Continuous Training and Support Program
- Prepare Regular Operating Status Reports

9.4.1 Operate Process and Information Systems. The laws of thermodynamics are said to govern all activity in our universe including human activity. One wit has said that the first law of thermodynamics says that you can't win, and the second says that you can't break even either. What these laws are really saying is that left alone, every system will degenerate over time. They also say that to maintain the performance level of a system, energy must be continuous injected into the system. Whether these laws apply to every situation in the universe or not, they do apply to process

management. Process management is an active, on-going, energy-injecting exercise. When effective process management is practiced on a daily basis, processes tend not to deteriorate over time.

There are seven keys to process management. Each of these keys plays an important role in ensuring that the process is at least maintaining the effectiveness and efficiency engineered into it during the process improvement project.

- *Process Ownership.* Every process must have a designated process owner with the authority to negotiate cross-functional interactions. Assuming a well-trained and empowered staff, most process problems are the result of breakdowns at internal and external process boundaries and interfaces. The role of the process owner is to monitor cross-functional situations and events and take immediate corrective action as indicated.

- *Boundary Management.* A process boundary exists wherever the handoff of a work product occurs. Most of the process boundaries in a typical process are internal—across functional boundaries within the organization. Other boundaries are external—usually between the enterprise and its suppliers and customers. There is a contract in place that governs the conditions of transferring work products across boundaries. Most of these contracts are implied with respect to internal boundaries, and expressed with respect to external boundaries. Whether implied or expressed, work contracts must be actively managed to ensure that all parties are living up to their responsibilities to meet all performance standards for handing off work products.

- *Monitor Workflows.* During process improvement, a TO-BE activity model was developed showing the activities that make up the process and how data and material move between and among processes. Now that the new process is in operation, these workflows must be monitored to ensure that all process objectives are being met. It is possible that the activity model does not account for all exceptional conditions, or that some activities need to be optimized or re-sequenced to improve workflows and work product quality.

- *Monitor Customer Requirements.* The primary purpose of a process is to provide a product or service that satisfies customer requirements within a system of agreed upon constraints. This is true whether customers are internal or external. It is necessary to ensure that the process is doing this on a continuing basis. This means that process owners and participants should regularly query their customers to ensure that needs are being met, and also to find ways of improving customer service. Some ideas can be immediately adopted, others may provide inputs for future process improvement projects.

- *Monitor Control Points.* Control points were established during process improvement and reengineering. Each control point was designed to provide data that indicates how the process is performing with respect to its design objectives. Most control points are established at process boundaries and interfaces. There is no reason to have control points if they are not going to be monitored. Most control points are monitored on a daily basis although some may require more frequent or less frequent monitoring. A good system of control points provides data to process participants so that they can take immediate corrective action when problems occur or trendlines are deteriorating. Some control points provide management data that indicate that a cross-functional situation may be developing that is outside the control of work teams.

- *Measure Process Performance.* Processes are designed to carry out the mission, goals, and objectives of the enterprise. Control points provide raw data about process performance. Process owners and others must analyze the raw data provided by the control points with respect to agreed upon standards of performance. When there is a significant deviation in performance to standard, or when trend data indicates deterioration, process owners must take corrective action.

- *Obtain Feedback from Process Stakeholders.* A process may be satisfying all design objectives, and process performance may be acceptable based on measurement data; but circumstances may have changed stakeholder needs, requirements, and desires. Periodically, every process should be assessed with respect to how it is serving current stakeholder requirements. If stakeholder needs have changed, it may be necessary to make adjustments in the way the process works.

One of the most important elements of process management is to ensure that staff (process participants) are performing at optimum levels, and that their needs as employees and as humans are being met. This means that communications must be open and effective so that employees can make their maximum contribution. Information must be available and flow freely throughout the organization. And, training programs must be available so that employees can develop both interpersonal and job skills required for effective team participation.

9.4.2 Monitor Performance. The purpose of process reengineering is to develop high-performance processes. The purpose of performance monitoring is to keep reengineered processes from deteriorating or degrading. The truth is that most organizations do a poor job of monitoring process performance. This is evident by the amount of time most organizations spend in so-called *firefighting* activities. Firefighting almost always results in a *quick-fix* being applied to solve the problem. A quick-fix addresses the symptoms of a problem rather than its root causes. After enough quick-fixes have been superimposed on a process, the overall effectiveness and efficiency of the process deteriorates.

In monitoring process performance, process owners look for two situations. The first situation is when an exceptional event occurs outside the performance parameters established for the process. The second situation is when a pattern of deterioration occurs that indicates that the process is breaking down and will eventually fail to deliver quality products or services.

The first situation usually has a definite cause. The cause can be a defect in incoming data or material, an equipment or system breakdown, or an employee error. It is important to find the root cause of an exceptional condition so that the problem can be fixed at the source. In this way, the likelihood of a recurrence of the problem is minimized. For example, if a problem is caused by bad material, the source of the bad material must be determined, and the cause eliminated. A quick-fix would be to correct the bad material and continue. This would do nothing to prevent future material defect problems.

The second situation is usually a result of a deterioration somewhere in the process. It can be a machine tool wearing out, employees with personal problems that affect their job performance, or a basic defect in the process itself. These kinds of problems can be difficult to solve especially in service-based processes. Brainstorming along with cause and effect analysis is called for to solve these kinds of problems.

Other things that are monitored include overall customer satisfaction, worker productivity, schedule performance, budgets and expenses, and quality. A well-designed process will have control points and metrics to facilitate this kind of process monitoring. Many of the techniques and tools described in section 10 in this guidebook can be used to monitor process performance.

9.4.3 Identify/Classify/Resolve Problems and Issues. Effective organizations actively seek out problems and issues so that they can be dealt with before they lead to process, product, or stakeholder problems. For instance, airline inspectors often fly incognito to experience the service of the airline from the customer's perspective. Some organizations use quality circles to solicit input from employees on actual or potential problems. It is common practice in government to log lessons-learned after the completion of every project.

While it is admirable to identify problems and issues, it is only effective if these problems and issues are classified, analyzed, and resolved. Process owners often find it useful to keep a process log or notebook to record all incidents, problems, and issues associated with their process. This log provides input for planning sessions, process improvement actions, and problem-solving conferences. There are several commercial software packages available that accept free-form data entry and then provides techniques to classify and analyze this data in many interesting ways. With this software, patterns can be discovered that would be very difficult to discern manually. Most of these packages also include the means to track actions and activities that result from the analysis of the input.

Many of the techniques described in section 10 can be used to classify and resolve problems and issues. But they can only be used if first, the data is collected and maintained.

9.4.4 Maintain Process and System Documentation. Effective process management requires a concerted effort to maintain all process and systems documentation. This can only be done when most or all documentation is maintained on automated systems. Process owners must ensure that any change to the process or its underlying information system is immediately reflected in the appropriate documentation. For processes, it is especially important to maintain activity and data models because they are the basis for making improvements in the future. Once a TO-BE model is implemented, it automatically becomes the AS-IS model. Process designers will rely on the accuracy and completeness of this documentation during future improvement projects.

One of the most important documents to maintain is the process notebook described earlier in this guidebook. Like a ship's log, the process notebook can be a reliable reference document for the entire history of the process. As such, it can be used to support both process management and process improvement activities.

9.4.5 Conduct Continuous Training and Support Program. The most effective enterprises highly value training as an enabler of superior performance. There are two types of training involved in process management. One type refers to formal training programs designed to impart specific knowledge or skills related to process work. The second type refers to informal training exercises that can be a routine part of the job. One of the primary advantages of establishing a work team environment is that each member of the team can learn from others.

It is up to process owners and management to help establish the training objectives for formal training programs as well as encourage lots of informal on-the-job training. Employee's work schedules should not be so intense that there is no time for learning activities. Many mangers find that incorporating short training sessions into regular staff meetings is an effective way to communicate the value management places on training as a regular part of job responsibilities.

Front-line workers are those who work directly with a product or service, or who face the customer. It must be remembered that the entire organization exists to provide products and services to customers. Everything else is non-value added from the customer perspective. Therefore, the entire organization as a whole (including management) can be looked upon as a support organization for front-line workers. With this perspective, process owners and process managers strive to find ways to support their front-line workers on a continual basis. There is no better way to improve process performance in meeting the needs of all stakeholders in the process.

9.4.6 Prepare Regular Operating Status Reports. Finally, process management requires an effective system of communicating status reports related to process performance. In the industrial age enterprise, status reports were generated at the front line and flowed upward through successive (sometimes excessive) layers of management. In the information age enterprise, status reports flow horizontally so that everyone (especially front-line workers) have the information they need to provide superior performance. The concept of worker empowerment demands this type of information sharing. Local area networks, client/server systems, e-mail, bulletin board services, and other emerging technologies provide the means to effect this horizontal flow of information.

In well-designed processes, control points exist to provide upper management with the specific data and information they need to do their jobs. This lessens the need to spend non-value added time preparing and communicating routine status data. Once the routine is eliminated, upward status reporting can be restricted to the exceptional which helps ensure quick action on those situations requiring upper management involvement.

This concludes the operate and maintain process and information systems step.

9.5 Step 25: Conduct Continuous Process Improvement Program

Process management, as described in the previous step, is concerned with maintaining the gains produced by a business process improvement effort. The emphasis is on preventing the newly redesigned process from deteriorating or degrading over time. In this context, process management is reactive. That is, it is waiting for indicators to suggest that there is a problem or issue, then responding to the threat to process performance that problem or issue suggests.

Many enterprises are going beyond basic process management by putting a proactive Total Quality Management (TQM) program in place. TQM makes Continuous Process Improvement (CPI) an organizational mandate and the primary responsibility of all management levels. TQM doesn't wait for problems to occur, it actively seeks to avoid problems from occurring in the first place.

TQM is not a methodology and as such doesn't have a life cycle like business process reengineering. It is actually a system of leadership and management that leads to the establishment of a *culture* of excellence and superlative performance, especially with respect to anticipating and responding to customer needs. Business Process Reengineering (BPR) attempts to recognize and satisfy all stakeholder interests, TQM is customer driven. BPR strives for immediate and dramatic improvements in process performance, TQM strives for long range and continuous improvements with a focus on establishing and maintaining excellent customer relationships.

The principal features of a well-developed TQM program include the following:[31]

- *Management leadership, commitment, and participation.* In a TQM environment, all levels of management are actively engaged in process management and improvement. Employees have access to leaders and managers, there is a free flow of information in both directions, and leaders are visible.

- *Participation of all functions of the organization.* In a TQM environment, there are no turf issues or power plays. Everyone understands that they are there to serve customers. Problems and issues are avoided or resolved in a cooperative fashion. While responsibility and

31 *Process Management*, Eugene H. Melon, McGraw-Hill, 1993, Chapter 10.

accountability are required, blame is not assessed and punishment is not the order of the day when things go wrong.

- *Employee commitment and involvement.* In a TQM environment, employees are involved in the process and encouraged to take risks to improve the organization, its products, and its customer service. Team work is stressed, and employees are motivated to share their knowledge and experience with others. The organization understands that it is there to support front-line workers who build products, provide services, and satisfy customers.

- *Customer orientation.* In a TQM environment, it is understood that the purpose of the organization is to serve customer needs, requirements, and desires. In the context of mission, and with respect to all stakeholders, the process is optimized to serve customers. Wherever possible, guidelines replace rules, empowerment to act replaces passing the buck, and employees make the extra effort to help their customers and clients.

- *A system for continuous improvement.* In a TQM environment, improvement is the order of the day. Techniques are available to gather and analyze performance data so that improvements can be quantified and tracked. Employees are trained to anticipate problems and empowered to do something constructive about them. Ideas and best practices are freely shared throughout the organization.

- *A means for assessing progress.* In a TQM environment, control points and measures are built in to processes so that process performance can be tracked in real time. Employees have access to performance data as it becomes available and trained on what to do with this data. There is a linkage between planning and production systems so that everyone in the organization can assess progress to plan.

- *Education and training.* In a TQM environment, training is continuous whether conducted by formal or informal means. The enterprise strives to be a learning organization where problems are solved once and lessons-learned shared. Mistakes are considered opportunities for learning, not cause for punishment. Skill development is stressed so that employees are as flexible as possible in their work assignments, and comfortable with changes in work processes and technology.

- *Rewards and recognition.* In a TQM environment, employees are recognized and rewarded on individual skill development and cooperative team work in pursuit of process objectives. Skill development leads to a more flexible work force and conditions employees to be more receptive (less fearful) of change. Team performance is the most productive means of rewarding accomplishment because it discourages turf battles and personal aggrandizement.

- *Communication.* In a TQM environment, people communicate freely with each other. Information is a resource to be shared rather than hoarded. Fear, uncertainty, and doubt is overcome by the free exchange of information about policy, plans, and performance. Technology is employed to maximize horizontal communications which leads to empowerment and more effective team work.

- *Strategy and deployment.* In a TQM environment, strategy is developed by senior leadership in a cross-functional manner and then deployed throughout the organization level-by-level. Every strategy is decomposed until an action

plan is developed which will help realize the strategy. Performance measures are linked to strategy to ensure that process and organizational performance can be tested against plans.

- *Supplier relationships.* In a TQM environment, suppliers are considered to be partners in the pursuit of satisfying customer needs, requirements, and desires. Suppliers understand what is expected of them and take responsibility for delivering high-quality data and materials at the time they're needed, and at or below the agreed upon cost estimate.

In summary, in a TQM environment, there is a definite customer orientation and focus that conditions the actions of employees within the context of satisfying all stakeholder interests. Human resource excellence is a business objective since employees are considered to be the most important asset in the enterprise. Management is based on proven leadership principles and management actions are focused on continuously increasing the effectiveness and productivity of employees. Organization structures are in place to optimize process performance. Processes have owners who strive to break through functional barriers in pursuit of process excellence. Information systems are engineered to enable and support well-designed processes.

The following tasks are performed in the conduct continuous process improvement program step:

- Review Performance/Status/Problem Reports
- Conduct Surveys/Interviews/ Questionnaires/Focus Groups
- Monitor Stakeholder Feedback
- Identify Incremental Improvement Opportunities
- Design Incremental Change Specifications
- Implement Incremental Change Program
- Prepare Regular Improvement Status Reports

9.5.1 Review Performance/Status/Problem Reports. Active process management results in a continuous stream of ideas, suggestions, compliments, complaints, problem reports, and people-related issues. These data are supplemented by a stream of performance measurement data. In an organization practicing TQM, each of these artifacts and measures of process operations is given serious attention by employee work teams. The more difficult situations are brought to management's attention by the employees themselves. This is an important concept. In a traditional organization, managers bring problems to the attention of employees. That a TQM culture is well-established is self-evident when employees take the initiative to bring problems to the attention of management.

When policy deployment is practiced in an organization, each employee has a list of daily or routine objectives and responsibilities complete with performance indicators. *Daily management requires effective management of routine processes, discovering abnormalities or deviations, and preventing their recurrence.*[32] This means that problem determination and reporting is or becomes a routine job performance task.

Problem reports, status reports, and measurement data is a resource that can be used to drive continuous process improvement efforts. This is more likely to happen when employees themselves are responsible for improvement efforts. In the traditional authoritarian environment, problems and issues tend to be hidden or suppressed until they become so large that they cannot escape the attention of management.

32 *Total Quality Control Essentials*, Sarv Singh Soin, McGraw-Hill, 1992, Page 74.

9.5.2 Conduct Surveys/Interviews/ Questionnaires/Focus Groups. Since customers are the focus of continuous process improvement efforts, it is necessary to maintain frequent and open communications with customers. Work teams are empowered to conduct periodic customer satisfaction surveys, interview selected customers, and hold focus groups when indicated. Problem reports, complaints, and even compliments associated with customers can indicate a need to solicit the *voice of the customer.*

The industrial age is best characterized by a quote attributed to Henry Ford: *A customer can have any color car he wants as long as it is black.* Most government enterprises have moved very little from that attitude. The information age is best characterized by Alvin Toffler in *The Third Wave*: *...completely customized goods [and services] produced with wholistic continuous-flow processes, increasingly under the direct control of the consumer.*[33] This means that it is an imperative to stay close to customers and ensure that their needs and desires are recognized and acted upon. This is especially true in government enterprises because they have lagged so far behind the private sector in their treatment of customers. This is evidenced by competition in public domain services, the move to outsourcing, and privatization actions in recent years.

The way to stay close to customers is to meet with them, listen to them, and form partnerships to design, maintain, and improve high-performance processes. The challenge for government enterprises is to move from a rule-based culture to a service-based culture while maintaining equity and fairness. It can be done and it has been done in the public sector.

9.5.3 Monitor Stakeholder Feedback. Like all enterprises, government must satisfy multiple stakeholders. The Framework methodology recognizes five classes of stakeholders:

- *Customers.* Customers are the recipient of products and services produced by processes. However, customers of government services are more like clients than consumers. Unlike consumers in the private sector, clients of government services are often unwilling customers. For instance prisoners are unwilling consumers of penal system services. Nevertheless, customers have a voice and feedback should be solicited from them as it appropriate to do so.

- *Suppliers.* Suppliers provide goods, services, and data that are consumed in government processes to produce required outputs. Government must strive to move from an adversarial relationship with their suppliers to more of a partnership relationship. The information age both demands this and at the same time provides the means to accomplish the objective. Government enterprises have much to gain by listening to feedback provided by key suppliers.

- *Higher Authority.* Higher authority is any entity that imposes rules, constraints, standards, or requirements on government processes. Congress acts as higher authority to most Federal processes. Higher authority, like all stakeholders, has an interest in process performance. The move to *reinvent government* is largely concerned with changing the relationship of higher authority to the processes it affects. Rules, regulation, and public laws are now being subject to review, revision, or rescission. But in the move to free up processes from unwarranted controls, it is important to understand higher authority's intent and interests.

33 *The Third Wave*, Alvin Toffler, William Morrow and Company, 1980, Page 202.

- *Resource Providers.* Resource providers are any entity that fuels processes. Taxpayers and citizens act as resource providers for most Federal processes. The fuel may be funds, machines, facilities, contracts, or labor hours. These stakeholders have a voice also that should be listened to while engaged in continuous process improvement.

- *Process Participants.* Process participants are the employees and managers that perform business processes. Quality of worklife, rewards and recognition, skill development, and pride of accomplishment are some of the interests process participants have in process performance. Since it is difficult to satisfy other stakeholders if process participants are dissatisfied, it is most important to listen to their voice as continuous process improvement proceeds.

9.5.4 Identify Incremental Improvement Opportunities. The results produced by the first three tasks in this step provide the raw material for identifying improvement opportunities. In a TQM environment, those improvements that can be acted upon without the need to establish a formal process reengineering or redesign effort are called incremental improvements. Employee work teams identify, classify, prioritize, and characterize improvement opportunities. These are often the subject of regular management/staff meetings or regularly scheduled quality improvement efforts.

Work teams employ many of the techniques described in section 10 of this guidebook to gather and analyze performance and decision data related to improvement possibilities. The use of techniques and tools removes the subjectivity sometimes associated with incremental improvements, and builds confidence with management that the work team knows what it is doing and is acting on the basis of facts.

The routine work of gathering improvement opportunity data is often supplemented by support resources that evaluate the worth (benefits) of the improvement opportunity and estimate the time and resources needed to implement.

9.5.5 Design Incremental Change Specifications. When an improvement opportunity is reviewed and approved, it becomes necessary to design the changes that will be necessary to implement. Incremental improvements most often affect work flows and activities rather than organizational structure or information systems support. They usually also have limited cross-functional implications and seldom require a capital investment. Nevertheless, there is still the need to engage in a limited design effort to minimize the chance of disruptions to process performance or customer service.

The design effort for implementing incremental improvements depends to a large extent on the availability of accurate and up-to-date process-related documentation. This is why document maintenance is emphasized in the process management step. All proposed design changes should be reflected in the documentation to maintain its accuracy and usefulness.

9.5.6 Implement Incremental Change Program. Implementation should be staged to minimize normal process operations. Following implementation, a test plan should be executed to ensure that no errors have been inadvertently introduced into the process, its products, or its services. Process owners should be actively involved in all implementation efforts especially those that have cross-functional implications.

In some cases, the regular work team will implement incremental improvements, in other cases, a special task team will be formed to accomplish this. It is often helpful to have an outside facilitator or consultant review the implementation process. It may also be useful to include a customer and/or supplier representative to provide a check and balance arrangement.

9.5.7 Prepare Regular Improvement Status Reports. A characteristic feature of a TQM environment is the persistent effort to evaluate and assess process performance with respect to

stakeholder interests. While the specific nature of status reporting is dependent on the characteristics of the process, the following categories of data may be included in a system of regular status reporting:

- Customer complaints, comments, and compliments
- Instances of inconsistent output quality
- Absence of taking corrective actions indicated in previous reports
- Lack of interest in or knowledge of customer situations
- Overly long problem response time as indicated by performance measures
- The existence of too many verification or inspection activities
- Evidence of redundant, unnecessary, or non-value added activities
- Too much rework or corrective activities
- Excessive costs associated with value added activities suggesting the need for information systems support
- Incoming material quality and timeliness
- Quality, availability, and features of machines, equipment and tools
- Defects in technical designs and lack of supporting data
- Skill level deficiencies or lack of labor resources
- Management-related issues

Whatever the format of the status report, it should have these features:

- The specific problem is defined and characterized
- Performance data related to the problem is gathered, analyzed, and summarized
- There is a recommendation on the course of action to be taken
- Evidence of accountability has been established and a suspense record has been created
- There are follow-up reports of previously reported problems.

In summary, in a TQM environment, there is a continuous insertion of energy into all business processes to improve process performance and satisfy stakeholder interests in an optimal fashion. Employees, especially front-line employees, are empowered to act individually and as teams. This empowerment is established by a continuous education and training program backed up by an engaged management following established and proven leadership principles.

This concludes the execution phase of the Framework methodology.

SECTION 10. TECHNIQUES FOR PROCESS IMPROVEMENT

There is a saying: *if all you have is a hammer, everything looks like a nail.* Process improvement teams need a complete repertoire of techniques and tools for the same reason a carpenter needs a full complement of tools. Whether building processes or houses, tools in the hands of skilled craftsmen can produce a much better product.

In this guidebook, the term *technique* means a method or procedure for gathering, analyzing, or displaying data or information. The term tool refers to an automated system for implementing a technique. The term *product* refers to a specific or commercial tool. For instance, *brainstorming* is a technique, *groupware* is a system that automates the brainstorming technique. *Lotus Notes* is a commercial groupware system. In the literature, the terms *tools* and *techniques* are often used interchangeably. This is not terribly important as long as the reader knows the context in which the terms are used.

This section of the guidebook will briefly describe over 25 techniques that can be used in support of process improvement efforts. The presentation of each technique will be brief because the only way to really understand a technique is to actually use it. One can no more learn how to use a technique by reading about it than one can learn to ride a bike by reading about it. Eventually, you just have to mount up and ride.

The objective is not to use techniques for their own sake. The purpose of having techniques is so that process improvement teams can base their decisions on objective data rather than subjective feelings. By using techniques to support process improvement recommendations and designs, teams will be better positioned to overcome barriers and obstacles to improvement, and will more readily secure approval from higher authority to proceed with improvement efforts.

This section is not meant to be all-inclusive of process improvement techniques. There are other techniques that have proved useful in process improvement, and readers may want to check the references listed in appendix B for other techniques.

The following subsections contain lists of techniques that conform to the requirements specified in the subsection. In each case, the techniques are listed in the same sequence that they are described in section 10.3.

