The Performance-Based Management Handbook

A Six-Volume Compilation of Techniques and Tools for Implementing the Government Performance and Results Act of 1993 (GPRA)

Volume Six

Using Performance Information to Drive Improvement

Performance-Based Management Special Interest Group (PBM SIG)
http://www.orau.gov/pbm

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The **Performance-Based Management Special Interest Group (PBM SIG)** is a U.S. Department of Energy (DOE) and DOE contractor funded organization made up of DOE and DOE contractor personnel who have a special interest in performance-based management. The mission of the PBM SIG is to facilitate, promote, and advance the use of performance-based management in DOE. The activities and publications of the PBM SIG are coordinated and administered by the Oak Ridge Institute for Science and Education.

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Volume 6

Using Performance Information to Drive Improvement

Prepared by the

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Preface

?. . . chart a course for every endeavor that we take the people's money for, see how well we are progressing, tell the public how we are doing, stop the things that don't work, and never stop improving the things that we think are worth investing in."

President William J. Clinton, on signing the
Government Performance and Results Act of 1993

Introduction

All high-performance organizations, whether public or private, are, and must be, interested in developing and deploying effective performance measurement and performance management systems, since it is only through such systems that they can remain high-performance organizations. When President Clinton signed the Government Performance and Results Act of 1993 (GPRA) into law, this commitment to quality was institutionalized. Federal agencies were required to develop strategic plans for how they would deliver high-quality products and services to the American people. Under GPRA, strategic plans are the starting point for each federal agency to (1) establish top-level agency goals and objectives, as well as annual program goals; (2) define how it intends to achieve those goals; and (3) demonstrate how it will measure agency and program performance in achieving those goals.

The publication of *The Performance-Based Management Handbook, A Six-Volume Compilation of Techniques and Tools for Implementing the Government Performance and Results Act of 1993* follows a logical progression of resources developed to assist in the effective and efficient implementation of GPRA. In chronological order, these resources are:

- The National Performance Review (NPR)
- *How to Measure Performance—A Handbook of Techniques and Tools*
- *Guidelines for Strategic Planning*
- *Guidelines for Performance Measurement*
- *Executive Guide: Effectively Implementing the Government Performance and Results Act*
- *NPR Benchmarking Study Report Best Practices in Customer-Driven Strategic Planning*
- *NPR Benchmarking Study Report Best Practices in Performance Measurement*
- *The Performance-Based Management Handbook, A Six-Volume Compilation of Techniques and Tools for Implementing the Government Performance and Results Act of 1993*

The National Performance Review

In the same year that GPRA was signed into law, President Clinton and Vice President Gore initiated the National Performance Review (NPR) to reinvent government. One of NPR's reinvention initiatives was to foster collaborative, systematic benchmarking of best-in-class organizations, both public and private, to identify best practices in a wide range of subjects vital to the success of federal agencies in providing high-quality products and services to the American people.

How to Measure Performance—A Handbook of Techniques and Tools

Developed in October 1995, *How to Measure Performance—A Handbook of Techniques and Tools* was the Performance-Based Management Special Interest Group's (PBM SIG's) first handbook. It was produced at a time when DOE personnel were struggling with the concepts and conventions of performance measurement

and has been touted as a very useful guidance document. The handbook describes three different approaches to developing performance measures; provides sections on performance indexing, data analysis, and reporting techniques; and includes a thorough glossary of terms, an inclusive list of references, and a substantial list of sample performance measures.

Guidelines for Strategic Planning

This Department of Energy (DOE) guidance document (DOE/PO-0041) was published in January 1996 by the Office of Policy and International Affairs to help strategic planning teams plan for, organize, and prepare the departmental strategic plan required under GPRA. It provides guidance both to those organizations and personnel starting the strategic planning process for the first time and to those reviewing or updating existing plans. The steps outlined within this document represent a very simplified approach to strategic planning.

Guidelines for Performance Measurement

The DOE Performance Measurement Coordination Team released this guidance document (DOE G 120.1-5) in June 1996. It is often referred to as a companion document to the PBM SIG's first handbook. While both documents cover performance measurement, this document also covers the relationship of performance measurement to organizational operations, presenting topics such as performance linking, tying into departmental systems, and coordinating performance measures.

Executive Guide: Effectively Implementing the Government Performance and Results Act

The U.S. General Accounting Office (GAO) published this document (GAO/GGD-96-118) in June 1996. It resulted from a study done at the request of Congress in which a number of leading public sector organizations that were successfully pursuing management reform initiatives and becoming more results-oriented were studied. Each of these organizations set its agenda for management reform according to its own environment, needs, and capabilities. Yet, despite their differing approaches to reform, all these organizations commonly took three key steps to becoming more results oriented: (1) define clear missions and desired outcomes, (2) measure performance to gauge progress, and (3) use performance information as a basis for decision making. These three key steps are discussed in this GAO executive guide, along with their relationship to GPRA. Also discussed is the role of top leadership and the practices it can follow if it hopes to make GPRA a driving force in an organization. Accompanying the discussion of each practice is a case illustration involving a federal agency that has made progress in incorporating the practice into its operations.

NPR Benchmarking Study Report: Customer-Driven Strategic Planning

In February 1997, NPR published its *Benchmarking Study Report Best Practices in Customer-Driven Strategic Planning*, which documents and details the in-depth processes and approaches of those best-in-class organizations that excel at incorporating their customers' needs and expectations into their strategic planning processes. This study provided public and private leaders and managers with world-class practices and formulas for success in developing and deploying strategic plans and goals for an agency.

NPR Benchmarking Study Report: Best Practices in Performance Measurement

To complement its strategic planning study, NPR commissioned the first-ever intergovernmental benchmarking consortium involving not only U.S. federal agencies, but also local governments and the government of Canada in a collaborative study of performance measurement. As documented in its June 1997 report, the NPR Performance Measurement Study Team found that the best performance measurement and management systems and practices work within a context of strategic planning that takes its cue from customer needs and customer service. They also found that:

- Leadership is critical in designing and deploying effective performance measurement and management systems.
- A conceptual framework is needed for the performance measurement and management system.
- Effective internal and external communications are the keys to successful performance measurement.
- Accountability for results must be clearly assigned and well-understood.
- Performance measurement systems must provide intelligent information for decision makers, not just compile data.
- Compensation, rewards, and recognition should be linked to performance measurements.
- Performance measurement systems should be positive, not punitive.
- Results and progress toward program commitments should be openly shared with employees, customers, and stakeholders.

The Performance Measurement Process Model

To provide them with a useful frame of reference as they studied performance measurement in best-in-class organizations, the NPR Performance Measurement Study Team built a model of the performance measurement process used in the federal context. This Performance Measurement Process Model was published in its June 1997 report. This model is shown in Figure PBM.1 on the following page.