10.1 Technique Modes

For convenience, we group techniques into four categories—graphical, statistical, modeling, and textual. Each category is useful for specific purposes at different points in the Framework methodology. Familiarity with the techniques, and experience in their use will help teams know when, where, and why to select one category of technique over another. Some techniques may fit into two or more categories.

10.1.1 Graphical. Graphical techniques are best used when it is necessary to display the relationships between or among entities. These relationships can show order or sequence, priorities, dependencies, groupings and categories, and physical positioning. The following are graphical techniques:

- Quality Function Deployment (QFD)
- Process flow and process deployment
- Affinity diagramming
- Relationship diagramming
- Pareto analysis
- Force field analysis
- Program Decision Process Chart (PDPC)
- Program Evaluation and Review Technique (PERT)
- Gantt charts
- Checksheets
- Cause and Effect charts.

Graphical techniques are highly useful for communicating ideas to interested parties outside of the process improvement team. Whenever possible, data should be displayed in the form of graphics.

10.1.2 Statistical. Statistical techniques are used to gather and analyze data resulting from repetitive processes. Statistical techniques should only be used when there is enough data available (enough data points) to make the results meaningful. The use of most statistical techniques requires specialized training in the science of statistics, heuristics, and probability theory. The following are statistical techniques:

- Histograms
- Simulation
- Control charts.

10.1.3 Modeling. Models are highly structured graphics with a specialized syntax designed to convey graphical information with a high degree of precision. Many modeling techniques are precise enough to be supported with automated tools that can draw the models and transfer meaningful data to dictionaries, directories, repositories, and other software systems. Modeling techniques are used to gather, analyze, and display data. The following are modeling techniques:

- Process flow and process deployment
- Activity modeling
- Data modeling
- Simulation.

10.1.4 Text-based. Text-based techniques include narratives, reports, tables, matrices, and numeric representations. They are often used to supplement the results obtained from using other techniques. In general, the more structured the data recorded with the use of text-based techniques, the more useful and maintainable the data. Even data presented in report form should follow a well-developed content outline and be supplemented wherever possible with graphs, charts, models, and tables. The following are text-based techniques:

- Brainstorming
- Nominal Group Technique (NGT)
- Performance cell
- Strategic benchmarking
- Strength, Weakness, Threat, Opportunity (SWOT) analysis
- Hoshin planning
- Activity-based Costing (ABC)
- Best practices benchmarking
- Economic analysis
- Survey/interview.

10.2 Technique Application

Techniques should be used to accomplish predetermined objectives. That is, select a technique for a specific purpose and ensure that the purpose is fulfilled. Otherwise, process improvement teams can get carried away with the use techniques and end up more confused than when they started. The following subsections are designed to suggest applications for techniques.

10.2.1 Consensus Building. Process improvement is usually accomplished by cross-functional teams working together. At the conclusion of every step in the methodology, there should be team consensus on the results obtained, the meaning of those results, and the application of the results in subsequent steps. The use of techniques puts process improvement in objective, rather than subjective terms. The more objective the results, the easier it is to gain consensus because emotional or irrational elements are minimized. By consensus, we mean understanding, agreement, harmony and unanimity. Consensus is the basis for effective decision making.

Process improvement also results in the development of in-process reports that have to be reviewed and approved before improvement efforts can continue. This means that the improvement team must gain consensus with review teams and higher authorities. Techniques can aid this process by displaying data in terms that can be easily understood by those who are not working day-to-day on the improvement team. Almost all of the techniques presented in this section can be used to gain consensus both within the improvement team and with outside elements.

The first step in gaining consensus is to get all of the facts, ideas, opinions, concerns, issues, barriers, and objections out in the open so that they can be dealt with in an objective manner. The following techniques are particularly effective in this:

- Brainstorming
- Nominal Group Technique
- SWOT analysis
- Hoshin planning
- Force field analysis
- PDPC
- Survey/interview
- Cause and Effect analysis.

The second step in gaining consensus is to display or present data in a form that makes it easy to either agree on a set of data or point out areas of disagreement that can be further investigated. In addition to the techniques listed in the above subsection, modeling techniques can be used to display data in a way that helps resolve areas of disagreement.

10.2.2 Data Gathering. The more useful the data that are gathered in support of process improvement efforts, the more effective process improvement efforts will be. For meaningful process improvement, data must be gathered about the process in question (baseline data); from all interested parties (stakeholders) especially their needs, requirements, and desires; about the environment the process operates in (organizational and technological infrastructure); and about the possibilities for improvement.

There will always be more data available than the process improvement team can hope to gather and analyze. This means that the data gathering process must be disciplined and structured. Before any data is gathered, the team must be able to answer the following questions (who, what, when, where, why, how, and how much:)

- What data do we need
- Why do we need it
- When do we need it (what step in the methodology)
- What filters will we use to screen out unneeded data
- What will we do with the data when we get it
- What are the best sources for the data
- Why are they the best sources
- Who do we need to talk to
- How much time will we allocate to data gathering
- What do we need to look at (investigate)
- What is the best means (technique) of getting the data
- Who will do the data gathering
- What do they need to know before they start?

Planning the data gathering effort is most important. The plan should be written and evaluated before the data gathering effort starts. For instance, a good benchmarking effort can take three to six months and cost several thousands of dollars to conduct. The team should be certain of their objective before they commit the time and expense of using this technique. The following techniques are the ones most useful for data gathering:

- Brainstorming
- Performance cell
- Strategic benchmarking
- QFD
- SWOT
- Best practices benchmarking
- Economic analysis
- Survey/interview
- Checksheets
- Control charts.

10.2.3 Data Analysis. Raw data is seldom useful. All the data that is worth gathering is worth analyzing to derive meaning (information) from the data. Ineffective data analysis is more than worthless, it is misleading and damaging. The adage: *there are lies, damn lies, and statistics* points out that we can analyze data in such a way as to support any predetermined conclusion if we so choose. To minimize or prevent this from happening, data analysis must be as disciplined and structured as the data gathering process that produced the data.

In data analysis, it is important to select the most effective technique for the job at hand, use the technique properly, and then let the results speak for themselves. If there are disagreements in the interpretation of the results, rather than rework the analysis, it is better to note the differences in a

supplemental report. In this way, others can examine the results without bias.

The following techniques are the ones most useful for data analysis. There are many techniques that can be used for data analysis, so it is most important to select the ones most appropriate for the task at hand. Experience in using the techniques will provide skill in technique selection. Some of the techniques listed are also used in data gathering. In other words, the technique is used to both collect and organize data. In this case, the results are more suspect because the person or team using the technique may have lost some objectivity in the analysis phase of the technique:

- Nominal Group Technique
- Strategic benchmarking (analysis, conclusions, and recommendations)
- QFD
- Affinity diagram
- Relationship diagram
- Activity modeling
- Data modeling
- Activity-based costing
- Pareto analysis
- Histograms
- Best practices benchmarking
- Simulation
- Force field analysis
- Economic analysis
- PDPC
- PERT
- Control charts.
- Cause and Effect.

10.2.4 Decision-support. Most of the techniques covered in this section are designed for use by the process improvement team. Some, however, are quite useful for presenting data to review teams and higher authorities to aid in decision making with respect to some phase of the improvement project. It is important that when a technique is used to generate decision-support data, the data itself is neutral, balanced, and factual. It is proper to recommend a course of action, but the decision making team must have access to all of the data that lead to a recommendation for one course of action and the rejection of other alternatives.

Decision-support data should be concise and focused. The techniques used to develop decision-support reports will generally produce far more data than should be presented to the decision making agency. This so-called *backup* should be organized and preserved should it be needed to justify the recommended course of action. It should not, however, be part of the original submittal except in summary form. The following techniques are effective for developing decision-support materials. A key decision-support factor is noted for each technique listed:

- Nominal Group Technique (rank/ prioritize alternatives)
- Performance cell (acceptance of performance targets)
- Hoshin planning (acceptance of performance objectives)
- Activity—modeling TO-BE situation (proposed future state)
- Data modeling—TO-BE situation (proposed future state)
- ABC (acceptance of unit cost values)
- Force field analysis (acceptance of barriers to progress)
- Economic analysis (implementation alternatives)
- PERT (acceptance of schedules and costs)
- Cause and Effect (acceptance of drivers).

10.2.5 Presentation. Techniques provide an effective means of developing materials for presenting progress, results, plans, proposals, scenarios, and other aspects of an improvement project. The following techniques are most often used to develop presentation aids. In most cases, the presentation materials are a by-product of technique use, not the main purpose for using the technique:

- Performance cell
- QFD (high-level matrices only)
- Hoshin planning (cascading objectives)
- Process flow, process deployment
- Activity models (context and node trees only)
- Data models (entity/relationship only)
- Pareto charts

- Histograms
- Gantt charts
- Check sheets
- Cause and Effect (simplified for presentation).

10.3 Technique Descriptions

The objective of this section is to present a brief description of some of the techniques that have proved useful in support of process improvement efforts. The purpose is to make process improvement team members aware of the range of techniques that are available.

The techniques presented in this section are organized by general purpose with respect to process improvement efforts. Strategic techniques are the ones most useful for supporting planning efforts, developing performance measures and targets, process visioning, and conceptual relationships within the organizational unit. Tactical techniques are most often used to discover or understand process improvement opportunities, and to develop process improvement initiatives and alternatives. Operational techniques are most often used on a continuing basis to monitor process performance, support continuous improvement efforts, and solve process-related problems. This is meant as a guide, not to suggest that technique use is in any way restricted. The techniques described below may be used together in any combination anywhere in the 25-step methodology. The classification of techniques into strategic, tactical, and operational is only for convenience in describing them, and to suggest their most prevalent use.

10.3.1 Strategic Techniques. The first phases of a process improvement project are concerned with preparing for process improvement efforts. It is during the planning phase that process improvement teams need to understand their objectives and challenges. The techniques described in this subsection have proved most useful for supporting planning efforts, and discovering and describing problems and opportunities.

10.3.1.1 Brainstorming. Brainstorming is one of the most widely used process improvement techniques. It is actually a disciplined form of creative thinking. The idea behind brainstorming is to use the mind's power of association. Given one idea on a particular subject, the mind can often come up with related ideas. In a group situation with 7 to 15 people, each idea offered up stimulates others to come up with their own related ideas. Brainstorming is aided by a facilitator who provides the structure for a brainstorming session and ensures wide participation from the group.

Brainstorming can be performed in a conference or classroom with whiteboards or wallcharts, or it can be performed using groupware facilities. Groupware is the generic name for a system of networked personal computers with special software and projection capability. Rather than call out their ideas with the facilitator writing them on a board, participants enter their ideas directly into a personal computer. Among other services, the software system collates all the ideas entered into the system.

The general rules for brainstorming are the following:

- Ideas submitted by participants are not filtered or judged. This permits a free flow of ideas, some of which might be useful, some not.
- During the idea generation phase, there is no discussion on the ideas. Discussion would interrupt the flow and nullify one of the important advantages of this technique.
- Ideas are recorded as submitted. This is a moot point if groupware facilities are used.
- Continue with the session until all ideas are exhausted. Sometimes a brief rest break will lead to further ideas on the topic under study.

Among its other benefits, brainstorming, because of its fast pace, often uncovers obstacles and barriers to a planned course of action that otherwise might stay hidden for some time.

10.3.1.2 Nominal Group Technique (NGT). NGT is a structured group activity that can be used to evaluate and rank a series of actions or activities concerning the development of a plan or program to resolve an issue. Often NGT techniques are used after a brainstorming session to organize, evaluate, and rank the ideas developed by the group. The concept is similar to brainstorming. The synergy of the group is applied to the problem at hand. The power of this technique is that all members of the team get an equal voice in selecting an idea or action item.

The general rules for using nominal group technique are the following:

- The facilitator states the problem to be solved, or the nature of the decision to be made by the group.
- Ideas are generated or brought over from the brainstorming session.
- In a round-robin situation, each team member, in turn, presents an idea related to the problem at hand. The facilitator continues around the group until all ideas are exhausted.
- The group then discusses the ideas on the board or screen and clarifies, consolidates, and groups them into related categories.
- The group develops the criteria that will be used to judge and rank-order the ideas.
- Each team member then selects from five to eight of the ideas or actions from the list of all ideas or actions. These represent that team member's preferences. The team member then ranks those selected ideas or actions from one to five (or eight) with the most preferred item getting the highest number.
- The facilitator then counts the votes cast for each of the items on the list. The item getting the most votes represents the consensus opinion of the group. It is usually advisable to discuss the results and ensure that the selected ideas or actions really are what the group wants. It may be necessary to take another vote on a shortened list of items that got the most votes in the first round.

10.3.1.3 Performance cell technique. The Performance Cell Technique (PCT) is designed to provide a bridge that links business planning, process identification, and process improvement. Once established in an organization, PCT provides critical performance data (baseline and target) that together with business planning improvement objectives functions as a *charter* for process improvement action teams. PCT also establishes a basis for calculating the Return On Process Improvement (ROPI) equations. ROPI is a technique for estimating and measuring the improvement in process value as a result of a potential or actual process improvement action or project.

PCT is designed to support the objectives and principles in the Government Performance and Results Act by providing a technique to quantify performance indicators for efficiency and effectiveness relating to any given process, conduct performance gap analysis, and deliver coherent improvement goals and targets to process improvement teams at the start of an improvement project. In this way, a clear connection between strategic planning objectives and process performance can be established, maintained, and monitored. Improvement efforts will be directly related to strategic and business planning objectives. Performance indicators will be established that help ensure that the gains made through process improvement efforts will be held, beginning when the new process is deployed and becomes operational.

PCT also helps ensure that process improvement efforts are optimized for all process objectives including cycle time, process cost, and quality such that the needs of all process stakeholders are taken into account. When compromises must be made, PCT provides an objective means of developing criteria for decision-making purposes. For more information on this technique, refer to the Performance Cell Tutorial which is part of the Framework methodology series of documents.

10.3.1.4 Strategic benchmarking. Strategic benchmarking is a continuous, systematic and analytical process for evaluating and assessing the business practices, operations, and functions of organizations that are recognized as best-in-class for the purpose of establishing priorities, targets, and goals.[34] Benchmarking is most often used during the strategic and business planning phases to aid in developing long- as well as short-term plans, goals and objectives. Benchmarking teams typically examine from five to twelve enterprises that share several characteristics with their own organization. A benchmarking team will examine:

- Finished goods, products, and service features
- How products and services are produced and supported
- Supporting functions such as administration, personnel, and finance
- Measures such as cost, cycle time, and quality
- Strategies, plans, goals and objectives.

The benchmarking process most recommended is the one developed by Xerox Corporation who is generally credited with formalizing the concept.

The following are the usual steps in benchmarking:

- Determine what to benchmark and define the purpose of the study
- Form and train a benchmarking team
- Identify benchmark partners and establish the basis for the study
- Collect and analyze all data gathered from benchmark partners
- Produce a benchmarking report with conclusions and recommendations.

10.3.1.5 Quality Function Deployment. Quality Function Deployment (QFD) is a systematic approach to determining and understanding customer requirements for products and services, and then translating those requirements into specifications for developing and delivering the desired products and services. QFD is based on a system of interlocking matrices that can be customized, as needed, to suit the types of products and services in question. From one to 44 matrices are developed depending on how elaborate and detailed the design team wishes to get.

Typically, marketing, service, engineering, procurement, and production people work together and with customers to develop and refine the matrices. QFD can answer the following questions:

- What do customers really want or desire from our products and services
- What are the priorities in their wants and desires
- How well do competitors or alternative sources meet these requirements
- What product and service features will meet customer requirements
- Will any product design features conflict with or reinforce other features
- What processes are needed to produce product and service features?

The first QFD matrix is often called the *house of quality* or the *voice of the customer* because its primary function is to determine real customer needs. In some cases, especially with services, this is the only matrix needed by the improvement team. This matrix maps customer wants with product features. The second matrix maps product features with required product components. The third matrix maps product components with the processes

34 The Benchmarking Book, Michael J. Spendolini, Amacom, 1992.

required to produce them. The fourth matrix maps processes to finished products and services. Therefore, there is a causal chain developed from final product back to customer demand. Additional matrices are for highly specialized analysis and usually only applicable to highly engineered products.

QFD helps ensure that all efforts by the organization are the direct result of understanding what has to be done to satisfy customer needs, wants, desires, requirements, and expectations. Conversely, QFD helps an organization discover and eliminate all those activities that do not directly contribute to fulfilling customer requirements. For further information on QFD, check the bibliography in appendix B, or refer to "House of Quality," John R. Hauser and Don Clausing, *Harvard Business Review*, May-June 1988, pp 63-73.

10.3.1.6 Strength/Weakness/Opportunity/Threat (SWOT) analysis. SWOT analysis is a systematic approach to understanding the organization, its products and services, and its processes in terms of the internal and external environment in which it operates. SWOT analysis is generally conducted as part of the strategic planning process, although it may be effectively used at various times in the 25-step methodology to stimulate creatively and idea generation.

SWOT analysis is best conducted by a cross-functional team with the aid of a facilitator who acts as a neutral party during the procedure. The team attempts to develop a list of all of the organizational strengths and weaknesses related to the topic of discussion. For instance, If the topic is a process under an improvement study, the team lists all of the process's strengths and weaknesses with respect to customer service requirements, competitive sources, or best-in-class as determined during a benchmarking study. Next, the team tries to discover all of the threats to attaining process success as defined during business planning or described in performance cells. Finally, the team tries to uncover all the opportunities for excellence that can be achieved by overcoming threats, maximizing process strengths, and minimizing process weaknesses.

10.3.1.7 Hoshin planning. Hoshin planning, or Hoshin Kanri and Nichijo Kanri to be precise, originated at the Bridgestone Tire Company in Japan in the 1960s[35]. Since then, virtually all large Japanese, and many American companies have adopted these techniques with good results. Hoshin Kanri (which means control of objectives) is a more effective form of *management by objectives* (MBO), and is actually based on military planning methods. We recommend using a modified form of Hoshin Kanri for the improvement division of the annual plan (see section 4).

Nichijo Kanri (which means daily management) is a form of management by critical success factor or by key indicator. We recommend using a modified form of Nichijo Kanri for the operations division of the annual plan.

The following terms with their precise definitions are used in Hoshin planning:

- *Objective:* An objective is a desired end result or condition expressed in measurable terms that can be achieved by the successful performance of one or more business or functional processes.
- *Goal:* A goal (or target) is the criterion by which you measure the accomplishment of an objective. Every objective must have a quantifiable goal or target.
- *Strategy:* A strategy is a method or procedure for accomplishing the related objective and achieving the desired goal.
- *Performance Measure:* A performance measure is an indicator built in to a strategy that can measure progress toward satisfying the related strategy.

35 Total Quality Control Essentials, Sarv Singh Soin, McGraw-Hill, New York (1992), Chapter 3.

- *Critical Success Factor (CSF):* A CSF is a business function or activity that must be performed correctly and completely.

- *Key Indicator:* A key indicator is a measurement that is readily obtained by observation of a business process or activity which provides data on how well a process or activity is performing.

- *Variance or limits:* The degree to which a key indicator can vary and still be within tolerance.

With Hoshin planning, there is a series of cascading, interlocked objectives that provides direct links between strategic objectives and specific action plans. The concept is that when the lowest level objectives are satisfied, the higher level objective is automatically satisfied, and so on up the chain of objectives. For more information of this technique, refer to the Planning Tutorial which is part of the Framework methodology series of documents.

10.3.1.8 Process flow/deployment. A process flowchart is a high-level representation of the major activities, inputs and outputs, and decision points in a process. It is produced by a cross-functional work team in the initial stages of an improvement project. It is generally produced on a wallchart that is displayed for the duration of the improvement project. The wallchart can be effectively used to launch an activity modeling session. The value of the process flow diagram is that it shows the *big-picture* of a process, is quickly produced, is highly visible, and (unlike more rigorous techniques like IDEF) the method to create it is non-threatening to functional persons. The process flow diagram is usually produced once customer requirements are known either through a planning session, brainstorming session, or after using QFD techniques.

The diagram begins with the inputs to the process and ends with the desired outputs. Three questions are asked as each element of the process flow diagram between the inputs and the outputs is produced:

- What is the activity (what is done to the input)
- What customer requirement does it satisfy (why are we doing it)
- What decisions are made during the activity?

A process deployment diagram is similar to a process flow diagram except in it, each activity of the process is mapped to the organizational unit that is responsible for the activity. In other words, the deployment diagram adds *responsibility* to the process flow diagram. This is most helpful as the first step in setting the scope of a process improvement project and determining the composition of the cross-functional team that will work on the project. This mapping is usually done by listing the organizational units at the top of the wallchart, and aligning activities under the unit as appropriate.

Both process flow and process deployment diagrams are quite useful for verifying the workings of a process with outside stakeholders, especially customers. This is because the wallchart is easily understood by persons who may not be familiar with more complex modeling methods such as IDEF. Verification by stakeholders is exceedingly important before process improvement continues to ensure that the process improvement team does not lose sight of why they are improving the process—to better serve stakeholder interests.

10.3.1.9 Affinity diagram. Affinity diagramming (also known as the KJ method™ after its creator, Kawakita Jiro) is the organized, consolidated output resulting from a brainstorming session in which large amounts of data have been generated. It is used when the issues being investigated are numerous and complex, and the thoughts on how to deal with the issue are in disarray. In using this technique, individual ideas or items are grouped under a common header that best summarizes or consolidates those ideas or items. In this way, a great many items can be reduced to a smaller number of related groups. The groups then become the basis for an action plan or an approach to solving a problem.

The technique is performed by a facilitated improvement team, working at different times individually, in small groups, and all together. The process is best performed using wallcharts (or whiteboards) and index cards (or yellow stickies). The process is creative, yet disciplined and is quite effective. The following steps are performed:

- State the issue or topic
- Brainstorm for ideas writing each idea on a card or stickie
- Distribute the cards to the group or subgroups
- Group the cards by categories or common characteristics
- Discuss the groupings
- Title each grouping and revise as necessary
- Draw a wallchart that sequences the grouping and lists the items that make up each group.

10.3.1.10 Relationship diagram. Relationship diagrams are simple representations of cause and effect with respect to a given problem or process. In a relationship diagram, each element of a process or problem is written inside a circle or rectangle on a wallchart. The circles themselves are usually arranged in a larger circle. Starting at the one-o'clock position, the question is asked of the item at that location: what other items are related to this item and what is the nature of the relationship?

The relationship is expressed by drawing a line between the two items. If the item at the one-o'clock position is the driver, cause, influencer of, or takes precedence over, the other item (say the item at two-o'clock), an arrowhead is placed on the two-o'clock item. If the relationship is the reverse, the arrowhead is place on the item at the one-o'clock position. In the example below, providing materials takes precedence over using the materials to construct something. If the problem being solved has to do with the quality of the birdhouse, the diagram suggests that first the quality of the materials should be checked.

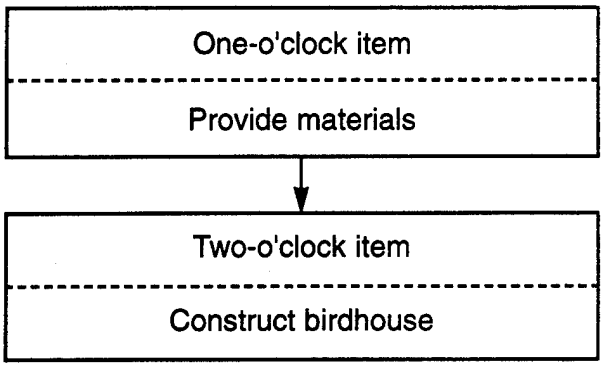

Figure 10-1. Relationship Diagram

Each item on the wallchart is examined in the same way until all arrows with the arrowheads in the proper position have been drawn. There will be zero to many arrows pointing in to each item, and zero to many items pointing out of each item. If an item has no arrows, the item is removed from further consideration. The item with the most arrows leaving is the most independent of all the items on the chart. It may be the root cause of every other item. The item with the most arrows pointing into it is the most dependent item. It may be the root effect of the problem or process.

Usually, all improvement efforts should be directed at the root causes of a problem or process non-performance issue. The items that are root effects can serve as validators since if the root causes are corrected, the root effects should go away or cease to be a problem. Besides identifying root causes, this technique can also be used to prioritize efforts based on those items (problems or activities) that have the most arrows leaving them.

10.3.2 Tactical Techniques. Techniques in this category are the ones most often used specifically for process analysis. Strategic techniques focus on discovering or defining problems and opportunities, while tactical techniques focus on solving problems and exploiting opportunities.

10.3.2.1 Activity modeling.[36] A model is a representation of a set of components of a system, subject area, or process. The model is developed

36 See *Integration Definition for Function Modeling (IDEFO)*, FIPS Pub 183, December 21, 1993. Material for this subsection was extracted from this publication.

for understanding, analysis, improvement, or replacement of the system or process. The model describes what a system or process does, what controls it, what things it works on, what means it uses to perform its functions or activities, and what it produces.

An activity model is composed of a hierarchical series of diagrams that gradually display increasing levels of detail describing functions or activities and their interfaces. Models provide a *blueprint* of activities and their interfaces that must be understood in order to make process improvement decisions that are logical, affordable, integratable, and achievable.

Activity modeling is used to:

- Perform analysis and design at all levels of the process
- Produce reference documentation as a basis for process improvement and integration
- Communicate among analysts, designers, users, and managers
- Facilitate consensus among cross-functional teams
- Manage large and complex projects using qualitative measures of progress
- Provide a reference architecture for enterprise analysis, information engineering and resource management.

The basic concepts embodied in activity modeling include the following:

- Graphic representation of activities and the interactions among activities
- Conciseness
- Communication
- Rigor and precision
- Step-by-step procedures
- Functional vs Organizational viewpoint.

10.3.2.2 Data modeling.[37] Data modeling is used to produce a graphical information model that represents the structure and semantics of information within an environment, system, or process. Use of a standard modeling technique permits the construction of semantic data models that may serve to support management of data as a resource, the integration of information systems, and the building of computer databases. The purpose of the modeling technique is to produce models in a standard, consistent, predictable manner in order to manage data as a resource. The modeling standard provides a:

- Means for understanding and analyzing an organization's data resources
- Common means of representing and communicating the complexity of data
- Method for presenting an overall view of the data required to run an enterprise
- Means for defining an application-independent view of data that can be validated by users and transformed into a physical database design
- Method for deriving an integrated data definition from existing data resources.

Data models are comprised of entities that represent persons, places, things, concepts, ideas, and events that are related to the process. The entities are graphically shown with their attributes (data items), keys (data identifiers), and their relationships to other entities.

Data modeling performed by a cross-functional process improvement team is usually limited to identifying the entities, primary keys, major attributes and business rules associated with

37 See *Integration Definition for Function Modeling (IDEF1X)*, FIPS Pub 184, December 21, 1993. Material for this subsection was extracted from this publication.

the process under improvement. Data models are then turned over to data administration and technical support where they are fully developed so that they can be used to drive database development and information system integration. In this way data modeling provides a common means of communication between functional and technical elements with respect to database development.

10.3.2.3 Activity-Based Costing (ABC). ABC is a technique used to determine the cost elements needed to produce a given product or service. By identifying these cost elements, it becomes possible to determine the unit cost of every major output produced by a process. As part of ABC analysis, activities are evaluated in terms of whether they add value or don't add value to the output product or service. When this information is known, process improvement efforts can be directed to minimizing or eliminating non-value added costs and activities from the process.

ABC analysis also includes the concept of tracing activity costs back to the point in the process where the given cost is triggered. This enables the improvement team to focus on cost-drivers (the root cause of the cost) rather than at the point in the process where the cost is felt. For instance, in a given process, if maintenance costs for product x are considered to be too high, the cause of the maintenance problem may be that defective (low quality) materials were procured earlier in the process to build the product. The way to reduce maintenance costs is not to improve maintenance activities on product x, but rather to improve the quality of the materials used to build product x. This will result in lower maintenance costs on the product.

ABC analysis is facilitated by first producing an activity model of the process being studied. With a fully decomposed activity model, it becomes relatively easy to research financial data, develop unit costs, locate non-value added activities, and find cost-drivers. ABC analysis is most effective in manufacturing processes, but has been found useful in service-based processes as well.

10.3.2.4 Pareto analysis. A Pareto diagram is a simple bar chart that graphically illustrates the components of a problem or proposed solution in decreasing order of occurrence or importance. With Pareto analysis, improvement teams can focus on *the important few rather than the trivial many* when dealing with a problem or opportunity. This technique is the practical application of the 80-20 rule which states that in any given situation with multiple casual elements, 80% of the problem or situation is embodied in 20% of the constituent elements.

Pareto analysis is used to arrange data into categories that can be time, location, component, person, type, etc., and then graphically ranking the number of occurrences in each category over a given period of time. Before Pareto analysis can be used, data related to the situation must be collected. Checksheets (described later) are the most common technique for collecting data for Pareto analysis.

In the Pareto diagram below representing a process problem, categories 1 and 2 cause most problem occurrences and should be the focus of the process improvement team's efforts. In this example, there are a total of 260 occurrences, and categories 1 and 2 account for 170 (about 70%) of the occurrences.

Process improvement teams may be reluctant to use Pareto analysis because it is so simple. However, there are many uses of the Pareto diagram and one effective use is for management presentations. In practice, after Pareto analysis produces the trivial few categories of problems to be solved, cause and effect analysis (described later) can be used to find the root causes.

10.3.2.5 Histograms. A histogram is another type of bar chart. A histogram represents and displays the frequency of occurrence of classes of data. The resulting diagram is used for further analysis, usually of a statistical nature. Histograms can display central tendencies (mean, median, and mode), width and range of occurrences (standard deviation), and shape. Histograms, therefore, tell a lot about the operation of a system which can be used to improve the system. This technique is

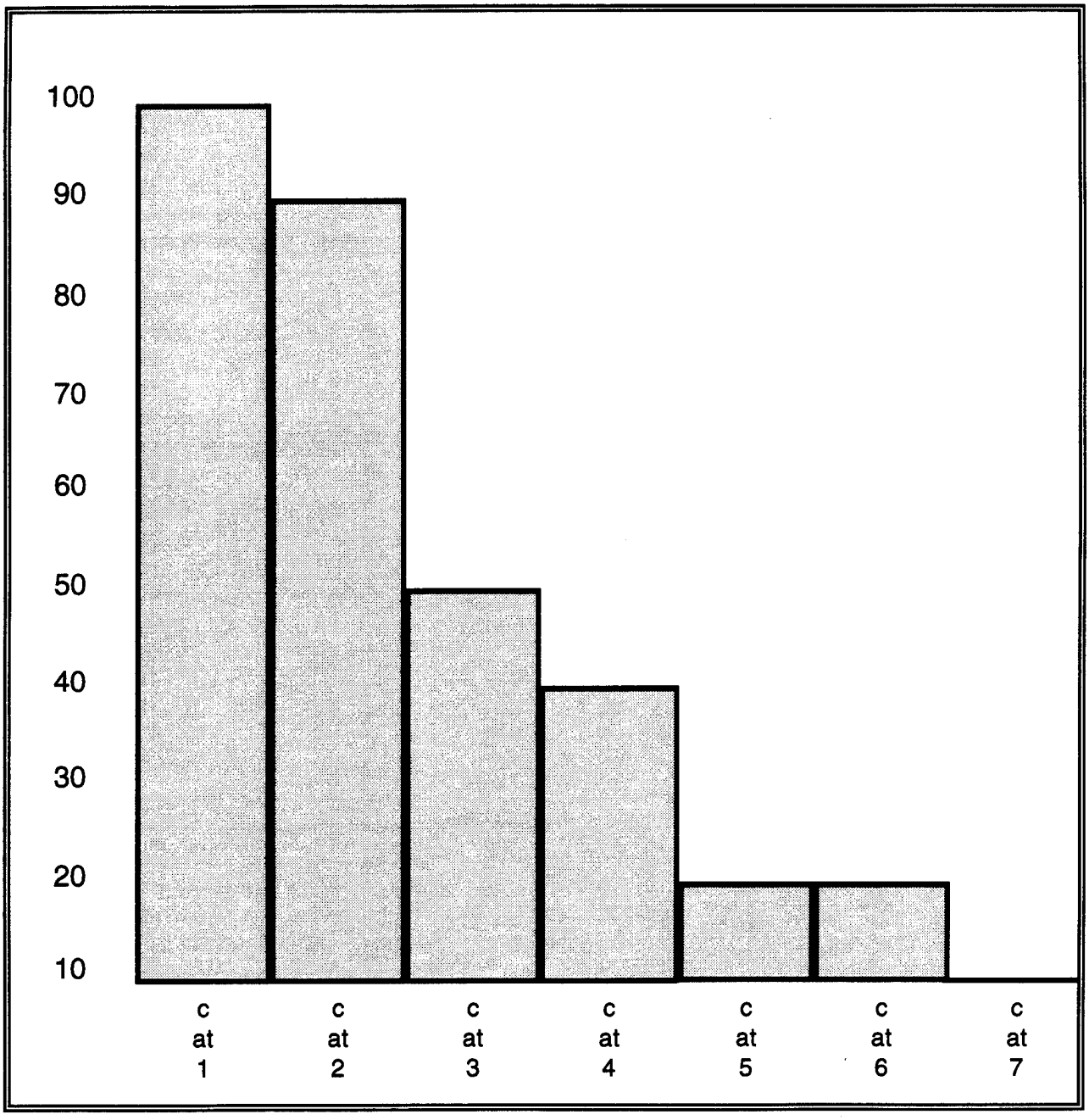

Figure 10-2. Pareto Diagram

usually used to determine the baseline condition or situation of a process or system, and to validate or verify the results of an improvement effort.

For instance, if a given process is operating at a quality level of 3 defects per 100 opportunities and the goal is to achieve 3 defects per 1000; data collected before and after the improvement project can be subjected to histogram analysis to determine whether the improvement objective was accomplished.

10.3.2.6 Best practices benchmarking. Best practices is one of several forms of benchmarking. The intent, as it is with all benchmarking, is to learn from other organizations and apply what was

learned to bettering the organization. There are six basic steps to process benchmarking:[38]

- *Plan:* Understand and measure critical success factors
- *Search:* Research appropriate organizations for process comparison
- *Observe:* Monitor process performance and analyze performance gaps
- *Analyze:* Determine the root cause of the performance gap
- *Adapt:* Select best practices and modify for company environment
- *Improve:* Enhance and integrate business process improvements.

10.3.2.7 Simulation.[39] Simulation is the use of a model to conduct experiments. The model, which changes over time, conveys an understanding of the system being represented. The purpose of experimenting using simulation is to solve problems by discovering something unknown or testing theoretical solutions to problems. The results of the experiment are then used to make prudent decisions.

Simulation is a tool that characterizes a problem, and provides a means for evaluating potential solutions. Since there are usually many possible solutions for every problem, finding potential solutions requires a thorough understanding of what constitutes the problem. This understanding is accomplished by collecting and analyzing data pertaining to the issue. Candidate solutions are then designed based upon this data and tested in the simulation environment.

Simulation:

- Can promote creativity and zest for trying new ideas
- Can predict outcomes for various courses of actions
- Can account for the effects of variances occurring in a system
- Promotes total solutions
- Brings expertise, knowledge, and information together
- Can be cost effective in terms of time.

Simulation addresses aspects of processes for which activity and data modeling are not suited. Since activity and data models are static, they cannot cope with the impact of resource flow. Such impacts include bottlenecks, underutilization of resources, and distribution anomalies. In summary, simulation is a useful technique to supplement and enhance the value of activity and data modeling and activity-based costing.

10.3.2.8 Force field analysis. The concept of force field analysis is that any problem or situation is a result of the forces acting upon it. There are two general types of forces involved restraining forces and driving forces. Driving forces are those that are trying to cause a change in a static condition. Restraining forces are those that are trying to maintain the static condition. When attempting change or improvement, if the restraining and driving forces can be understood, the process improvement team can look for ways to enhance the driving forces and moderate the restraining forces.

Force field analysis uses a graphical technique to map the forces that are affecting situation. All of the restraining forces are shown on one side of a horizontal line that represents the current situation, and all of the driving forces are shown on the other side. In the example shown below, the improvement team wants to drive down the defect rate in a process. The forces that are restraining this effort are shown below the situation line, and the forces that are driving this effort are shown above.

38 *The Benchmarking Workbook*, Gregory H. Watson, Productivity Press, Cambridge, 1992.

39 This subsection was extracted from the *Functional Process Simulation Guidebook*, ANSER, December, 1993.

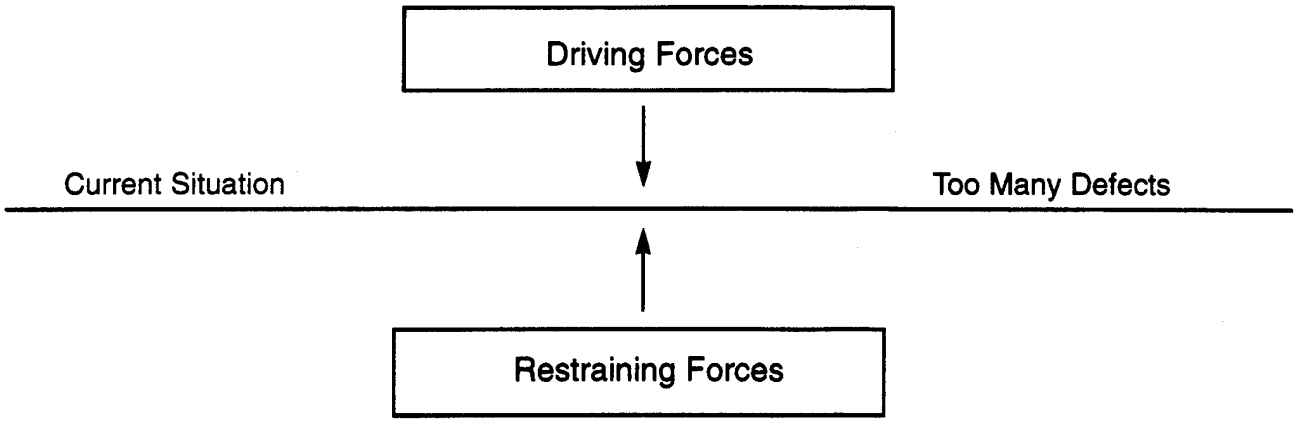

Figure 10-3. Force Field Diagram

One driving force may be customer complaints, another, management imperative. A restraining force may be poorly maintained equipment.

Once all of the forces are mapped, it becomes possible to see how opposing forces line up and then look for ways to counter forces against each other so that the current situation moves in the direction of the desired improvement. Force field analysis is particularly valuable in investigating organizational change management issues including the very familiar *resistance to change* syndrome which is a restraining force. A driving force that could counter the resistance to change force might be a change in employee incentives If the incentives are sufficient, resistance to change will be overcome.

Force field analysis works very well with cause and effect analysis (described later), which can be used to determine the root cause of both restraining and driving forces. For instance, the improvement team may want to use cause and effect analysis to determine the source for the restraining force—resistance to change. Once the causes are known, cause and effect analysis can again be used to determine exactly what kind of incentive package (driving force) it would take to overcome this restraining force.

10.3.2.9 Economic Analysis. Economic analysis is a structured technique that can be used to identify alternative solutions to a given problem, and then select the most cost-effective alternative. Economic analysis uses a simple six step process.

1. State the problem to be solved or the desired accomplishment in non-biased, objective terms.

2. State the assumptions and constraints that form the boundary conditions for developing alternative solutions. Assumptions are explicit statements (but not facts) used to describe the present and future environment upon which the economic analysis is based. Constraints are factors external to the environment that limit the number of alternatives which can be developed.

3. List all of the alternative solutions for the defined problem. Alternatives take the form of make v buy, buy v lease, repair v replace, automation v manual, and change v status quo.

4. List all of the costs and benefits for each alternative. Benefits must be stated in quantifiable (measurable) terms although not necessarily monetary terms.

5. Compare alternatives in terms of their costs and benefits in net present value terms. Usually, software algorithms are used to automate this procedure.

6. Adjust alternative solutions for risk and sensitivity. Risk analysis takes into account the uncertainty of future results based on present actions. Sensitivity analysis is a method of compensating for the uncertainty of the assumptions upon which the choice of alternatives were made.

10.3.2.10 Program Decision Process Chart (risk analysis). Program Decision Process Charts (PDPC) are used to develop contingency plans for proposed courses of action. Every course of action (including improvement actions) carries with it the risk of failure. If it didn't, it would probably have already been done.

The starting point for using this technique is to identify the elements of an improvement program or action plan. Often, affinity or relationship diagrams can be used for this purpose. Each component in the action plan is written on a wallchart. For each action, a process improvement team brainstorms all of the things that could possibly go wrong in trying to carry out the indicated course of action. These are noted in a tree-shaped diagram, usually shown horizontally rather than vertically.

For each potential problem, the team then develops potential countermeasures that can be used to overcome each barrier. When countermeasures have been developed for each potential roadblock or problem, the team then evaluates the probability of each problem occurring, the severity of the resulting situation, and the most effective response. From this, an overall contingency plan can be developed that provides the means of monitoring the ongoing effort to see if any of the problems are occurring, and initiate a pre-designed plan of action to head them off if they do. One of the values of the technique is that the chart can be posted to serve as a highly visible reminder of what can go wrong during an improvement effort.

10.3.2.11 PERT/Gantt Charts. PERT (Program Evaluation and Review Technique) and Gantt charts are components of project management systems used to develop, track, and display project scheduling data by task. Each phase of a process improvement project should be scheduled using one or both of these techniques. Automated project management software systems make it easy to incorporate these techniques in any project-oriented activity. The primary requirement to use them is to have a complete work breakdown structure (WBS) that can be used as the basis for schedule development. The tasks that make up the 25-step methodology described in this guide should be sufficient detail for a WBS.

The *Project Managers Handbook* noted in appendix B is a complete guide to project management principles and practices. While it was developed to support construction projects in the U.S. Army Corps of Engineers, it can still be easily adapted to process improvement projects.

10.3.3 Operational Techniques. The techniques described below are called operational techniques because they should be used on an ongoing basis to support process management (see section 2) as well as process improvement. Often process improvement projects and actions are warranted on the basis of the day-to-day results of using these operational techniques. When process problems occur on a continuing basis, or exceptional problems reoccur more frequently than expected, it can be an indication that process redesign efforts are required.

10.3.3.1 Checksheets. A checksheet is a simple method of collecting recurring process-related data at its primary source. It provides an easy, structured means of recording data related to an activity that has many uses, including supporting process management and improvement efforts. There is no standard form for a checksheet. Each checksheet is specifically designed for its intended purpose. There are guidelines for developing them:

- The checksheet should be easy to use as a natural add-on to a routine task or ongoing assignment.
- Each entry in the checksheet should take only a second or two to make.
- It should be easy to organize, tabulate, and summarize the entries on the checksheet.

- It should be easy to spot potential or actual problems by glancing at the checksheet.
- When location is important such as the number of defects reported for a product, the checksheet should be constructed as a model or a map of the product to give visual evidence of where most problems are occurring.
- The checksheet should be coded for the day of the week, time of day, collection point, person doing the recording, and any other factor that could be useful in drawing conclusions from the checksheet data.

Checksheets can be used to find patterns in recurring events. Such patterns could be related to time-of-day, a specific machine, an individual operator, a particular type of customer, a physical location, etc. Checksheets provide factual data that can be used in place of subjective data to guide process management and process improvement efforts. Checksheets can provide data that can be used with other techniques such as Pareto charts and cause and effect diagrams.

The following is an example of a checksheet used to log types of customer complaints.[40]

Customer Complaint Log	Week Ending: 3/11/94	
Rude sales person	XXXXXXXXXXXXXXXXX	18
Selling price not marked	XXXXX	5
Evening hours too short	XXXXXXXXX	9
Waited too long for service	XXXXXXXXXXXXXXXXXXX	20
Poor selection for "big & tall"	XXX	3
Dressing room cramped	XXXX	4
Too expensive	XXXXXX	6
Poor location	X	1
Poor display	XXXXXXX	7
Not enough styles	XXXXXXXX	8
Poorly lit	XXX	3
Confusing return policy	XXXX	4
Store Clerk: P. Smith	TOTAL	88

Figure 10-4. Checklist

40 *Using Quality Improvement Tools to Build Customer Satisfaction*, J. Stephen Sarazen, American Management Association Extension Institute, 1992.

10.3.3.2 Control Sheets (Run Chart). A control sheet or run chart is a line graph plotted over time that records events occurring in a process. Unlike the checksheet described above, the control sheet is used to determine the amount of variation in a standard process over time. Unlike a histogram, the control sheet shows the precise time that an out-of-control event occurred, or the tendencies of the process over a period of time.

Control sheets are closely associated with *Statistical Process Control,* (SPC) and find their primary use in manufacturing or process control applications. Lately SPC techniques have been tried with success on service-based processes. The primary requirement is having an acceptable and reliable way to collect data. Once the data is collected, it is subjected to statistical evaluation that provides a scientific basis for establishing the amount and nature of process variation. The variation is expressed in terms of standard deviation (ie 6-sigma quality), number of out-of-range events, and patterns of process performance. These data can be used to determine when a process is in need of redesign or improvement.

Successful use of this techniques requires a basic understanding of statistical methods and design of experiments. It is not generally recommended for use by functional people who do not have the requisite training.

10.3.3.3 Cause and Effect Analysis. Cause and Effect (C&E) diagrams (also called fishbone diagrams because of their shape, or Ishikawa diagrams because of their creator) are useful for many purposes in process management and improvement. C&E diagrams are used to identify the factors that contribute to a problem, a solution, or a situation. It is most often used to find the root cause(s) of a given problem, or the basic element(s) that need to be put in place to effect a solution to a problem.

The graphic nature of a C&E diagram makes it effective to develop although it takes skill and perseverance to develop one well. A C&E diagram can also function as a presentation aid when redrawn in a simplified manner.

To use a C&E diagram, the problem to be solved (the effect) is written at the right end of a horizontal line. Diagonal lines are drawn on either side of the horizontal line with each line representing a major facet related to the problem. Often standard headings are used for these diagonal lines consisting of people, machines, measurements, material, information, and finances. The improvement team then brainstorms for all the potential causes of the problem in each category. As a cause is identified, the question is asked, what caused that and so on until several levels of underlying causes are uncovered. With this information, the process improvement team can proceed to use other techniques to develop solutions for the causes of the main problem.

A C&E diagram can get quite messy and it must sometimes be redrawn or broken down into smaller units (each unit headed by an effect). While not as effective visually, a C&E diagram can also be developed in indented outline form. It is also helpful to convert a completed fishbone diagram into an outline form before proceeding with other techniques.

10.3.4 Techniques Matrix. The following matrix can be used as a guide for selecting techniques by process improvement phase. This matrix is only a guide and should not be interpreted as restricting the use of techniques to any particular phases. The following symbols are used in the matrix:

- PL - Planning Phase
- RE - Process Reengineering Phase
- CM - Organizational Change Management Phase
- TI - Technical Change Management Phase
- EE - Enterprise Engineering Phase
- PE - Project Execution Phase.

10.4 Automated Tools

Many of the techniques described in this section are supported with automated tools. For each of these tools, there are one or more commercial or government off-the-shelf products

TECHNIQUE / PHASE MAPPING	P L	R E	C M	T I	E E	P E
Survey/Interviews	⊠	⊠	⊠			
Site Visits/Focus Groups	⊠	⊠	⊠			
Questionnaires/Assessments	⊠		⊠	⊠		
Flowcharting		⊠			⊠	
Process Deployment Map/Matrix	⊠	⊠			⊠	⊠
Creative Thinking/Brainstorming	⊠	⊠	⊠	⊠	⊠	
Checksheets		⊠				⊠
Nominal Group Technique	⊠		⊠			
Multi-voting	⊠		⊠			
Groupware Tool	⊠	⊠	⊠			⊠
Pareto Diagrams		⊠	⊠			
Cause and Effect Diagrams		⊠	⊠	⊠	⊠	
Affinity Diagrams	⊠	⊠			⊠	
Relationship Diagrams	⊠	⊠	⊠			⊠
Tree Diagrams		⊠		⊠	⊠	
Hoshin Planning	⊠					
Process Decision Program Charts		⊠		⊠	⊠	
Force Field Analysis			⊠	⊠		
Matrix Diagrams		⊠		⊠	⊠	
Quality Function Deployment	⊠	⊠			⊠	

Figure 10-5. Techniques Matrix

available. The CIM Center for Functional Process Improvement Expertise maintains an up-to-date list of software tools, and has many of these tools available for demonstration or for use on a loan basis. Please call the Center at this number for more information: 1-703-892-4260.

10.4.1 Groupware Tools. Lotus Notes and Vantana V are two widely used products for supporting groupware requirements.

10.4.5 Benchmarking Tools. The American Society for Quality Control has a benchmark product available. They can be reached at this number: 1-800-248-1946.

10.4.6 Quality Function Deployment Tools. Several commercial companies are now introducing software to support the higher matrices of QFD.

10.4.2 Modeling Tools. Tools such as Leverage and Design IDEF are readily available to support modeling workshops. These products are productive when used in IDEF workshops. There are also several commercial programs available to support process mapping and flowchart activities.

10.4.3 Simulation Tools. Software programs to support simulation including cycle time and resource usage are becoming available. Some of these tools are designed to work in conjuction with IDEF models. Others require model development before they can be effectively used.

10.4.8 Economic Analysis Tools. Several products are available from government sources for use in economic analysis. The Support Center can make these available on a loaner basis.

10.4.4 Project Management Tools. There are a wide variety of project management software tools on the market. They range from easily to use to extremely robust. Some of the most widely used include OpenPlan, Harvard Project Manager, and Primavera.

10.4.7 Control Sheet Tools. There are many statistical tools now available. Most include software that supports several of the quality techniques described in this sections such as cause and effect, barrier analysis, and histograms.

SECTION 11. BRE, TQM AND INFORMATION ENGINEERING

This section discusses some general concepts and strategies associated with process improvement, and the relationship of process reengineering to other methodologies. Process reengineering shares many of the same objectives and goals as Total Quality Management (TQM), especially with respect to organizational structure and cultural modernization. Process improvement projects will be more successful and implemented faster if they mesh well with the organization's information engineering strategy. Finally, project improvement projects must be conducted according to accepted principles of project management if risks are to be minimized and improvement costs contained.

11.1 Process Improvement Concepts

This section reviews some of the principles of process improvement and defines basic terminology. It also elaborates on Section 2.2.5—Functional Integration, and Section 2.2.5—Migration and Transition Issues.

11.1.1 Process. A process is defined as an organized grouping of activities that takes inputs (data and materials) from an internal or external supplier, adds value to them in accordance with the purpose of the process, and provides the output to an internal or external customer. Processes consume resources as they transform inputs into outputs. Processes are also constrained by various controls imposed on them.

Quite simply, if the value of the outputs of an activity exceed the total cost of the inputs plus the cost of the resources consumed, the activity is considered to be value added. If not, the activity is non-value added. The purpose of process improvement is to optimize value added activities by improving quality and reducing cycle time, while at the same time eliminating or minimizing non-value added activities and costs.

Enterprises, including DoD can be organized in essentially four ways:

- Function — Accounting, personnel, engineering
- Product line — Chrysler, Dodge
- Geography — Central Region, Arizona
- Process — Order fulfillment, operational intelligence.

The first three organization types are basically hierarchical (vertical structures) while the fourth, Process, is horizontal. By horizontal, it is meant that the process crosses one or more functional boundaries within the enterprise.

In DoD, sustaining base operations are essentially organized by function while military operations are organized by geography. Full implementation of a process improvement will require a move to a more horizontal (process) management structure, because vertically organized enterprises inherently contain huge amounts of non-value added costs and activities. We give the name bureaucracy to this phenomenon.

Processes can be viewed in their entirety in what are called end-to-end processes, or as any level of subprocess. Except in moderately sized enterprises, processes must usually be broken down into a reasonable size before process improvement projects can be conducted with a reasonable expectation of success.

11.1.2 Process Modeling. Modeling functional processes and the associated data and information needs is a fundamental concept in the process improvement methodology. Models are used in two ways; first to define, understand and communicate the way functional processes currently work (the AS-IS condition); and then, following improvement analysis, the way these same processes could or should work (the TO-BE condition). The guidebook *Corporate Information Management: Process Improvement Methodology for DoD Functional Managers* fully introduces the concepts and facilities of modeling.

11.1.2.1 Activity model. Activity models show the interrelationships among the activities that make up a functional process or the part of the functional process under review. These interrelationships are expressed in terms of ICOMs where:

- I means input (data and materials)
- C means control (standards, regulations, requirements, budgets, etc.)
- O means output (products and services)
- M means mechanism (labor hours, machine hours, etc.).

The activities that make up a process are analyzed by a technique called decomposition (subdividing an activity into its component activities) until the required level of detail is obtained.

11.1.2.2 Data model. Data models show the interrelationship among the data entities that support functional processes. A data entity represents a person, place, thing, concept, idea, or event. For instance, *Employee* would be an entity in any process that involves employees.

Entities are composed of attributes (data items) that contain information about the entity. In most cases, one or more attributes are assigned the role of *keys* or *identifiers* for the entity. Keys provide a means of selecting and accessing an occurrence of an entity from a file or database system.

11.1.2.3 AS-IS condition. When both an activity and a data model have been developed and validated that describe how the functional process under study actually works, the AS-IS condition for the process has been established. This is also called the baseline for the process. With the baseline established, the process improvement efforts have a fixed starting point as well as a reference point for measuring the degree of improvement obtained. The concept of a baseline is vital. Without a baseline, improvement efforts run the risk of *going in circles* or sub-optimizing the process during redesign.

11.1.2.4 TO-BE condition. There are many techniques used in improvement analysis. Once a set of potential improvements has been identified (called an initiative), the AS*f*IS models are adjusted to show how the process will work once the improvements are implemented. The redesigned models are called the TO-BE condition for the process. More than one set of TO-BE models may be developed if there are alternative designs that will implement the planned improvements.

The TO-BE models have many uses:

- They function as a *strawman* for discussion purposes
- They provide a means of testing improvement assumptions
- They help communicate proposed slates of improvements
- Once a set of improvements is implemented, they can easily be adjusted to become the new AS-IS condition (new baseline) for the improved process.

11.1.3 Functional Process Integration. It is usually not feasible to initiate process improvement projects for functional processes that are large, complex and that cross many organizational boundaries. It is generally too disruptive, requires too many people on the process action team, costs too much to complete, and carries with it a high risk of failure.

Functional process improvement can proceed in stages, each of which deals with a subset of the overall processes. At the proper time, these subsets are combined using the concept of functional process integration. Figure 11.1 illustrates this concept within a functional area with five functional activities, each of which deals with one part of the process. As shown in the figure, two integration projects will be launched to combine (integrate) the results of separate improvement efforts. Project (X) will be an integration of the efforts of projects (A), (B), and (C).

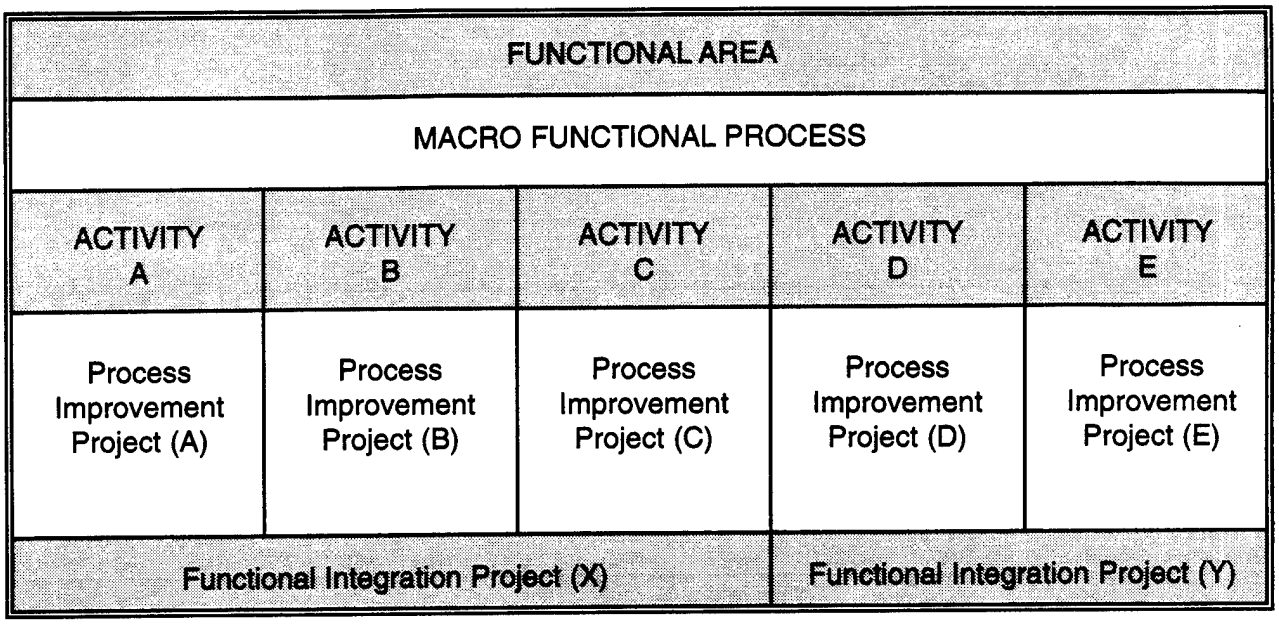

Figure 11-1. Functional Integration

The goals of integration are to:

- Manage strategic changes in processes from a DoD-wide perspective to achieve optimum solutions for defined customer needs
- Share common processes, data and support mechanisms, and information systems—thereby reducing unneeded redundancy and overhead.

The strategy for integration is based on developing a full understanding of functional processes by building activity and data models, which are then analyzed to uncover opportunities for integration in four principal areas:

- Measures that are common to functional processes
- Data in order to maximize the use of shared data
- Methods utilizing *best practices* techniques to optimize performance
- Technologies to enhance systems interoperability.

The DoD Enterprise Model is the basis for all integration activities and provides a framework for initiating and managing integration efforts.

Integration efforts are managed using proven reengineering techniques:

- Standard data, which is mandatory for integration efforts
- Resolve inconsistencies between performance measures and critical success factors in each functional area and activity
- Look for integration opportunities through the elimination of redundant activities and conflicts in resource utilization
- Standardize/consolidate like activities or justify the maintenance of duplicate activities
- Assist in migration/integration of related information systems

- Develop Data Management Plans (DMPs) and Technical Management Plans (TMPs) to a sufficient level to support integration efforts.

The Defense Data Repository System (DDRS), which contains many of the metadata (definition and model data) about data, processes, and information systems, is a primary tool for integration efforts. Once integration at the functional level is accomplished, integration at the technical level can proceed with higher levels of confidence that enterprise and organizational goals and objectives will be met.

11.1.4 Performance Measures. Process improvement projects are designed to improve the performance of functional processes. The term *improvement* suggests measurement. Functional managers must know the critical measures of performance that will be used to judge the success of their improvement efforts. Performance measures are discussed in more detail in Section 2 of this guide. Measurements are important because they:

- Focus attention on the factors associated with successful mission achievement
- Indicate how efficiently assigned resources are being used
- Assist in setting measurable business objectives and monitoring progress in achieving them
- Provide input for improvement analysis including root cause analysis, trendline analysis, and many other analysis techniques
- Provide data needed for benchmarking programs
- Set employee performance targets
- Establish a means of monitoring ongoing progress.

11.1.5 Information Systems. Under the CIM program, responsibility for effective use of information system assets becomes the responsibility of the functional managers who benefit from them. In other words, the functional manager is considered to be the customer of information services on a fee-for-service basis and is charged with the responsibility of spending wisely to obtain needed services.

The technical organizations are charged with the responsibility of maintaining the technological infrastructure that serves the DoD as a whole. By analogy, assume that the technical organizations keep the furnace in good repair, but the functional managers call for the heat they need in their own areas, and then pay for it.

It is the objective of DoD to achieve an open systems environment that can support all of the mission areas of the Department utilizing off-the-shelf products, shared data systems, client-server architectures, single user interface (graphical, tactile, and voice-sensitive), single point of entry for all data—all with appropriate privacy, security, and reliability controls in place.

Currently, most DoD functional processes are supported in their information systems needs by legacy systems. Legacy systems are the systems currently installed in DoD agencies and components, many of which are technically, if not functionally, obsolete and costly to maintain.

Migration systems are existing information systems that have been selected as a standard system to support existing processes. Whenever feasible, two or more legacy systems are consolidated into one migration system. Some migration systems may evolve directly into an open systems environment.

Target systems are migration systems that have been upgraded to support process improvement actions based on approved functional economic analysis (FEA) decision packages. Over time, target systems will be converted to the open systems environment.

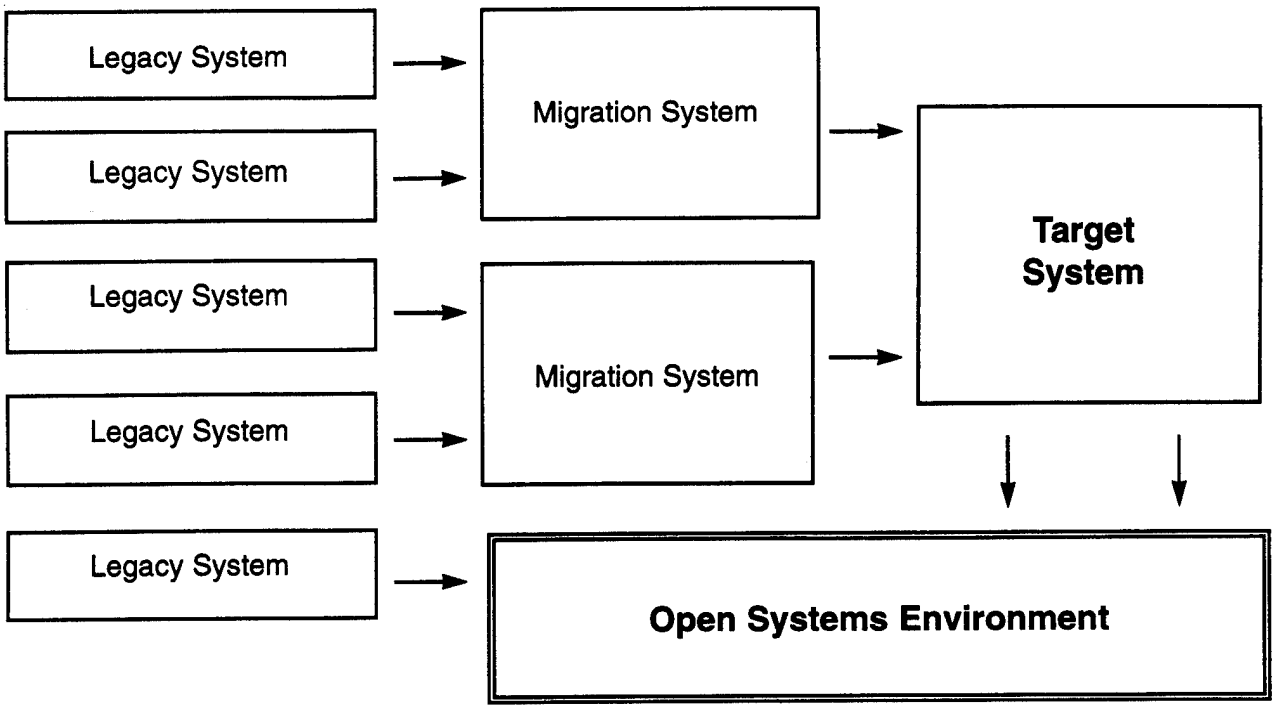

Figure 11-2. Information Systems Migration

Figure 11.2 shows the relationships of these systems categories and how legacy systems will eventually be converted.

11.2 Total Quality Management (TQM) Concepts

In our traditional management system, each department, intact team, and individual keeps its head down and does the job assigned. Within the thick, high walls of each function's "stovepipe," individual contributors, teams, and management staff work to optimize the efficiency of their own unit. Performance appraisals, merit rating systems, and compensation are all designed to reinforce this narrow view. In this system, senior and middle managers use their "command and control" hierarchy to plan, direct, staff, coordinate, and control the functional units. Deep inside their dark stovepipes, with little or no contact with their internal or external customers or suppliers, workers and their supervisors look up the stovepipe to management and their support staff for direction and feedback.

We now know this system is obsolete. It is too slow...and improvements are often not focused on customer needs. In simpler times, this system worked. In today's much more complex and fast-moving world, this approach is about as useful as buggy whips and Morse code. Those organizations still clinging to this vertical structure are collapsing, like planned communist economies, under the weight and cost of their lumbering, unresponsive bureaucracy.

Connecting teams to their internal and external suppliers and customers and helping them to cooperatively manage processes as they flow across functions will flatten hierarchies as well as smash stovepipes.

— Jim Clemmer,
Firing on all Cylinders,page 83

Government and industry have come to understand that previously acceptable quality norms of goods and services are no longer acceptable.

Customer satisfaction, reliability, productivity, costs and for industry, market share, profitability, and even survival are directly affected by the quality of an organization's products, services and performance.

Therefore, it becomes essential to develop attitudes and systems—at all levels of an organization—that promote and implement continuous improvement of procedures, processes, products and services. Those attitudes and systems are the focus of Total Quality Management (TQM), also termed Total Quality Leadership (TQL)..

The objective of TQM is to broaden the focus of quality to embrace the concept of continuous process improvement. To change the concept of quality from the traditional to the modern as listed below:

Traditional	**Modern**
Defect correction	Defect prevention
Quality by inspection	Quality by design
Acceptable levels of defects	World class quality
Emphasis on cost and schedule	Emphasis on quality, cost, and schedule

—Total Quality Management Guide, A Two Volume Guide for Defense Organizations, Final Draft, 2/15/90

Total Quality Management is about transforming organizations from the industrial age paradigm to an information age paradigm. TQM principles are quite compatible with process reengineering principles. The objective is the same—to improve processes. Differences are in degree of change, speed of change, and technique. This section will focus on some of the improvement areas and concepts particularly emphasized by TQM practitioners.

11.2.1 Domains. The design factors for quality exist at three levels: the core product or service, the support available to the customer, and the service enhancements that represent the intangibles that provide customer satisfaction. Process owners should consider the quality implications at all three levels as part of an improvement program.

The organization itself controls the first two domains of quality—the core product and the support package that goes with it. These are often referred to as "Hi-Tech" items. But the individual employee who is in direct contact with the customer controls the third domain, enhanced service. This is often referred to as "Hi-Touch." This is why quality and process improvement programs must involve everyone in the organization because virtually everyone has a customer, the recipient of his or her work project..

11.2.1.1 Core product functionality. This domain is concerned with the actual product or service delivered to customers. There are essentially three

elements of concern with respect to improvement programs:

- Meeting minimum customer requirements
- Product/service reliability
- Ease of use.

11.2.1.2 Product support. This domain covers all of the support services available with the basic product or service. The most important factors with respect to quality include:

- Accessibility
- Convenience
- Dependability
- Maintenance and service
- Repair and replacement
- Installation and training.

11.2.1.3 Customer Service. This domain is more difficult to characterize because it primarily deals with the specific day-to-day interactions between customers and employees, which are not within the direct control of management. Quality in this domain is a function of values and beliefs and how well they're practiced, employee empowerment to act, training in quality and service, and the degree to which the organization is service-driven rather than rule-driven.

11.2.2 Variables. There are four primary variables to be considered in quality management programs. Figure 11.3 shows the way TQM positions quality-related variables. For instance, fitness for purpose is a product characteristic that is evident outside of the organization, while conformance to standard is more of an internal variable. Organizational values affect employees and are easy to discern from outside the organization, while cultural values are more of an internal value.

11.2.2.1 Fitness for purpose. This variable primarily influences the product or service and the consequences are felt outside of the organizational unit. Joseph Juran promotes fitness for purpose as a major element in the concept of quality and teaches that when quality is designed into the product, the product will be fit for use.

Quality questions associated with this variable include:

- How will the product be used?
- Where will the product be used?
- Who will be the users?
- Are there any potential dangers to health and safety?

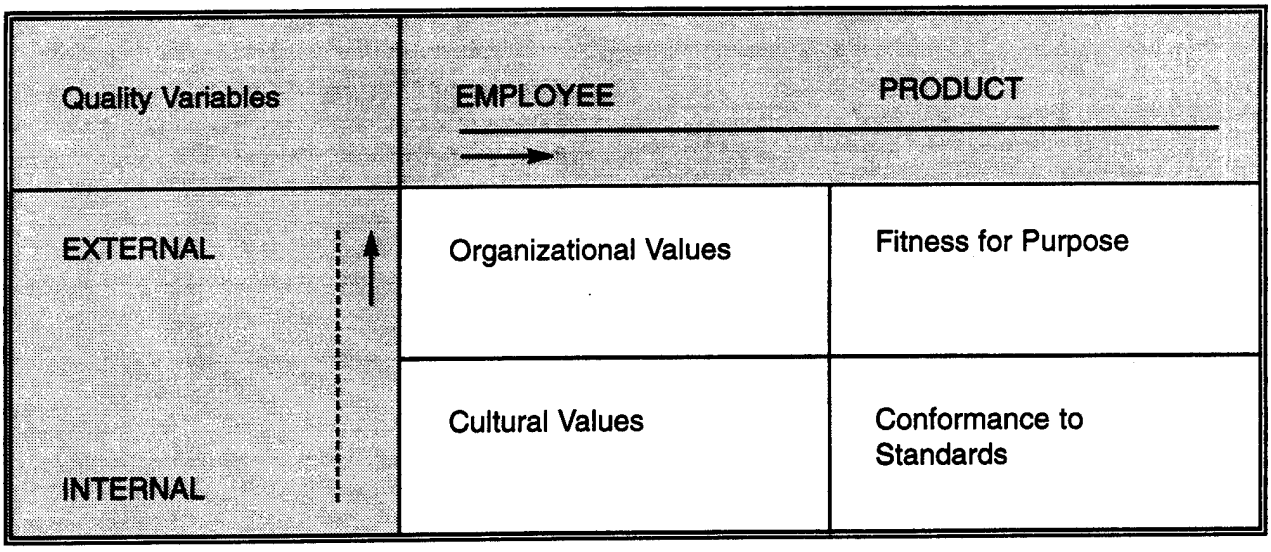

Figure 11-3. Quality Variables

- Are there any potential risks to society or the environment?
- What is the urgency for delivery?
- What other sources for the product exist?
- Are there any innovative uses for the product?

11.2.2.2 Conformance to standards. This variable primarily influences the product or service and the consequences are felt within the organizational unit. W. Edwards Deming was a proponent of statistical quality control and taught that constant vigilance is the key to maintaining high quality standards. He promoted the Shewhart cycle, named after Walter Shewhart, which entails continuous process improvement and innovation.

PLAN Develop product specifications based on customer needs. Develop performance measures and the means to check them.

DO Design the processes that will produce the products and services. Work the processes and collect quality, service, and management data.

CHECK Develop variances of actual performance to plan and develop improvement initiatives to correct deficiencies.

ACT Implement the process improvement program and incorporate new technologies as appropriate.

11.2.2.3 Cultural Values. This variable primarily influences the employee, and the consequences are felt within the organizational unit. The Total Quality Management culture is based on three factors:

- Management commitment and leadership
- Training and skill in applying the techniques and tools of process improvement
- Organization-wide involvement and employee empowerment.

Without a strong quality training program that considers all three aspects, most quality and process improvement programs and projects will fail, or deliver far less value than they could have.

> Our present culture is permeated by an atmosphere of distrust. We devise intricate checks and balances to control every action with a bureaucracy that boggles the mind and causes excessive administrative costs. Meanwhile, we fail to train our managers for leadership, pay little attention to the system that allows counterproductive efforts to go unchallenged, do not properly educate, train or motivate our personnel to be effective and productive, nor do we allow them to contribute to the full extent of their abilities....Rather, we should be putting the desired achievements on the spot light, provide leadership and incentives for success, and measure and reward in accordance with achievements.
>
> —*Total Quality Management Guide, A Two Volume Guide for Defense Organizations,* Final Draft, 2/15/90

11.2.2.4 Organizational Factors. This variable primarily influences the employee, and the consequences are felt outside the organizational unit. Continuous process improvement and the quality/service environment can only flourish within the limits established by the organizational structure.

Rigid hierarchical organizational structures, layer upon layer of management and oversight, rule-based rather than performance-based reward systems, thick procedures books and a form for every purpose—all work against establishing an organization that can prosper as a Total Quality Management enterprise.

The effects of organization are felt outside the organization and have major impacts on the third domain of quality described above. If a customer hears any of the following remarks from an employee either on the phone or in person, it is a sign of probable organizational constipation.

- I'm sorry, I can't help you.
- You'll have to come back tomorrow.
- I have to take my break now.
- We don't do that/we're not allowed to do that.
- That's not my department/there's nothing I can do.
- Could you call back some other time.
- I don't know anything about that product/service/problem.
- He doesn't work here any more, and he had your file.
- You'll have to get in that other line.

The ideal organization:

- Is managed primarily by process rather than function
- Uses self-managed teams that are empowered to make decisions
- Is intensely focused on customer service
- Is performance, rather than rule-based
- Rewards unit performance and individual skill development
- Has minimal but sufficient administrative controls.

11.2.3 Improvement Objectives Independent of Methodology. Both process reengineering and TQM have the same goals with respect to the business process itself. The characteristics of a well-managed process are listed below. If the process in question is deficient in one or more of these areas, process improvement is called for whether the methods used are reengineering or TQM.

This list of process attributes can be the beginning of a meaningful process vision statement.

- The process is assigned to a process owner who is accountable for results.
- The process is well-bounded with respect to the enterprise, and external customers and suppliers have been identified.
- The internal (subprocess) boundaries have workable interfaces between the process and internal customers and suppliers.
- All controls (policies, procedures, standards, rules and regulations) are applicable, appropriate, and well-documented.
- Performance measures, key indicators, and critical success factors are in place and used as part of a continuous improvement program.
- All products and services have been validated against true customer needs and requirements and are best-in-class.
- All suppliers are involved in the continuous improvement process.
- Resources are used primarily to support value added activities, the unit costs of all major outputs are known, and the "tooth/tail" ratio is optimum for each class of output.
- There is minimum waste, rework, rejects, returns, service call-backs, customer complaints, and other negative measures associated with the processes' inputs and outputs.
- The process, products and services, and performance targets have been developed or validated using benchmarking and best practices techniques.

11.2.4 The TQM/BRE Relationship. TQM (or Total Quality Leadership—TQL) and process reengineering (BRE) are closely related. The differences are more academic or political than real. Much organizational grief can be avoided by downplaying the names given to process improvement and focusing on the application of

whatever methods, techniques, and tools will get the job done.

In time, there may be no practical distinction between TQM and BRE. Both concepts deal with essentially the same elements and strive for common objectives. If there are distinctions, they are ones of emphasis rather than exclusion. The reader may feel free to move any of the following issues from one category to the other.

TQM is biased toward dealing with these issues:

- Cultural issues
- Management and organizational structuring
- Reward and recognition systems
- Mission and function refinement
- Strategic and business planning
- Customer relations
- Product feature specification
- Controls, constraints and standards
- Product quality more than services quality
- Benchmarking
- Process design
- High-Touch
- Continuous improvement.

BRE is biased toward dealing with these issues:

- Process issues
- Process analysis and redesign
- Supplier relations
- Input requirements (data and materials)
- Resource management and utilization
- Cost driver management
- Best practices analysis
- Information systems support issues
- Services quality over product quality
- Cost issues
- Response and throughput time issues
- High-Tech
- Quantum (orders of magnitude) levels of improvement.

Figure 11.4 shows how TQM and BRE arrive at the mutual objective of satisfying customers and producing superlative products and services. To read the chart from the perspective of a TQM practitioner, start at the top and move toward the center and to the right. To read it from the perspective of a BRE practitioner, start at the bottom and move toward the center and to the right.

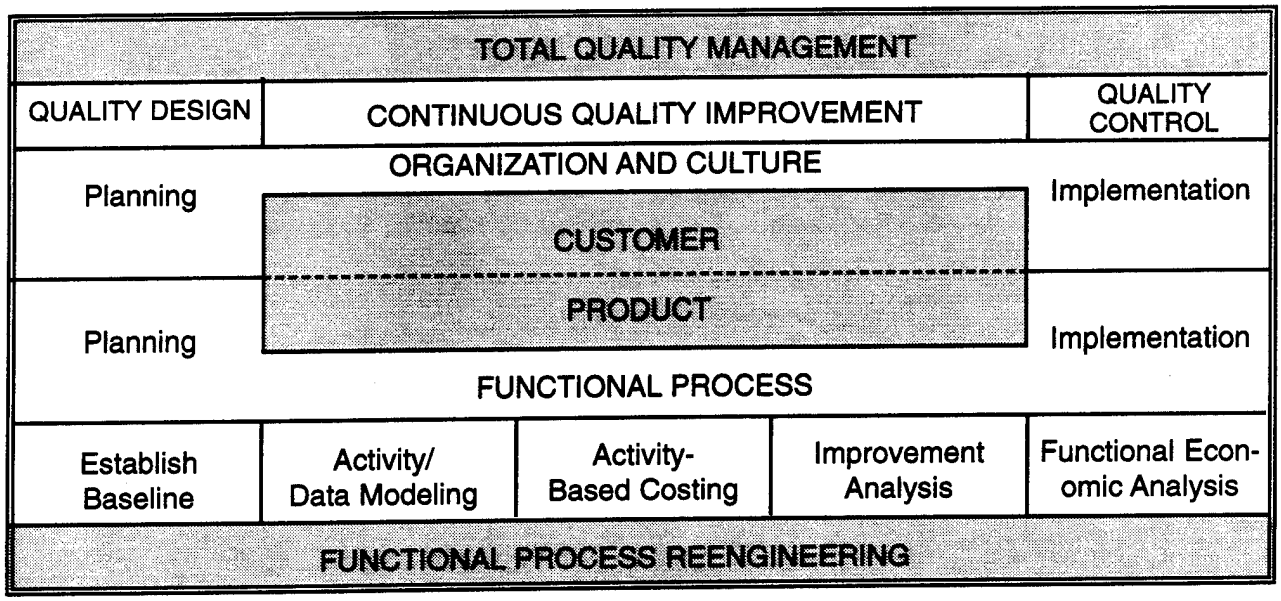

Figure 11-4. TQM/BRE Chart

TQM planning and implementation issues center around management and organizational issues; BRE planning and implementation issues deal with processes.

11.3 Information Engineering Concepts

Information engineering is concerned with devising automated systems that support functional processes consistent with the overall technical infrastructure established by the OSD. The technical elements function as a supplier of information services to the process or functional manager who is the customer. Value-chain analysis theory hold that suppliers (technical elements) are an integral part of process improvement planning.

Information engineering uses a standard methodology and various techniques and tools to create applications and database structures based on functional activity and data models. The Defense Data Repository System (DDRS) is designed to facilitate the relationship between the functional and the technical elements.

Actual application systems development proceeds in accordance with the Life Cycle Management of Information Systems (LCMIS) program using a variety of computer-aided software engineering tools (CASE).

The techniques and tools incorporated into the three methodologies of Total Quality Management, Process Reengineering, and Information Engineering can be used together to construct the modern enterprise. Figure 11-5 suggests the relationships among these three methodologies.

The emphasis in TQM is to ensure that the enterprise knows what it is trying to achieve and why. Strategic and business planning techniques are used to understand the environment in which the enterprise functions, the customers it will serve, and the products and services it will build to serve those customers. As part of this process, the enterprise adapts a quality culture and restructures its organization into an information age paradigm.

The functional architecture, described in DoD 8020.1-M, is the linkage between the planning aspects of TQM and functional process improvement. The functional architecture contains data about mission, scope, rules, methods, management processes, goals, objectives, performance measures, performance targets and the functional management strategy.

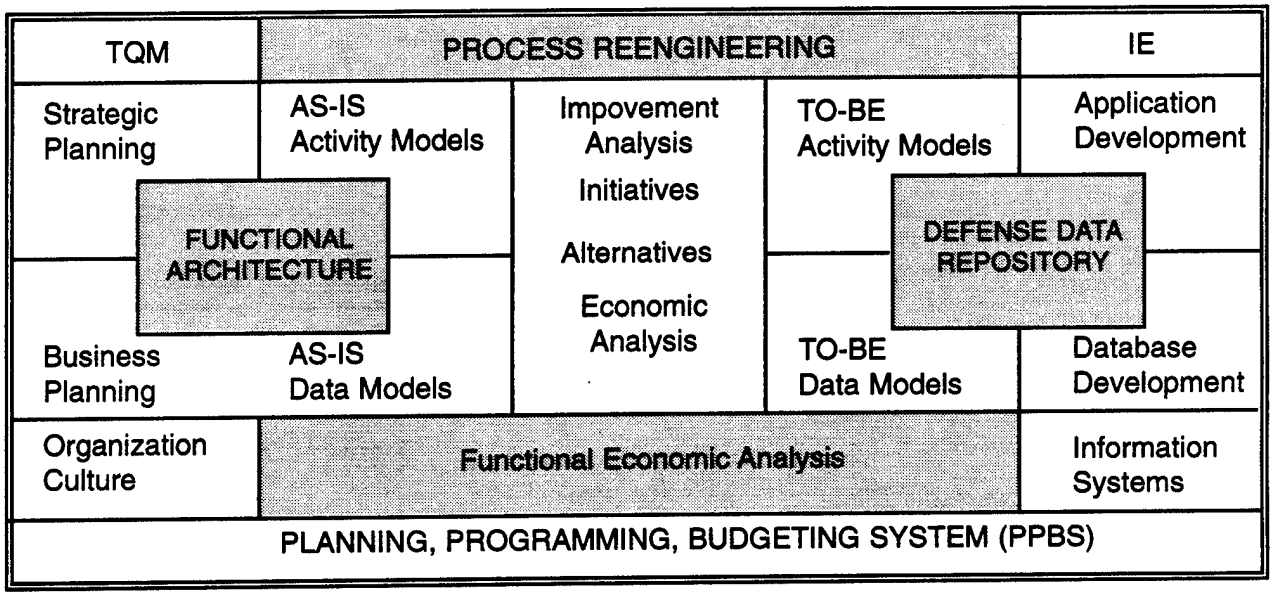

Figure 11-5. TQM-BRE-IE Relationship Model

From the functional architecture, BRE techniques are used to develop AS-IS data and activity models, cost models, and cycle time data. The AS-IS models form the basis for improvement analysis, which leads to a series of improvement initiatives.

Techniques are used to develop alternative approaches to implementing improvement initiatives and performing economic analysis on those alternatives.

Proposed improvement packages are used to transform the AS-IS models into TO-BE activity and data models, which reside in the DDRS. (AS-IS models are also stored in the DDRS.) Meanwhile, the functional manager prepares the FEA, which contains the proposed improvement packages along with all business, functional, economic, and technical justification data.

Once the FEA is approved, the information systems components of the improvement package can be developed by the information engineering staff using the facilities of the DDRS and appropriate CASE tools. The role of the software engineers (using LCMIS methods) is to produce the supporting application systems and restructure the corporate databases to accommodate the change initiative.

The PPBS crosses all methodologies and acts as a consolidation and control vehicle, as well as a means of communicating the proposed impacts and potential effects of all actions, changes, and new developments to higher authority.

11.4 Life Cycle Project Management Concepts

The Framework methodology for process improvement is designed for compatibility with project management principles in general, and life cycle project management (LCMIS) requirements in particular.

11.4.1 Concepts of Project and Project Management. All process improvement programs and actions should be organized and managed as a project. A project has the following characteristics:

- It is well-organized and includes appropriate team members.
- It is well-planned using Work Breakdown Structure concepts.
- It is well-executed using Critical Path Methods for schedule control.
- It is well-tracked using proven exception handling procedures.
- Its management is well-coordinated with functional management.
- Project records and documentation are appropriately maintained.

The critical success factors for project management include the following:

- Attention to organization and team building
- Project conceptualization and planning
- Rigorous schedule and milestone performance management
- Rigorous budget management
- Enlightened human resource management
- Effective coordination and communications management
- Organized records management
- Use of automated project management support tools
- Conformance to policy and directives.

Other important elements necessary to successful project management include:

- Full support from senior leaders
- Selection of a well-trained project manager
- Appropriate facilities apart from the normal work stations
- Appropriate computer hardware, software, office machines, communications, and training and presentation equipment
- Administrative support for documentation and records management

- Facilitation and/or consultative support
- Sufficient time and funds to do the job right the first time.

11.4.2 Life Cycle Management.c. Life Cycle Management of Information Systems (LCMIS) is a program designed to optimize the development and deployment of information systems on a DoD-wide basis. The LCMIS program helps ensure that information systems dollars are spent wisely by ensuring that existing systems are utilized to their capacity and requests for new systems will not result in duplication of effort and unnecessary redundancy.

The LCMIS program is used in conjunction with process improvement whenever the FEA proposes a new information system or significant modifications to existing information systems.

The LCMIS process is structured as follows.

- Manage and Oversee the LCMIS Process
  - Provide Corporate Information Management
  - Manage Planning, Programming, Budgeting System
  - Manage Life Cycle Management Information Systems
  - Manage Acquisition
  - Conduct Information Systems Integration
  - Conduct MAISRC
- Perform LCMIS Project Management
  - Plan Project
  - Manage Resources
  - Manage System Engineering
  - Develop Acquisition Documentation
  - Conduct Cost/Benefit Analysis
  - Prepare MAISRC
- Perform Systems Engineering
  - Perform Concept Development
  - Perform Design
  - Perform Development
  - Perform System Integration
  - Perform Deployment
  - Perform Operational Transition.

11.4.3 Project Planning. The most important considerations for project planning is that the project plan must be in writing and that it be reviewed and approved by all interested parties prior to project execution. The key elements in a well-developed project include the following:

- Statement of Purpose
- Scope of Work
- Work Breakdown Structure
- Organizational Breakdown Structure
- Responsibility Assignment Matrix
- Schedules and Milestones
- Budgets and Cost Estimates
- Quality Management Plan
- Management Control Plan.

Most process improvement programs have a planned duration (life cycle) of six months, but may range from about two to twelve months. The project plan should be as simple as possible based on the expected complexity of the project itself. As a rule of thumb, project management activities (organization, planning, and execution) should consume no more than 15% of the total estimated project time.

11.4.4 Project Execution. Once the project plan is approved, project execution consists primarily of tracking performance against plan and swiftly dealing with deviations in scope, work item definition, assignments, schedule conflicts and performance, cost performance, and unplanned contingencies (issues and problems).

A process improvement project may be organized into planning and execution phases that correspond to the phases in the improvement methodology (Framework). That is, Phase 2, Process Reengineering, may have a complete and

separate project plan; while Phase 3, Enterprise Engineering, may have its own plan. This is generally preferable to trying to plan the entire six phases of process improvement because there are too many unknowns, and budget and schedule estimates will be higher suspect.

SECTION 12. SUPPORT FOR PROCESS IMPROVEMENT PROJECTS

Process improvement is now an important mission within the Department of Defense. Because functional managers are expected to take the lead in initiating and conducting process improvement projects, the Office of the Secretary of Defense has established an extensive system of support services to aid functional managers in carrying out their responsibilities.

Support services include an extensive documentation library, training programs available in a wide variety of media and delivery systems; workshops that furnish just-in-time training and on-the-job facilitation on improvement projects; and sources for additional training, consultation, facilitation, and access to expertise from a number of agencies and components involved in process improvement.

This guidebook refers to some of these support services in Appendix D. If you don't find what you are looking for there, the next step is to call the CIM Process Improvement Hotline at 1-800-TELL-CIM. If the hotline staff cannot answer your questions, they will direct you to someone who can.

12.1 Documentation

The documentation resources available to support process improvement teams include official DoD publications, guidebooks and other informal materials developed by or for the Department, and commercial books and articles relating to process reengineering and total quality management. In addition, many DoD Agencies and Components have developed useful materials out of their experience. Many of these materials are inventoried by the Defense Technical Information Center (DTIC), and can be ordered directly from them. For other sources, call the hotline.

Many of the most important and useful documents are available on a CD-ROM disc which is updated two or three times a year. The CD-ROM contains what otherwise would be about two feet of paper documents. In addition, the CD-ROM includes an index software program to help you quickly locate the information you need. Plans call for a hypertext version of the CD-ROM in the near future.

12.1.1 Framework for Managing Process Improvement. The Framework concept includes an entire library of documents oriented around the six-phase, 25-step methodology described in this document. As of March 1, 1994, the following documents are available:

- F/MPI Methodology Briefing
- F/MPI Planning Tutorial
- F/MPI Performance Cell Tutorial
- F/MPI Organizational Change Management Tutorial.

Approximately 25 supporting documents are planned for the series, and most will be available by September 30, 1994. Section 3.3 in this guide gives a general description of the planned Framework library.

12.1.2 Process Improvement Guidebooks. Guidebooks are designed to support major steps in the methodology and offer extensive instructions on how to prepare key deliverables complete with examples and other supporting information. As of March 1, 1994, the following guidebooks are available:

- Process Improvement Methodology for the DoD Functional Manager
- Functional Economic Analysis
- Functional Process Simulation
- Preparing for and Initiating Functional Process Improvement Programs
- Functional Process Improvement Quality Plan.

The reader should be aware that the methods and techniques of process improvement are in a high state of flux; and there are differences in terminology, concepts, methods and techniques in many of the publications and documents related to the process improvement program. In time, these differences will be resolved.

12.1.3 Other Support Documentation. The Department of Defense is approaching process improvement and quality management using the principles of benchmarking and best practices. Because of this, there is a concerted effort to use industry terminology and adopt the best methods and techniques wherever they may be found. This means that virtually all of the professional literature on process improvement and quality management is applicable to DoD's program. Functional managers involved in process improvement may want to acquire some of the most important references listed in Appendix B.

As experience is gained with process improvement, there are a number of case studies and lessons learned becoming available. For instance, a report is available summarizing the benchmark that was conducted in August 1993 by the Assistant Director for Business Process Improvement. This study covered 12 private and commercial enterprises engaged in programs of process improvement. A case study of the Merced County, California, experience in reengineering a welfare system is now available. The case study emphasizes the organizational change management aspects of reengineering and will be profitable reading for any government agency contemplating a major reengineering effort.

12.2 Training

Training programs are rapidly being developed to support process improvement projects. Many of these programs are available now or are being developed by DISA/CIM. The Information Resource Management College (IRMC) has a number of executive-level courses available on process improvement. The Army Management and Engineering College (AMEC) has a full curriculum of courses covering all aspects of process improvement and total quality management. Several contractors have been tasked to develop additional courses. The International School of Information Management (ISIM) has two distance learning courses available on process improvement.

12.2.1 Skills for Process Improvement Action Teams. The primary skills needed to successfully participate in a process improvement program fall into three categories:

- Methodology expertise as contained in this guidebook
- Skill in selecting and applying the techniques described in Section 10
- Teamwork skills including the personal skills noted in Appendix E.

The success criteria for a process improvement team member include the following, which together could be described as teamwork skills. However, it is doubtful whether these attributes can be taught in a training course.

- Functional expertise in one or more business process areas
- Comfortable with technology, computers and information systems
- Empowered to function in a process improvement team
- Team player who strives for synergy and is supportive of others
- Articulate and concise
- Open-minded and will to listen to others
- Creative and visionary
- Trustworthy and discreet
- Seeks opportunities to improve processes
- Persuasive, able to construct a logical argument for a plan of action
- Deals well with conflict and ambiguity
- Politically astute and can discern which battles can be won or lost
- Conscientious and dependable
- Optimistic, enthusiastic and wants to help the team succeed
- Respected by business peers and senior management
- Proactive and not afraid to take a risk
- A good listener with good interviewing skills
- Has leadership potential.

Considering the skills and attributes thought necessary for process improvement team members, it is not difficult to understand why most organizations who have achieved success report that it takes five to ten years to establish a culture supportive of process improvement efforts.

12.2.2 Training Philosophy. We look to the authorities in the field of process reengineering and continuous process improvement for enlightenment on the theory and practice of training. From these authorities and out of our own experience in applying the methods and techniques will evolve a distinctly DoD training philosophy in support of process improvement.

> Organizations are undergoing rapid change in the way they operate and the way people think, talk and act. This change process must be supported by an aggressive training program that reinforces these changes and provides growth opportunities for your employees.
>
> Process improvement team (PIT) members must be trained to work as a team, understand the process, collect and analyze data and improve the process. As a prerequisite to becoming a PIT member, each individual should have been trained in and should have used basic team and problem-solving tools such as:
>
> - Team process
> - Brainstorming
> - Check sheets
> - Graphs
> - Histograms
> - Pareto diagrams
> - Scatter diagrams
> - Nominal group techniques
> - Delphi narrowing technique
> - Force-field analysis
> - Cause-and-effect diagrams
> - Mind maps
> - Statistical process control
>
> In the long run, a team lacking training and skills will not completely comprehend the situation it is trying to improve and will not implement the best combination of solutions.
>
> —H. James Harrington,
> *Business Process Improvement.*

Education in quality methodologies is crucial and necessary if a company is to succeed and achieve its quality vision, to increase its productivity, and to ensure increasing customer satisfaction. Listed here are some basic quality methodologies that should be part of an employee education effort.

- Introduction to Total Quality Control
- The Plan, Do, Check, Act (PDCA) improvement cycle
- Fourteen quality control techniques
- Taguchi methods
- Quality circle member training
- Quality function deployment (QFD)
- Sampling techniques
- Hoshin planning
- How to achieve customer satisfaction

—Sarv Singh Soin, *Total Control Essentials.*

Every study of high-service/quality providers shows that training plays a huge role in the improvement process. Training consists of understanding what is to be done and why (education and awareness) and then developing the ability to make the targeted changes happen (skills)....Often the greatest education and awareness challenge on the road to higher service/quality is getting people to let go of their old paradigms...Your people need help grasping the basic service/ quality concepts and understanding your organization's vision, values, improvement strategies and plans. They also need a chance to discuss their role, next steps, concerns and the like. Your introduction to service/quality should contain the following elements.

- Why improve service/quality?
- What is service/quality?
- What are our old assumptions and new paradigms?
- What's our reason for being, vision and values?
- What's the territory (scope) to be covered?
- How will this be deployed?
- What are the next steps?

U.S. Navy Captain Jerald Gartman led a service/quality revolution at Cherry Point Aviation Depot in North Carolina that saved millions of dollars. Extensive training was central to the effort. Captain Gartman says the payback on training proved to be $14.00 to $1.00. He concludes, "Training is very, very expensive and ignorance costs more than you can imagine."

—Jim Clemmer, *Firing on all Cylinders.*

One of the more successful options has been to use a broad-based task force for the purpose of designing the (quality) curriculum. Under this concept the Quality Council creates a task force (project team) whose mission is to develop a plan for training in planning for quality...

The task force mission is to:

- Identify the company's needs for training in planning for quality
- Propose a curriculum of courses that can meet those needs
- Identify which categories of personnel should take which courses
- Identify the sources of needed training materials, whether to be self-developed or acquired from suppliers
- Identify the needs for leaders: trainers, facilitators
- Propose a timetable
- Estimate the budget.

—Joseph M. Juran, *Quality by Design.*

One of the essential ingredients of a broad-scope quality program is an extensive amount of training. Experience in training has identified the reasons why some quality programs fail:

- Failure to provide training at the time it will be used (just-in-time)
- Lack of participation by line managers in designing training
- Reliance on the lecture method of training
- Poor communication during training (poor instructors).

—Joseph M. Juran,
Quality Planning and Analysis.

Often the key element that is missing in efforts to improve work-flow processes is the training that will enable empowered teams of employees to do their jobs. Classroom and on-the-job training ensures that employees are adequately equipped with the skills to perform their work, and includes training in quality management concepts and skills such as teamwork, problem-solving and methods for collecting and analyzing data using basic statistical tools.

To support this massive quality effort, Xerox created an extensive training program. All Xerox employees have received at least the basic 28-hour Leadership Through Quality training; many have been trained in advanced quality techniques. Over the last four years, Xerox has invested four million man-hours and $125 million in Leadership Through Quality training.

—V. Daniel Hunt, *Managing for Quality.*

One of the first things necessary for a robust benchmarking program is a good internal training program that teaches your teams how to conduct a benchmarking study. Education changes thinking; training changes behavior, both are needed in benchmarking.

—Gregory H. Watson,
The Benchmarking Workbook.

Employee involvement, teamwork, and integration—these conditions of excellent companies do not occur because of executive mandate. Employees must be enabled to create such conditions of excellence. Education and training of all employees is the most powerful enabler of people in the Baldrige view....Investment in education is the capital expenditure in the human side of quality. As such, it is of primary interest and importance to Baldrige examiners.

—Christopher W.L. Hart and Christopher E. Bogan, *The Baldrige.*

12.2.3 Training Delivery Modes. There are many training methods available for process improvement training programs. Five key methods are discussed below.

12.2.3.1 Traditional instructor-led training. While this is the most common method of training in the United States, it is by far one of the most inefficient. It is inefficient in three ways:

- Cost
- Skill development
- Retention.

Cost: When students must travel to the training site, typical training costs can run as high as $500.00 per day per student. This figure takes into account travel costs, student salary costs, instructor costs, and materials costs. It does not take into account facilities or special equipment.

Skill development: Most instructor-led training is lecture-based. This is the least effective means of developing skills in the student population. The more workshop-oriented (hands-on) the training experience, the more likely that skills will be developed.

Retention: Studies have shown that student retention of material presented in instructor-led training rapidly declines to about 20% of the material covered. Many factors influence this number but, in general, it is the acceptable figure.

Instructor-led training in the Management Framework for Process Improvement (MF/PI) should be workshop oriented and should use case studies, role plays, field trips and other interactive means of conveying the subject material.

12.2.3.2 Self-paced training. This method of training is suitable for instruction in basic skills such as process improvement techniques. Good self-paced materials are expensive to produce and maintain and therefore can only be used in a cost-effective manner when the training population for a given course exceeds about 500 students.

12.2.3.3 Just-in-time training. This method of training is rapidly gaining favor because it focuses learning activities on material that will be used on the job soon after the training event is complete. Just-in-time techniques work best with local seminar/workshop training and with self-paced training. It is not generally practical to use just-in-time concepts with instructor-led training when travel time is involved.

12.2.3.4 Distance learning. Distance learning is a method of computer-managed training where students are enrolled in an electronic classroom. The students and instructors are dispersed and communicate using a personal computer and a modem. This method of training is gaining popularity because it combines several desirable training concepts:

- It is instructor-led in the sense that an instructor gives assignments, reviews student work and is available to answer questions. The instructor is, of course, only available via electronic mail and possibly by telephone.
- The student works at his or her own pace within a given timeframe for completing an assignment. Thus, distance learning does not unduly interfere with the students other activities. School is in session 24 hours a day, seven days a week.
- There is no travel time or cost involved.
- Courses can be designed and scheduled to be taken just in time to improve student retention factors.
- Because there is no lecture component, distance learning courses tend to be skill-based. Conceptual knowledge is gained from reading assignments, and the student evidences comprehension by completing a written assignment or project.

12.2.3.5 Behavior modification training. This method of skill-based training is based on extensive research on adult learning. It was developed in 1969 by Melvin Sorcher, a General Electric industrial psychologist, based on some pioneering work in clinical psychology. The method has enjoyed a high degree of success wherever it has been conscientiously applied. Behavior

modification training methods are based on an eight-step methodology:

- Provide evidence that the skill to be learned is important
- Explain the specific behaviors (actions) that are involved in the skill
- Demonstrate the skill in a variety of work settings
- Provide the conceptual framework for the skill (knowledge required)
- Allow the student to practice the skill (real or simulated)
- Provide constructive feedback on student performance (reinforce/coach)
- Assist students in identifying occasions for using the skill on the job site
- Follow up within six months on progress in applying the skill to the job.

12.2.4 Institutions. Institutions providing training services include the following:

- Information Resource Management College (IRMC)
- Army Management and Engineering College (AMEC)
- International School of Information Management (ISIM)

12.2.5 Process Improvement Curricula. New training opportunities are constantly being developed to support process improvement. For the latest training curricula from the institutions and agencies providing process improvement training, and a list of available courses, please call the CIM Hot Line: 1-800-TELL-CIM.

12.3 Workshops

At presently, there are five standard workshops that support process improvement projects. Each workshop is designed to accomplish specific tasks and produce specific deliverables. The length of any given workshop will vary from two to eight weeks, depending on its focus and requirements. There is generally a requirement to perform offline activities between workshops such as data gathering, interviewing, research, and benchmarking.

12.3.1 Scoping Workshop - two weeks. Training is provided in overall methodology with detailed instruction in the specific use of IDEF techniques. Facilitators assist the project team in refining the project's context, objectives, and opportunity areas. Mission, objectives, and goals are assessed. Also provided are high-level activity and data modeling, which may include producing "strawman" models. A specific project plan is also developed. This initial workshop includes daily project facilitation, leadership, focus, and support.

12.3.2 Baseline Workshop - six weeks. Guided by the facilitator, the project team develops and decomposes the AS-IS model using IDEF techniques. The project team is guided in determining what analysis is to be done, identifying the data for analysis, and capturing improvement opportunities. The project team also receives assistance from the facilitator in validating the AS-IS model and in collecting data for cost, time, and quality analysis. Preliminary analysis is made on the collected data..

12.3.3 Improvement Analysis Workshop - six weeks. Improvement analysis continues aided by activity based costing, process flow, and quality analysis exercises. This effort is designed to determine the potential areas of improvement and aid in identifying and consolidating common functions, eliminating non-value added activities and costs, and streamlining the process. Using these data, the project creates the process vision and TO-BE models. The team prepares the preliminary FEA and aids in the preparation of the preliminary implementation or functional strategic plan. The facilitator provides assistance in the technical and analytical aspects of activity and data modeling, as well as in activity based costing technique, process flow, simulation, and quality analysis.

12.3.4 Final Validation Workshop - six weeks. The team validates the TO-BE models and supporting models and narratives, and develops the implementation plan. The team completes the implementation plan and the final FEA and prepares a final report. Implementation begins, which may include functional changes, system changes, pilots, prototypes, and training.

12.3.5 Integration Workshop - two weeks. The work done thus far is evaluated with respect to the DoD Enterprise Model and opportunities for cross-functional integration are explored.

12.4 Support Services. Support services provided by DISA/ Improvement include the following:

- Methodology support
- Project startup and management
- BPI training for the CADRE 100
- BPI Program Hotline Support
- Support of IDEF modeling
- FIPS Standards development
- Model conversion and integration assistance
- IDEF repository management
- FEA consultation
- Loaner tools
- Guidebooks
- BPI consulting
- Best business practices.

ANNEX A. GLOSSARY

Activity - A name process, function, or task that occurs over time and has recognizable results. Activities combine to form business processes.

Activity Accounting - The collection of financial and operation performance data about significant activities of an enterprise.

Activity-Based Costing (ABC) - An accounting technique that allows an enterprise to determine the actual costs associated with each product and service produced by that enterprise without regard to the organizational structure of the enterprise.

Activity-Based Management (ABM) - A system of management that seeks to optimize the value-added activities performed by the enterprise while at the same time minimizing or eliminating the non-value added activities, resulting in overall improvements in the effectiveness and the efficiency of the enterprise in serving its customers.

Activity measure - A performance value assigned to an activity's primary output.

Activity model - A graphic representation of a business process that exhibits the activities and their interdependencies that make up the business process to any desired level of detail. An activity model reveals the interactions between activities in terms of inputs and outputs while showing the controls placed on each activity and the types of resources assigned to each activity.

Activity model (AS-IS) - An activity model that portrays how a business process is currently structured. It is used to establish a baseline for subsequent business process improvement actions or programs.

Activity model (TO-BE) - An activity model that results from a business process redesigned action or program. The TO-BE model shows how the business process will function after the improvement action is implemented.

Activity, non-value added - Any activity that provides a negative return on the investment or allocation of resources to that activity. Within broad limits, the enterprise benefits by allocating less resource to non-value added activities.

Activity, value added - Any activity that contributes directly to the performance of a mission, and could not be eliminated without impairing the mission.

AIS - Automated Information System

AMEC - Army Management Engineering College

AS-IS Model - A model that represents the current state of the organization modeled, without any specific improvements included. (contrast with TO-BE Model).

Baseline - The current condition that exists in a situation or representation (model) of a situation. Usually used to differentiate between a current and a future representation.

Benchmarking - A method of measuring processes against those of recognized leaders to establish priorities and targets leading to process improvement. It is undertaken by identifying strategies, customers, processes and costs to benchmark and their key characteristics; determining who to benchmark; collecting and analyzing data from direct contact, survey, interviews, technical journals, and advertisements; determining the "best of class" from each benchmark item identified; and evaluating the process in terms of improvement goals.

Best practice - A way or method of accomplishing a business function or process that is considered to be superior to all other known methods.

Bill of Activity - BOA. A structured listing of the sequence of activities performed to produce a unit of a product or service. Similar in concept to a bill of materials (BOM), which is a structured list of the components of a product.

Business case - A structured proposal for business process improvement that functions as a decision package for enterprise leadership. A business case includes an analysis of business process needs or problems, proposed solution, assumptions and constraints, alternatives, life cycle costs, benefits/ cost analysis, and investment risk analysis. Within DoD, a business case is called a Functional Economic Analysis (FEA).

Business process - A collection of activities that work together to produce a defined set of products and services. All business processes in an enterprise exist to fulfill the mission of the enterprise. Business processes must be related in some way to mission objectives.

Business Process Improvement (BPI) - The betterment of an organization's business practices through the analysis of activities to reduce or eliminate non-value added activities or costs, while at the same time maintaining or improving quality, productivity, timeliness, or other strategic or business purposes as evidenced by measures of performance. Also called functional process improvement.

C^3I - Command, Control, Communications, and Intelligence

Cadre 100 - A team of approximately 100 functional managers and professionals who are taking a leading role in functional process improvement activities within DoD.

CIM - Corporate Information Management Initiative (ODDI)

CIM - Center for Information Management (DISA/ CIM)

CIM Integration Architecture - A master plan for building the Defense Integrated Information (DII) technology platform. The DoD CIM Architecture supports a seven-level approach to defining information systems implementation activities. This ensures that all such efforts proceed from mission requirements, organizational objectives, and business process needs to workable systems that are compatible with the current geographic and technological infrastructure. Together, the seven levels provide a consistent platform for all systems operations.

Continuous process improvement - A policy that encourages, mandates, and/or empowers employees to find ways to improve process and product performance measures on an on going basis.

Cost center - A function in a business where the cost of producing a product or service is tracked and personnel are held accountable for performance.

Customer - The recipient of an output product or service. May be internal or external to the organization.

Database - A collection of related data, organized to serve one or more independent applications, stored with security, privacy, and integrity controls.

Data model (Business Rule Model) - A graphical representation of an organization's information and data assets expressed in terms of entities and relationships. Relationships are also called business rules because they enable or constrain business actions. Data models, like activity models, have AS-IS and TO-BE representations.

Data repository - A specialized database containing information about data and data relationships. Used to provide a common resource of standard data elements and models.

DBOF - Defense Business Operations Funds

DDI - Director of Defense Information

Defense Management Review Decision (DMRD) - The reductions from budgets mandated by the DoD comptroller.

DII - Defense Information Infrastructure

DISA - Defense Information Systems Agency

Discounted cash flow - A method of performing an economic analysis that takes the time value of money into account. Used to remove interest rates

and inflation factors from a calculation so that the results of analysis are comparable.

DMP - Data Management Plan

Driver - The root cause of a condition or measurement that is felt downstream in a process as in cost driver and quality driver.

DTIC - Defense Technical Information Center

EA - Economic Analysis

Economic analysis - A formal method of comparing two or more alternative ways of accomplishing a set objective, given a set of assumptions and constraints and the costs and benefits of each alternative, such that the analysis will indicate the optimum choice..

Enterprise - When used generically, an enterprise is defined as the aggregate of all functional elements participating in a business process improvement action regardless of the organizational structure housing those functional elements.

Enterprise level - The Enterprise Level of the CIM Integration Architecture provides the geographic, technological, and managerial platform upon which all information systems development activity is based; it is the foundation that must support all that is built above it in the higher levels. In general, it is synonymous with the entire Department of Defense.

Enterprise model - DoD Enterprise Model. A high-level model of the Department's mission, function, process, and information architecture used as a standard reference for constructing data and activity models and information systems.

Fee for service - A policy that determines the charge for a given product or service based on the calculated costs of producing the product or service with or without a margin (profit figure).

Fixed cost - A cost that does not vary with the amount or degree of production. The costs that remain if an activity or process stops.

Function - A specific set of skills and resources that can be used to perform one or more activities that make up a process. Usually, several functions are associated with a single process.

Functional activity - A subdivision of a functional area.

Functional area - One of eight process groupings with DoD. The eight functional areas are Finance, Health, Human Resources, Reserve Components, Materiel Resources, Procurement, Information Management, and Command and Control.

Functional Economic Analysis (FEA) - A technique for analyzing and evaluating alternative information system investments and management practices. Within DoD, FEA is a business case. Also, a document that contains a fully justified proposed improvement project with all supporting data, i.e, Business Case or Decision Package.

Functional management - A philosophy of management that organizes an enterprise by type of work performed. See also *process management.*

Functional process - A subdivision of a functional activity

Functional Process Improvement (FPI) - A structured approach by all or part of an enterprise to improve the value of its products and services while reducing resource requirements. Also referred to as business process improvement (BPI), business process redesign, and business reengineering.

Functional Process Improvement Program (FPIP) - A focused initiative within DoD to encourage consistent application of process improvement principles and techniques across its services and agencies. Also referred to as business process improvement program (BPIP).

IDA - Institute for Defense Analysis

IDEF - Integrated Definition Language

IDEF Modeling techniques - A combination of graphic and narrative symbols and rules designed to capture the processes and structure of information in an organization. IDEF0 is an activity, or behavior, modeling technique; IDEF1X is a rule, or data, modeling technique.

IM - Information Management

Improvement initiative - A set or package of planned improvements resulting from the analysis of baseline processes, inspection of strategic and business plans, and benchmarking results that, if implemented, will result in process improvement.

Improvement opportunities - Situations that can be changed to produce a more effective or more efficient process or product. Improvement opportunities may involve processes, business rules, or both. Opportunities are often packaged together as an improvement initiative.

Information technology - IT. A package of equipment and/or systems related to data and/or communications that can be used as an enabler of process reengineering.

Integrated-Computer Aided Software Engineering (I-CASE) - A set of software design and development tools operating with an integrated shared repository to support the entire systems development life cycle.

Investment justification - A functional economic analysis indicating that it is better to do a certain action than not do it. Investments may be compared and ranked by various criteria, including return on various categories of capital, risk-adjusted discounted cash flow, affordability, internal rate of return, etc.

IRMC - Information Resources Management College

Just in time - A policy calling for the delivery of materials, products or services at the time they are needed in an activity or process. Used to reduce inventory, wait time, and spoilage.

Life Cycle Management - LCM. A management process that governs a process or system from conception to final disposition. Also, Life Cycle Management of Information Systems, LCMIS.

MAISRC - Major Automated Information System Review Council

Migration system - An existing information system that has been officially designated to support standard processes and is intended to be the means of arriving at a target system or architecture (as in open systems architecture).

Model - A representation of a complex, real-world phenomenon such that it can answer questions about the real-world phenomenon within some acceptable and predictable tolerance.

Non-value added activity - An activity performed in a process that does not add value to the output product or service, which may or may not have a valid business reason for being performed. Similarly, **non-value added cost**.

ODDI - Office of the Director of Defense Information

Performance measure - An indicator that can be used to evaluate quality, cost, or cycle time characteristics of an activity or process usually against a target or standard value.

PPBS - Program, Programming, and Budgeting System

Present value - The current value of a future series of cash flows given a discount factor or interest value. Used to evaluate the alternative investments.

Process - A collection of activities that together produce a usable product or service by applying resources from one or more functional areas.

Process Action Team (PAT) - A group of "hands-on" people assembled as part of a Total Quality Management/Total Quality Leadership (TQM/TQL) project to solve a specific operational problem.

Process management - A philosophy of management that organizes an enterprise by the series of activities that combine to produce related types of goods and services for internal or external customers. See functional management.
Process model - See Activity Model.

Quality Function Deployment (QFD) - A requirements identification analysis, flow down, and tracking technique. It focuses on quality and communication to translate customer needs into product- and process-design specifics. Also known as the "house of quality."

Redesign - Business Process Redesign (BPR). The transformation of a business process to achieve significant levels of improvement in one or more performance measures relating to fitness for purpose, quality, cycle time, and cost by using the techniques of streamlining and removing non-value added activities and costs. Redesign projects typically take about six months to complete.

Reengineering - Business Process Reengineering (BRE). The radical transformation of a business process to achieve orders of magnitude improvement in one or more performance measures relating to fitness-for-purpose, quality, cycle-time, and cost; usually requiring the application of technology enablers. Reengineering projects typically take a minimum of two years to complete.

Risk adjusted discounted cash flow - RADCF. A formal method of performing an economic analysis that takes the time value of money and investment risk into consideration.

TMP - Technical Management Plan

TO-BE Model - Models that are the result of applying improvement opportunities to the current (AS-IS) business environment (see also *AS-IS Model*).

Total Quality Management/Total Quality Leadership (TQM/TQL) - Both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. TQM/TQL is the application of quantitative methods and human resources to improve the material and services supplied to an organization, all the processes within an organization, and the degree to which the needs of the customer are met, now and in the future. TQM/TQL integrates fundamental management techniques, existing improvement efforts and technical tools under a disciplined approach focused on continuous improvement.

Unit cost - The total costs in resource and material to produce one instance of a product or service.

Value added activity - A activity in a process that adds value to an output product or service, that is, the activity merits the cost of the resources it consumes in production.

Variable cost - A cost element that varies directly with the amount of product or service produced by an activity or cost. Variable costs go to zero if the activity stops. See also *fixed cost.*

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ANNEX E. PROCESS IMPROVEMENT TEAM QUALITIES

Characteristics of Effective Teams

- Inspired leadership
- Specific, quantifiable goals
- Commitment and loyalty
- Effective communications
- Achieve small victories along the way
- Think competitively
- Open minded/progressive thinking
- Recognize superior performance

Successful Team Cultural Values

- Belief in teamwork
- Scientific problem solving methods
- Respect for people
- Focus on customers/suppliers
- Belief that employees want to do a good job
- Mutual respect
- Continuous process improvement
- Risk taking
- Coaching to develop the less skilled
- Strive for win-win relationships
- Work to remove barriers

How to give constructive feedback in a team situation

- Be descriptive
- Don't use labels
- Don't exaggerate
- Speak only for yourself
- Talk first about yourself, not about the other person
- Restrict your feedback to things you know for certain
- Help people hear and accept your compliments when giving positive feedback

How to receive feedback in a team situation

- Breath deeply, relax
- Listen carefully to what is being said; actually *hear* what is being said
- Ask questions for clarity
- Acknowledge the feedback
- Acknowledge valid points
- Take time to sort out what you heard (or think you heard)

Effective communication guidelines

- Seek self-knowledge
- Live a pattern of cooperation
- Listen to others to understand
- Control the desire to pass judgment
- Protect the other person's ego
- Don't: direct, threaten, preach, lecture, judge, ridicule, distract, condescend, advise without permission, give false praise

Team leader role and responsibility

- Plan and orchestrate team activities
- Keep team focused on the situation at hand
- Promote teamwork
- Establish and maintain communication channels
- Coach
- Create trust

Team member role and responsibility

- Share knowledge and expertise
- Attend all meetings
- Carry out all assignments
- Participate constructively in all discussions
- Understand the process

How to plan a team meeting

- Determine the purpose or objective for the meeting
- Schedule the meeting (best times: AM Tuesdays through Thursdays)
- Define what you want the group to do
- Define the size group you will need
- Determine who should attend the meeting and why
- Develop the agenda
- Set the length of time needed to complete the agenda
- Decide how decisions are going to be reached
- Document the results, action items, and assignments

How to conduct a meeting

- Start on time
- Break the ice
- Make meeting assignments (if any)
- Review the agenda
- Review results of last meeting (on same issues)
- State purpose and objectives (ask: why are we here, and how will we know when we are done?)
- Seek contributions and focused discussion
- Clarify issues especially if there is disagreement
- Keep to the agenda
- Summarize, assign action items, close on schedule

- **Elements of team conflict**

- Frustration caused by lack of resolution
- Functional loyalties that impede cooperation
- Value, goal, and methodology differences
- Responsibility issues that result in power struggles
- Status seeking rather than team focus

Symptoms of conflict

- Members are impatient
- Ideas are attacked before they are completed
- Members take sides
- Comments are made with vehemence
- Every suggestion seems impossible
- Grossly divergent ideas of what to do
- Expressions of anger and dislike

Personal conflict resolution principles

- Rationality - Try to balance one's own emotions with reason
- Understanding - Try to understand the other party
- Communication - Consult with them before deciding
- Reliability - Practice personal integrity
- Non-coercive influence - Be open to persuasion, try to persuade them
- Acceptance - Accept ideas as worthy, care, and be willing to learn
- Goodwill - Do those things that are both good for the relationship and good for both parties

How to build an effective team[1]

Affirmative answers to the questions in this list signal that a work team is enjoying good progress and is functioning in an effective manner.

Understanding of work unit

- — Can members describe the business of their work unit?
- — Do they know the general work flow?
- — Are they aware of interaction with other areas and departments?

[1] *Teamwork: Involving People in Quality and Productivity Improvement*, Charles A. Aubrey, II and Patricia K. Felkins, ASQC Quality Press, 1988. Content™ 1985, B. J. Chakiris Corporation.

Insight of work issues and complexity

- Does the team assess the impact of proposed changes on people concerned?
- Do they understand the impact on productivity and costs?

Organization

- Are minutes taken of the meeting?
- Does the team gather and use the resources they need?
- Is past progress summarized and new action reported?
- Does the team plan effectively?

Procedures and norms

- Is the team run according to the code of conduct?
- Does the code need revision?
- Are procedures flexible?
- Are procedures appropriate to the group?

Communication

- Do members feel comfortable speaking to the group?
- Does the team use *we* words?
- Do members express their ideas clearly and concisely?
- Does the team communicate through timely minutes and reports?
- Does the group maintain contact with management and other teams?

Participation

- Are member enthusiastic about attendance?
- Does everyone participate in the process?
- Do members volunteer for group work?
- Is the team making full use of group resources, skills, and knowledge?

Cooperation

- Do team members help each other?
- Is work responsibility spread equally?
- Do group members actively support each other?
- Are members open-minded and willing to listen to other ideas?
- Do team members seem to like each other as friends and colleagues?

Loyalty, identity, and morale

- Are member motivated?
- Are members eager and enthusiastic about projects?
- Is there a sense of cohesiveness in the group?
- Do members care about the group and about each other?
- Do members seem to enjoy the problem-solving process?
- Can the team accept failure without feeling defeated?

Responses to leadership

- Is the group open to the leader's suggestions?
- Can the leader influence the group?
- Does the team respect the leader?

Group confidence and initiative

- Are members taking the initiative for task work and procedures?
- Do team members take responsibility for organizing?
- Do members keep the communication going without intervention of the leader?
- Does the group feel confident and competent in their task?
- Do team members seem satisfied with the group decision?

Conflict resolution

- Does the group recognize and resolve conflict?
- Do the members focus on issues rather than personalities?
- Can the group reach a compromise?
- Does the team use consensus?
- Does the team gather adequate information to understand disputed issues?

Acceptance of differences

- Do people listen to each other?
- Can differing opinions be expressed openly?
- Do members gather information on all sides of an issue?
- Can the team accept criticism?

ANNEX F. PROCESS IMPROVEMENT AND QUALITY CRITERIA

Quality, productivity, customer service excellence, and process performance are global issues. American and international standards now exist that are gaining acceptance by all major enterprises both public and private. The following subsections provide four sets of criteria that can be used to assess and evaluate business processes and guide process improvement efforts.

F1. Deming Prize Criteria

The Deming Prize is, of course, named after W. Edwards Deming, one of the pioneers of the quality movement, who first gained recognition in his work with post-World War II Japan. Prior to his death in 1993, he finally gained recognition in his own country. The Deming Prize criteria can be used as a guide for obtaining process and organizational excellence. Each area deals with one facet of the process quality equation.

1.0 POLICY
1.1 Policies pursued for management, quality, and quality control
1.2 Method of establishing policies
1.3 Justifiability and consistency of policies
1.4 Utilization of statistical methods
1.5 Transmission and diffusion of policies
1.6 Review of policies and the results achieved
1.7 Relationship between policies and long- and short-term planning

2.0 ORGANIZATION AND ITS MANAGEMENT
2.1 Explicitness of the scopes of authority and responsibility
2.2 Appropriateness of delegations of authority
2.3 Interdivisional cooperation
2.4 Committees and their activities
2.5 Utilization of staff
2.6 Utilization of Quality Control circles
2.7 Quality control diagnosis

3.0 EDUCATION AND DISSEMINATION
3.1 Education programs and results
3.2 Quality and control consciousness, degrees of understanding of quality control
3.3 Teaching and extent of dissemination of statistical concepts and methods
3.4 Grasp of the effectiveness of quality control
3.5 Education of related entities: contractors and vendors
3.6 Quality Control circle activities
3.7 System of suggesting ways of improvements and its actual conditions

4.0 COLLECTION, DISSEMINATION AND USE OF INFORMATION ON QUALITY
4.1 Collection of external information
4.2 Transmission of information between divisions
4.3 Speed of information transmission
4.4 Data processing, statistical analysis of information, and use of results

5.0 ANALYSIS
5.1 Selection of key problems and themes
5.2 Propriety of the analytical approach
5.3 Utilization of statistical methods
5.4 Linkage with proper technology
5.5 Quality analysis, process analysis
5.6 Utilization of analytical results
5.7 Assertiveness of improvement suggestions

6.0 STANDARDIZATION
6.1 Systematization of standards
6.2 Method of establishing, revising, and abolishing standards
6.3 Outcome of the establishment, revision or abolition of standards
6.4 Contents of the standards
6.5 Utilization of statistical methods
6.6 Accumulation of technology
6.7 Utilization of standards

7.0 CONTROL
7.1 Systems for the control of quality and related cost
7.2 Control items and control points
7.3 Utilization of such statistical control methods as control charts
7.4 Contribution to performance of Quality Control circle activities

7.5 Actual conditions of control activities
7.6 State of matters under control

8.0 QUALITY ASSURANCE
8.1 Procedure for the development of new products and services
8.2 Safety and immunity from product liability
8.3 Process design, process analysis, and process improvement
8.4 Process capability
8.5 Instrumentation
8.6 Equipment maintenance and control of purchases
8.7 Quality assurance system and its audit
8.8 Utilization of statistical methods
8.9 Evaluation and audit of quality
8.10 Actual state of quality assurance

9.0 RESULTS
9.1 Measurement of results
9.2 Substantive results in quality, services, delivery time, cost
9.3 Intangible results
9.4 Measures for overcoming defects

10.0 PLANNING FOR THE FUTURE
10.1 Grasp of the present state of affairs
10.2 Measures for overcoming defects
10.3 Plans for future advances
10.4 Linkage with the long-term plans

F2. Malcolm Baldrige National Quality Award Criteria

The Baldrige Award is administered by the National Institute of Standards and Technology.[2] Legislation creating the award was enacted in 1987 as Public Law 100-107 in recognition of the fact that quality had become a matter of national strategic importance. The purpose of the award, named after the late Secretary of Commerce, is to help the United States improve quality and productivity by:

- Stimulating companies to attain excellence for the pride of achievement
- Recognizing outstanding companies to provide examples to others
- Establishing guidelines that business, governmental, and other organizations can use to evaluate and improve their own quality efforts
- Providing information from winning companies on how to mange for superior quality.

The categories below are from the 1992 criteria and are shown with weighting factors:

1.0 LEADERSHIP (9%)
1.1 Senior executive leadership
1.2 Management for quality
1.3 Public responsibility

2.0 INFORMATION AND ANALYSIS (8%)
2.1 Scope and management of quality data and information
2.2 Competitive comparisons and benchmarks
2.3 Analysis and uses of company-level data

3.0 STRATEGIC QUALITY PLANNING (6%)
3.1 Strategic quality and company performance planning process
3.2 Quality and performance plans

4.0 HUMAN RESOURCE DEVELOPMENT AND MANAGEMENT (15%)
4.1 Human resource management
4.2 Employee involvement
4.3 Quality education and training
4.4 Employee performance and recognition
4.5 Employee well-being and morale

5.0 MANAGEMENT OF PROCESS QUALITY (14%)
5.1 Design and introduction of quality products and services
5.2 Process management—product and service production and delivery processes

2 *The Corporate Guide to the Malcolm Baldrige National Quality Award*, Marion Mills Steeples, ASQC Quality Press, 1993.

5.3 Process management—business processes and support services
5.4 Supplier quality
5.5 Quality assessment

6.0 QUALITY AND OPERATIONAL RESULTS (18%)
6.1 Product and service quality results
6.2 Company operational results
6.3 Business process and support service results
6.4 Supplier quality results

7.0 CUSTOMER FOCUS AND SATISFACTION (30%)
7.1 Customer relationship management
7.2 Commitment to customers
7.3 Customer satisfaction determination
7.4 Customer satisfaction results
7.5 Customer satisfaction comparison
7.6 Future requirements and expectations of customers

F3. ISO 9000/ASQC 9000 Criteria

ISO is the International Organization for Standardization, and its objective is to promote the development of standards, testing, and certification in order to encourage the trade of goods and services.[3] The organization consists of representatives from 91 countries. The American National Standards Institute (ANSI) represents the United States in this body. America participates in the writing of ISO 9000 standards through the U.S. Technical Advisory Group (TAG), administered by the American Society for Quality Control (ASQC).

ISO 9000 is a series of five international standards on quality management and assurance. ISO 9000 supplier certification is fast becoming a requisite for participating in international trade. DoD is in the process of supplanting military quality standards (MIL-Q 9858A) with ISO 9000.

The following list of categories is covered in one or more ISO 9000 documents. The actual standards can be obtained from ANSI, 11 West 42nd St., 13th Floor, New York, NY 10036 (212) 642-4900.

- Management responsibility
- Quality system
- Product identification and traceability
- Inspection status
- Inspection and testing
- Inspection, measuring, and test equipment
- Control of non-conforming product
- Handling, storage, packaging, and delivery
- Document control
- Training
- Statistical techniques
- Internal auditing
- Contract review
- Purchasing
- Process control
- Purchaser supplied product
- Corrective action
- Design control
- Servicing.

F4. Process Improvement Levels (Harrington)

H. James Harrington promulgates a system of process assessment and qualification with designations ranging from unknown status to world-class[4]. Each higher level includes the qualifications of all lower levels.

3 *ISO 9000*, Greg Hutchins, Oliver Wight Publications, 1993.

4 *Business Process Improvement*, H. James Harrington, McGraw Hill, 1991, chapter 8.

LEVEL	STATUS	DESCRIPTION
6	Unknown	Process status has not been determined
5	Understood	Process design is understood and operates according to prescribed documentation
4	Effective	Process is systematically measured, streamlining has started and end-customer expectations are met
3	Efficient	Process is streamlined and is more efficient
2	Error-free	Process is highly effective (error-free) and efficient
1	World-class	Process is world-class and continues to improve

Eight process categories are examined to determined the qualification level of the functional process under study:

- Customer related measurements
- Process measurements and/or performance
- Supplier partnerships
- Documentation
- Training
- Benchmarking
- Process adaptability
- Continuous improvement.

The following tables show the improvement path from level 6 to level 1 for each of the above categories. Note that to achieve a new level of performance, that level's requirements and all previous level's requirements must be met.

The terms *requirements*, *expectations*, and *desires* reflect a progression of ever increasing performance with *desires* being the highest possible attainment.

Level	Customer-Related Measurements
5	Measurements reflect the end-customer's view of the process
	Customer REQUIREMENTS are documented
	Customer feedback system is established
	Customer effectiveness charts are posted and updated
4	Customer REQUIREMENTS are met
	Customer EXPECTATIONS are documented
3	Customer EXPECTATIONS are met
	Challenge targets are set by the process improvement team (PIT)
2	Customer EXPECTATIONS are updated
	Performance for the last six months never fell below customer EXPECTATIONS
	Trend lines show continuous improvement
	World-class targets are established
	Customers are invited to regular performance reviews
	Customer DESIRES are understood
1	Customer expectation targets are regularly updated and always exceeded
	World-class measurements are met for a minimum of three consecutive months
	Many of the customer DESIRES are met

Level	Process Measurements and/or Performance
5	Overall effectiveness and efficiency are measured and posted where they can be seen by employees
	Effectiveness and efficiency targets are set
	Process operation and/or control weaknesses are evaluated and meet minimum requirements
4	Overall effectiveness targets are met and challenge targets are established
	Cost of poor quality measurements are developed
	Some internal efficiency measurements are established
	Internal effectiveness measurements and targets are 50% complete and posted
	Overall process cycle time and cost are defined
	No significant effectiveness, efficiency, or control exposures exist
	Substantial improvement activities are under way
3	There is a significant improvement in product quality cost
	Internal effectiveness and efficiency measurements are in place and are posted, with targets set by the affected areas
	There is a significant reduction in cycle time and bureaucracy
	Overall efficiency targets are met
	Most measurements show an improvement trend
	Key process control points are identified
	Tangible, measurable results are realized

Level	Process-Measurements and/or Performance
2	All measurements show an improvement
	Benchmark targets are defined for external customers and critical in-process activities
	In-process control charts are implemented as appropriate, and the process is under statistical control
	Feedback systems are in place close to the point at which the work is being done
	Most measurements are made by the person doing the job
	There is tangible and measurable improvement in the in-process measurements
	No operational inefficiencies are anticipated
	An independent audit plan is in place and working
	The process is error-free
1	All measurements exceed those of the benchmark company for three months
	Effectiveness measurements indicate that the process is error-free for all customer and in-process control points

Level	Process-Measurements and/or Performance
5	All suppliers are identified
4	Meetings are held with critical suppliers, and agreed-to input REQUIREMENTS are documented
	Feedback systems to critical suppliers are in place
3	Meetings are held with all suppliers, and agreed-to input REQUIREMENTS are documented
	All critical suppliers meet input REQUIREMENTS
2	All supplier inputs met requirements for the last three months
	Regular meetings are held to ensure that suppliers understand the changing needs and EXPECTATIONS OF THE PROCESS
1	All suppliers meet process EXPECTATIONS
	All suppliers meet process requirements for a minimum of six months

Level	Documentation
5	Process is defined and modeled with activity and data models
	Model accuracy is verified
	Documentation is followed
	Process improvement team members and process owners are named
	Process improvement team mission is documented
	Process boundaries are defined (enterprise model)
4	Process is modeled and documents are updated
	Overall process is fully documented
3	Subprocesses are documented
	Training requirements are documented
	Software controls are in place
	The readability level of all documents is at a grade level less than the minimum education of the people using them
	Employees understand their job descriptions
2	Change level controls are in place
	Documents are systematically updated
1	All documents meet world-class standards for the process being improved

Level	Training
5	Process improvement team is trained in the basic techniques and tools and the fundamental functional process improvement techniques
	In-process training needs are evaluated and documented
	Resources are assigned to support training needs
4	In-process job training procedures are developed for all critical activities
	People are assigned to conduct job and process training
	Process improvement team is trained in statistical process control
3	All people performing critical jobs are trained in the new procedures, including job-related training
	In-process job training procedures are developed for all activities
	Plans are in place to train all employees who are part of the process team in methods and problem-solving techniques
	Process improvement team members understand one or more sophisticated techniques used in process improvement actions
	All employees in the process receive training on the total process operation
2	All employees in the process are trained and scheduled for refresher courses
	Employee evaluation of their training process is complete and the training meets all employee REQUIREMENTS
	Team and problem-solving courses are complete and employees are meeting regularly to solve problems
1	Employees are regularly surveyed to define additional training needs and new training programs are implemented based on these surveys

Level	Benchmarking
5	Not required
4	Plan exists to benchmark customer requirements
3	Customer REQUIREMENTS are benchmarked
	Plan exists to benchmark critical activities
	Plan exists to benchmark the process
2	Process is benchmarked and targets are assigned
	Process improvement team understands the keys to the benchmark organization's performance
1	Ongoing benchmarking plan is implemented

Level	Process Adaptability
5	Not required
4	Data are collected that identify problems with present process adaptability
3	Employees are trained to distinguish how far they can deviate from the established procedures to meet a customer's special needs
	Future process change requirements are projected
	A proactive internal and external customer complaint system is established
	The customer reviews the process change plan and agrees that it meets his or her needs of the strategic period
2	Employees are empowered to provide the required emergency help to their customers and are measured accordingly
	Resources are committed to satisfy future customer needs
	Process adaptability complaints are significantly reduced
1	In the last six months, no customers complained that the process did not meet their needs
	Present process handles the exceptions better than the benchmark company's process

Level	Continuous Improvement
5	Basics of functional process improvement are in place
	All major exposures are identified and action plans are in place
	A detailed plan to improve the process to level 4 is agreed to and funded
4	A process is operational and control weaknesses are assessed and deemed containable
	A plan for improving the process to level 3 is prepared, approved and funded
3	The process philosophy accepts that people make mistakes, provided everyone works relentlessly to find and remove causes of errors
2	A plan to improve the process to level 2 is developed, approved, and funded
	The process philosophy evolves to the point at which errors are unacceptable. Everyone works relentlessly to prevent errors from occurring even once
	Surveys of the employees show that the process is easier to use
	Plans to improve the process to level 1 are prepared, approved, and funded
1	An independent audit verifies world-class status
	Plans are approved and in place to become even better

ANNEX G. DoD QUALITY AND PRODUCTIVITY SELF-ASSESSMENT GUIDE

This assessment instrument is related to task 6.1.2. Please see this section of the guidebook for additional information about the instrument. This assessment should take about 15 minutes to complete with an additional 15 minutes to score.

Organizational Climate

There are 70 statements in this part of the self-assessment guide. Respond to each with the number that indicates the extent of your agreement with the statement:

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

1. ___ People in this organization are aware of its overall mission.

2. ___ In general, this organization's customers believe that we care about what they think.

3. ___ People in this organization are aware of how their jobs contribute to the organization's mission.

4. ___ It's in everyone's best interests that this organization be successful.

5. ___ People in this organization are aware of how the organization's mission contributes to higher-level missions and objectives.

6. ___ In general, this organization's customers would not go elsewhere if it were possible.

People in this organization:

7. ___ Try to plan ahead for changes (such as in policy) that might impact our mission performance

8. ___ Try to plan ahead for technological changes (such as new developments in computer software) that might impact our mission performance

9. ___ Regularly work together to plan for the future

10. ___ See continuing improvement as essential.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

11. ___ People in this organization care about what will happen to the organization after they are reassigned

12. ___ Creativity is actively encouraged in this organization.

13. ___ Innovators are the people who get ahead in this organization.

14. ___ The quality of our work is second only to mission accomplishment as the overriding focus of this organization.

15. ___ Every member of this organization is concerned with the need for quality management.

16. ___ Continuous quality improvements within this organization can lead to more productive use of our resources.

17. ___ People in this organization know how to define the quality of what we do.

18. ___ Every member of this organization needs to contribute to quality improvement.

People in this organization:

19. ___ Live up to high ethical standards
20. ___ Like to do a good job
21. ___ Emphasize doing things right the first time.

The leader(s) in this organization (people at the highest level):

22. ___ Are committed to providing top-quality services/products/work
23. ___ Regularly review the quality of work produced
24. ___ Ask people about ways to improve the work produced
25. ___ Follow up suggestions for improvement
26. ___ Set examples of quality performance in their day-to-day activities
27. ___ Regularly review the organization's progress toward its goals and objectives
28. ___ Attempt to find out why the organization may not be meeting a particular goal/objective.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

People in my work unit:

29. ___ Turn to their supervisors for advice about how to improve their work

30. ___ Know their supervisors will help them find answers to problems they may be having

31. ___ Are challenged by their supervisors to find ways to improve the system.

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32. ___ The supervisors in my work unit make continuous improvement of our work top priority.

33. ___ The supervisors in my work unit regularly ask our customers about the quality of work they receive.

34. ___ The structure of our organization makes it easy to focus on quality.

35. ___ The way we do things in this organization is consistent with quality.

36. ___ People in my work unit understand how a quality emphasis leads to more productive use of resources.

37. ___ People in my work unit can describe the organization's quality and productivity policy.

38. ___ People in my work unit believe that quality and productivity improvement are their responsibility.

39. ___ People in my work unit take pride in their work.

40. ___ People in my work unit share responsibility for the success of failure of our services/products.

41. ___ People in my work unit believe that their work is important to the success of the overall organization.

42. ___ We have good relationships between departments in this organization.

43. ___ Co-workers in this organization cooperate with each other to get the job done.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

44. ___ A spirit of cooperation and teamwork exists in this organization.

45. ___ We have good relationships with other organizations that we work with.

46. ___ Supervisors in my work unit request employee opinions and data.

47. ___ People in my work unit are involved in improving our services/products/work.

48. ___ We have the appropriate personnel in my work unit to get the job done properly.

49. ___ The work goals or standards in my work unit are generally fair.

50. ___ The supervisors in my work unit do a good job of setting work expectations.

51. ___ People in my work unit are friendly with one another.

52. ___ People in my work unit enjoy their co-workers.

53. ___ We have the right tools, equipment, and materials in my work unit to get the job done.

54. ___ The materials and supplies we need in my work unit are delivered on time as ordered.

55. ___ The distribution of work among the people in my work unit is well balanced.

56. ___ In my work unit, we have enough time to perform our jobs in a professional manner.

57. ___ My work unit is structured properly to get the job done.

In my work unit:

58. ___ People are rewarded to get the job done

59. ___ People are paid fairly for the work they do

60. ___ Attempts are made to promote the people who do good work.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

In my work unit:

61. ___ People receive promotions because they earned them

62. ___ Supervisors give credit to people when they do a good job

63. ___ There are penalties for people

64. ___ People are given quick recognition for outstanding performance

65. ___ People know who their customers are

66. ___ People care about our customers

67. ___ There are effective communication channels between departments in this organization

68. ___ People do not have to rely on the grapevine or rumors for information

69. ___ People have ample opportunity to exchange information with their supervisors

70. ___ People get the facts and the information they need to do a good job.

Assessment of Process

There are 101 statements in this section. Circle the answer that most closely represents your perception of your organization.

	Yes	No	Not Sure	
				This organization has:
71.	2	1	1	Surveyed some/all of its members in order to determine whether improvements in quality are needed.
72.	2	1	1	Used formal interviews with some/all of its members in order to determine whether improvements in quality are needed.
73.	2	1	1	Informally asked some/all of its members for their opinions about whether improvements in quality are needed.
74.	2	1	1	Asked senior management for their opinions about whether improvements in quality are needed.
75.	2	1	1	Analyzed data concerning goal/objective accomplishments in order to determine whether improvements in quality are needed.
76.	2	1	1	Relied on higher-level directives in order to determine whether improvements in quality are needed.
77.	2	1	1	Asked established team members to report periodically.
				This organization is or might become committed to quality improvement because:
78.	2	1	1	We are mandated to do so by a higher authority.
79.	2	1	1	The people at the top level of this organization are/were dissatisfied with the quality being achieved.
80.	2	1	1	We want to improve an already acceptable quality record.
81.	2	1	1	We want to maintain a specified level of service in the face of budget reductions.
82.	2	1	1	The people we serve deserve our best efforts.

	Yes	No	Don't Have	**This organization has a quality improvement policy that:**
83.	2	1	1	Is written
84.	2	1	1	Has specific goals and objectives
85.	2	1	1	Everyone in the organization has seen
86.	2	1	1	Is taken seriously by people
87.	2	1	1	Holds people accountable for success/failure.

	Yes	No	NA	**Responsibility for quality improvement:**
88.	2	1	1	Is accepted by senior management
89.	2	1	1	Is accepted by middle management
90.	2	1	1	Is accepted by almost all organizational members.

91.	2	1	1	This organization has a separately identified office that oversees its quality improvement efforts.
92.	2	1	1	Quality improvement concerns are discussed/monitored at least on a quarterly basis.
93.	2	1	1	Managers at all levels have clearly defined roles in our quality improvement process.
94.	2	1	1	This organization uses teams to monitor quality improvement projects.
95.	2	1	1	Managers at all levels are responsible for the success or failure of our quality improvement efforts.
96.	2	1	1	This organization has a data base or tracking system for relevant quality information.

	Yes	No	NA	**In order to determine what our customers think about our products/ services, we:**
97.	2	1	1	Conduct surveys on a regular basis
98.	2	1	1	Ask customers informally
99.	2	1	1	Monitor complaints
100.	2	1	1	Ask our employees who have contact with our customers.

	Yes	No	NA	**The leaders at the top level in this organization:**
101.	2	1	1	Have agreed upon a definition of quality improvement
102.	2	1	1	Have set long-term goals concerning quality improvement
103.	2	1	1	Have set short-term goals concerning quality improvement
104.	2	1	1	Have defined performance measures to monitor progress toward reaching objectives and goals.

---

1 – Almost None
2 – Very Few
3 – Some
4 – Quite a Few
5 – Most
6 – Almost All

How many work units within this organization:

105. ___ Know how the organization defines quality improvement

106. ___ Have set long-term goals concerning quality improvement

107. ___ Have set short-term objectives concerning quality improvement

108. ___ Have defined performance measures to monitor progress toward reaching their objectives and goals?

How many organizational members:

109. ___ Can specify, if asked, what goals or objectives they are working on

110. ___ Were invited to participate in setting goals or objectives related to their work

111. ___ Know how the goals/objectives they are working toward relate to their work unit's mission

112. ___ Know how performance measures relate to monitoring their accomplishment of goals and objectives?

	Yes	No	NA	**Long-range planning in this organization includes:**
113.	2	1	1	Integration of quality improvements
114.	2	1	1	Prioritizing quality improvement issues
115.	2	1	1	Customer input.

	Yes	No	NA	**Long-range planning in this organization includes:**
116.	2	1	1	Employee input
117.	2	1	1	Quality improvement implementation strategies for all work units
118.	2	1	1	A means for monitoring quality improvement progress over time.

	Yes	No	NA	**In terms of setting organizational improvement priorities, we have considered or evaluated:**
119.	2	1	1	Changing our business strategy
120.	2	1	1	Improving our work methods or procedures
121.	2	1	1	Improving our employee utilization
122.	2	1	1	Revising or instituting training programs
123.	2	1	1	Acquiring recent technological improvements (equipment, etc).

---

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

124. ___ The structure of this organization supports its efforts to carry out its mission.

125. ___ Organizational members have the information they need to do their work.

126. ___ This organization has a realistic schedule for replacing outdated equipment.

127. ___ This organization's members have been adequately trained to use the equipment they have.

128. ___ Before equipment is bought by or issued to this organization, plans have been made concerning how it will be used and who will use it.

129. ___ Efforts are made to update work methods in this organization.

1 – Strongly Disagree 4 – Somewhat Agree
2 – Disagree 5 – Agree
3 – Somewhat Disagree 6 – Strongly Agree

130. ___ People in charge of similar work units frequently share information about their work methods and practices.

131. ___ Updating work methods can be key to quality improvement.

Organization members with good ideas are likely to:

132. ___ Formally submit them through a suggestion system

133. ___ Tell their supervisors

134. ___ Be asked periodically what they think.

	Yes	No	NA	
135.	2	1	1	This organization has a suggestion program.
136.	2	1	1	This organization has conducted brainstorming sessions that included lower level organizational members.
137.	2	1	1	This organization has used teams to gather information or solve problems.

---

1 – Strongly Disagree 4 – Somewhat Agree
2 – Disagree 5 – Agree
3 – Somewhat Disagree 6 – Strongly Agree

138. ___ Creative thinking is rewarded in this organization.

139. ___ Taking risks is rewarded in this organization.

140. ___ Managers at all levels have the authority to try promising new approaches.

141. ___ A promising new approach is likely to be approved quickly for a trial.

142. ___ The future strength of this organization is dependent on the continuing growth of its members through appropriate training.

Circle the response number next to the *one* statement that best represents your organization.

With respect to setting goals or expectations for their work, most non-supervisory members:

143. 6 Have direct input
4 Have indirect input through representatives
3 Can negotiate with management
1 Have no input.

To learn about quality management techniques, most organizational members:

144. 6 Attend mandatory in-house training programs
5 Attend in-house training programs on a voluntary basis
4 Attend outside seminars
3 Review available in-house resources (books and tapes)
1 None of the above.

	Yes	No	NA	**In order to tell how well we are doing, we monitor:**
145.	2	1	1	Our efficiency
146.	2	1	1	Our effectiveness
147.	2	1	1	Our productivity
148.	2	1	1	The quality or our services/products/work
149.	2	1	1	The timeliness of our work
150.	2	1	1	Our innovativeness

	Yes	No	NA	**In order to tell how well we are doing, we monitor:**
151.	2	1	1	The quality of working life for our members
152.	2	1	1	Our finances.
				The performance data that this organization collects:
153.	2	1	1	Are tracked over time
154.	2	1	1	Are compared with goals, standards, or objectives
155.	2	1	1	Are compared with data from other similar organizations
156.	2	1	1	Are evaluated at least quarterly
157.	2	1	1	Are used to identify problems/barriers
158.	2	1	1	Are evaluated by a team or task force
159.	2	1	1	Are used to identify opportunities for improvement.

	Yes	No	NA	
160.	2	1	1	Organizational members are informed about how this work unit stands in relation to goals, objectives, or standards?
				Top performing managers at all levels in this organization can expect:
161.	2	1	1	A monetary bonus or award
162.	2	1	1	An award
163.	2	1	1	To be recognized by leaders at the top level
164.	2	1	1	To be told they are doing a great job
165.	2	1	1	Increased responsibility.
				Top performing organizational members can expect:
166.	2	1	1	A monetary bonus or award
167.	2	1	1	An award
168.	2	1	1	To be recognized by leaders at the top level
169.	2	1	1	To be told they are doing a great job
170.	2	1	1	Increased responsibility.
171.	2	1	1	The performance appraisals of manager at all levels include quality improvement criteria.
172.	2	1	1	The performance appraisals of organizational members include quality improvement criteria.

Management Tools Assessment

There are 21 statements in this section.

	Yes	No	NA	**This organization has used surveys to:**
173.	2	1	1	Assess employees' opinion about the organization's practices or policies
174.	2	1	1	Gather information about what in the organization needs improving
175.	2	1	1	Assess the outcomes of its work
176.	2	1	1	Assess the quality of its work
177.	2	1	1	Assess employee opinions about the goals/objectives they are working toward.
				This organization has called groups of individuals together to:
178.	2	1	1	Define or clarify the organization's mission and/or work
179.	2	1	1	Define long-term organizational-level goals and/or long-term work unit-level goals
180.	2	1	1	Define short-term organizational objectives and/or short-term work unit objectives
181.	2	1	1	Identify obstacles to goal/objective accomplishment
182.	2	1	1	Define performance measures to track progress toward goal attainment.
183.	2	1	1	The organization uses statistical process control charts or graphs to track data over time.
184.	2	1	1	This organization uses diagrams or flowcharts to highlight potential causes of problems.
185.	2	1	1	This organization has evaluated its office and work space design.
186.	2	1	1	This organization has a high-quality information resource library.

	Yes	No	NA	
187.	2	1	1	This organization has arranged workshops to promote quality management awareness among its members.

	Yes	No	NA	**This organization has:**
188.	2	1	1	Published newsletters containing quality improvement information
189.	2	1	1	Posted information about quality improvement on bulletin boards
190.	2	1	1	Held contests to reward the most improved work units
191.	2	1	1	Attempted to inform and involve everyone in quality improvement
192.	2	1	1	Used team-building techniques to improve relationships
193.	2	1	1	Established improvement teams.

Organizational Assessment

There are 22 statements in this section.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

194. ___ Work delays are uncommon in this organization.
195. ___ Once a job or project gets started, it's usually finished without undue delay.
196. ___ There is little waste of materials and supplies.
197. ___ People make efforts to reuse or salvage excess materials and supplies whenever possible.

198. ___ Tools and/or equipment are maintained and operated at peak efficiency.
199. ___ Our tools and/or equipment rarely require repair.
200. ___ This organization has sufficient personnel to accomplish its mission.
201. ___ The personnel turnover rate is low.

202. ___ Working conditions (noise, heat, light, cleanliness) are excellent.
203. ___ Work facilities are excellent.
204. ___ Organizational members are well trained.
205. ___ Organizational members receive the guidance and assistance they need to accomplish their work.

206. ___ This organization's materials and supplies are well accounted for without unexplained losses.

207. ___ This organization's materials and supplies meet quality specifications.
208. ___ Organizational members rarely need to shift work priorities to get jobs done.
209. ___ Organizational members rarely need to redo a job or task.

1 – Strongly Disagree
2 – Disagree
3 – Somewhat Disagree
4 – Somewhat Agree
5 – Agree
6 – Strongly Agree

The organization's customers:

210. ___ Are satisfied with the quality of work
211. ___ Seldom complain
212. ___ Are satisfied with the quantity of work.

The organization's customers:

213. ___ Are satisfied with the timeliness of work
214. ___ Find minimal errors in the work
215. ___ Find the work consistent.

Scoring

For each line in each scoring table:

- Write the sum of your responses for the range of statements indicated
- Divide by the sum by the divisor value
- Write the result in the score column
- Compare your score with the target value for each quality

Scores less than the target indicate improvement areas or potential problem areas with respect to implementing process improvement projects.

While this assessment focuses on quality and quality improvement, most of the statements can be taken in the context of process improvement without loss of validity in the scoring tables.

One of the most valuable deliverables in this assessment is the list of qualities that should be of concern to change management as well as process improvement teams.

Organizational Climate					
State-ments	Sum Total	Divisor	Score	Target	Quality
1-6		6		3.50	Awareness of strategic challenge
7-11		5		3.50	Vision for the future
12-13		2		3.50	Innovation
14-18		5		3.50	Quality policy
19-21		3		3.50	Value system/ethics
22-25		4		3.50	Top management involvement
26-28		3		3.50	Visible commitment to goals
29-31		3		3.50	Role in improvement process
32-33		2		3.50	Concern for improvement
34-35		2		3.50	System for improvement
36-37		2		3.50	Awareness of issues
38-41		4		3.50	Attitudes and morale
42-45		4		3.50	Cooperation
46-47		2		3.50	Involvement
48-50		3		3.50	Perceptions of work place
51-52		2		3.50	Social interactions
53-57		5		3.50	Task characteristics
58-64		7		3.50	Consequential constraints
65-66		2		3.50	Customer orientation
67-70		4		3.50	Communications
Avg score—Divide sum by 20 =				3.50	

Process					
State-ments	Sum Total	Divisor	Score	Target	Quality
71-77		7		1.50	Job analysis
78-82		5		1.50	Higher authority
83-87		5		1.70	Quality emphasis
88-96		9		1.55	Top management leadership
97-100		4		1.60	Customer service
101-104		4		1.60	Define improvement
105-108		4		3.50	Unit goals
109-112		4		3.50	Organizational goals
113-118		6		1.50	Quality planning
119-123		5		1.50	Planning strategy
124-125		2		3.50	Organizational streamlining
126-128		3		3.50	Investment in technology
129-131		3		3.50	Methods/process improvement
132-134		3		3.50	New ideas
135-137		3		1.40	People-oriented input
138-144		7		3.50	Track progress
145-152		8		1.50	Measurement
153-155		3		1.40	Feedback

156-159		4		1.50	Evaluation
160		1		1.00	Results
161-170		10		1.50	Awards
171-172		2		1.50	Personal evaluations

Management Tools					
State-ments	Sum Total	Divisor	Score	Target	Quality
173-177		5		1.30	Assessments
178-182		5		1.50	Definition of tools
183-185		3		1.50	Measurement/process analysis
186-190		5		1.50	Awareness/communication
191-193		3		1.50	Organizational development
Avg Score—Divide sum by 5=				1.21	

Organizational Outcomes					
State-ments	Sum Total	Divisor	Score	Target	Quality
194-195		2		3.50	Work flow/delays
196-197		2		3.50	Waste
198-199		2		3.50	Tools/equipment
200-201		2		3.50	Staffing
202-203		2		3.50	Facilities
204-205		2		3.50	Training
206-207		2		3.50	Supplies/parts
208-209		2		3.50	Organization/group structure
210-211		2		3.50	Customer quality survey
212-213		2		3.50	Quantity
214-215		2		3.50	Reliability
Avg Score—Divide sum by 11 =				3.50	

ANNEX H. METHODOLOGY WORK BREAKDOWN STRUCTURE

PHASE 1: STRATEGIC AND BUSINESS PLANNING

Step 1: Develop/Validate the Strategic Plan

- T 1: Develop/validate the organizational articles of faith
- T 2: Identify major customer groupings and general customer requirements
- T 3: Conduct strategic benchmarking to establish performance targets
- T 4: Conduct SWOT analysis
- T 5: Identify core competencies
- T 6: Determine high-level customer service requirements
- T 7: Prepare breakthrough objectives
- T 8: Identify performance measures
- T 9: Document the strategic plan
- T 10: Review and approve the strategic plan.

Step 2: Develop/Validate the Business Systems Plan

- T 11: Review/validate the current business systems planning architectures
- T 12: Identify major business processes
- T 13: Develop the business process/ organizational map
- T 14: Prepare/validate information systems architectures
- T 15: Review and approve the business systems plan.

Step 3: Develop/Validate the Business Plan

- T 16: Review strategic and business systems planning materials
- T 17: Develop preliminary process notebook
- T 18: Conduct detailed customer requirements analysis
- T 19: Categorize process improvement projects
- T 20: Develop the business plan report
- T 21: Review and approve business plans.

Step 4: Construct Performance Cells

- T 22: Select performance cell by process
- T 23: Assign responsibility for performance cell development
- T 24: Develop performance cells
- T 25: Review and approve the performance cell document.

Step 5: Establish Process Improvement Project

- T 26: Specify process improvement project
- T 27: Select and confirm a process manager and project manager
- T 28: Develop and/or validate the process deployment map
- T 29: Record functional management considerations
- T 30: Document the scope/mission/objectives of functional elements
- T 31: Select and train the cross-functional process improvement team
- T 32: Develop a preliminary process vision
- T 33: Develop the process improvement strategy
- T 34: Develop the project plan
- T 35: Review and approve the project plan.

PHASE 2A: BUSINESS PROCESS REENGINEERING

Step 6: Conduct Baseline Analysis

- T 1: Develop or confirm the project scope
- T 2: Develop or review and revise AS-IS Activity Models
- T 3: Develop or review and revise AS-IS Data Models
- T 4: Perform activity based costing
- T 5: Perform time-line analysis (simulation)
- T 6: Document the baseline condition
- T 7: Revise performance cell descriptions
- T 8: Review and approve baseline documentation.

Step 7: Conduct Improvement Analysis

- T 9: Review process vision, objectives, and measures
- T 10: Conduct stakeholder requirements gap analysis
- T 11: Conduct best practices benchmarking analysis
- T 12: Select data gathering and analysis techniques

T 13: Identify and document performance gaps in product quality
T 14: Identity and document performance gaps in process cycle time
T 15: Identify and document performance gaps in process cost
T 16: Identify and document process-related issues
T 17: Identity and document organizational issues
T 18: Identify and document technology issues
T 19: Develop process improvement opportunities
T 20: Prepare process improvement analysis report
T 21: Review and approve process improvement analysis report.

Step 8: Redesign/Reengineer Processes

T 22: Review process improvement analysis report
T 23: Refine process vision statement
T 24: Develop initiatives for process improvement
T 25: Redesign/redevelop business processes
T 26: Refine/redevelop process deployment map
T 27: Describe and quantify new stakeholder relationships
T 28: Revise future state performance cell descriptions
T 29: Validate initiatives and models against requirements
T 30: Select alternatives for process improvement actions
T 31: Perform economic analysis on alternatives
T 32: Develop detailed TO-BE activity and data models
T 33: Initiate/coordinate data administration activities
T 34: Initiate/coordinate information systems activities
T 35: Prepare final process design specifications
T 36: Review and approve process design specifications.

Step 9: Prepare Functional Economic Analysis Decision Package

T 37: Review process improvement recommendations
T 38: Review organizational change management plan (from Section 6.3.5)
T 39: Review technology change management plan (from Section 7.3.6)
T 40: Develop preliminary Functional Economic Analysis (FEA)
T 41: Develop preliminary data and technical management plan
T 42: Perform technical review of FEA documents
T 43: Validate/revise preliminary FEA report
T 44: Prepare final Functional Economic Analysis report
T 45: Review and approve FEA

PHASE 2B: ORGANIZATIONAL CHANGE MANAGEMENT

Step 10: Assess Organizational Capability

T 1: Review process improvement organizational implications
T 2: Assess organizational status (strengths and weaknesses)
T 3: Document current organizational status
T 4: Review and approve organizational situation report.

Step 11: Identify Organizational Change Requirements

T 5: Review and evaluate process improvement analysis report
T 6: Document organizational best practices
T 7: Evaluate organizational change requirements
T 8: Develop time and cost estimates
T 9: Develop organizational impact statement
T 10: Review and approve organizational impact statement.

Step 12: Develop Organizational Change Management Plan

T 11: Analyze organizational barriers to change
T 12: Prepare strategies for overcoming barriers

T 13: Identify process-related training requirements
T 14: Develop organizational change management plan
T 15: Review and approve organizational change management plan.

PHASE 2C: TECHNOLOGY CHANGE MANAGEMENT

Step 13: Assess Technical Capability

T 1: Review Process Improvement Plan Technical Implications
T 2: Assess Current Technical Status (Strengths/Weaknesses)
T 3: Assess Emerging Technologies v Process Requirements
T 4: Document Technical Status
T 5: Review and Approve Status Report.

Step 14: Identify Technical Change Requirements

T 6: Review Process Improvement Recommendations
T 7: Identify Technology Best Practices
T 8: Evaluate Technical Change Requirements
T 9: Develop Time and Cost Estimates
T 10: Perform Technical Impact Statement
T 11: Review and Approve Technical Impact Statement.

Step 15: Develop Technical Change Management Plan

T 12: Design High-level Technical Models
T 13: Identify Barriers to and Implications of Change
T 14: Develop Strategies for Addressing Barriers
T 15: Identify Technology-related Training Requirements
T 16: Develop Technology Change Management Plan
T 17: Review and Approve Technology Change Management Plan.

PHASE 3: ENTERPRISE ENGINEERING

Step 16: Configure Technical Platform

T 1: Review Approved FEA Package and Supporting Documents
T 2: Review Technical Change Management Plan
T 3: Assess Current Status and Capabilities
T 4: Design Hardware Systems Support Requirements
T 5: Design Communications Support Requirements
T 6: Design Network Support Requirements
T 7: Design Systems Software Requirements
T 8: Document Technical Platform Requirements
T 9: Review and Approve Platform Requirements.

Step 17: Develop Application Systems

T 10: Review Approved FEA and Supporting Documentation
T 11: Review Technical Change Management Plan
T 12: Assess Current Capabilities
T 13: Design Application Support Systems
T 14: Develop Application Support Systems
T 15: Unit-test Application Support Systems with Data Base
T 16: Document Application Support Systems
T 17: Review and Approve Application Systems.

Step 18: Develop Data Base Structures

T 18: Review Approved FEA and Supporting Documentation
T 19: Review Technical Change Management Plan
T 20: Assess Current Capabilities
T 21: Perform Data Base Administration Activities
T 22: Design Data Base Structures
T 23: Unit-test Data Base Structures with Application Software
T 24: Document Data Base Structures
T 25: Review and Approve Data Base Structures.

Step 19: Construct Information Systems

T 26: Prepare Test/Pilot Site for Systems Assembly
T 27: Load Test Files and Data Bases
T 28: Assemble and Test Application Systems
T 29: Develop Draft Information System Manuals
T 30: Conduct Initial Training

T 31: Conduct Acceptance Trials
T 32: Develop Data Acquisition Plan
T 33: Review/Revise Organizational Change Management Plan
T 34: Develop Final Documentation Package
T 35: Acquire/Develop Functional/Technical Training Systems
T 36: Conduct Systems Audit and Acceptance Tests.

Step 20: Design Systems Integration Plan

T 37: Design Platform Integration Plan
T 38: Design Data Base Integration Plan
T 39: Design Application Systems Integration Plan
T 40: Review Information Systems for Conformity with DoD Enterprise Model
T 41: Identify and Resolve Cross-Functional Process Issues
T 42: Identify and Resolve Interoperability Issues and Concerns
T 43: Develop Revised (TO-BE) Architectures
T 44: Update Defense Data Repository System
T 45: Develop Transition/Migration Plan
T 46: Conduct Pre-installation and Deployment Conference.

PHASE 4: PROJECT EXECUTION

Step 21: Develop Installation/Deployment Project Management Plan

T 1: Review Approved Project-related Documents
T 2: Construct Project Management Plan
T 3: Secure Review/Approval of Project Management Plan
T 4: Execute Project Management Plan.

Step 22: Install/Deploy Information Systems

T 5: Select Initial Installation Site
T 6: Install and Test Information Systems
T 7: Implement Training Programs
T 8: Conduct Parallel Test Program
T 9: Secure Customer Acceptance
T 10: Implement Transition (Cut-over) Plan
T 11: Deploy Remaining Sites
T 12: De-commission Obsolete Information Systems
T 13: Conclude Information Systems Deployment Phase.

Step 23: Deploy Organization Change Management Plan

T 14: Issue Policy and Guidance
T 15: Implement Transition Plan
T 16: Deploy Implementation Plan
T 17: Complete Organizational Realignment
T 18: Changeover to New Process and Information Systems
T 19: Monitor Change Process
T 20: Adjust Program as Required
T 21: Prepare Final Implementation Report
T 22: Conclude Installation/Deployment Program.

Step 24: Operate/Maintain Process and Information Systems

T 23: Operate Process and Information Systems
T 24: Monitor Performance
T 25: Identity/Classify/Resolve Problems and Issues
T 26: Maintain Process and System Documentation
T 27: Conduct Continuous Training and Support Program
T 28: Prepare Regular Operating Status Reports.

Step 25: Conduct Continuous Process Improvement Program

T 29: Review Performance/Status/Problem Reports
T 30: Conduct Surveys/Interviews/ Questionnaires/Focus Groups
T 31: Monitor Stakeholder Feedback
T 32: Identify Incremental Improvement Opportunities
T 33: Design Incremental Change Specifications
T 34: Implement Incremental Change Program
T 35: Prepare Regular Improvement Status Reports.

Poor Man's Project Planner: Task Assignments and Estimates

Step				Resp.	
Tas K #	Responsible	Start Date	End Date	E. Hours	E. Cost
Step Summary					

Poor Man's Project Planner: Step Assignments and Estimates

Poor Man's Project Planner: Project Assignments and Estimates

[NOTES AND IDEAS]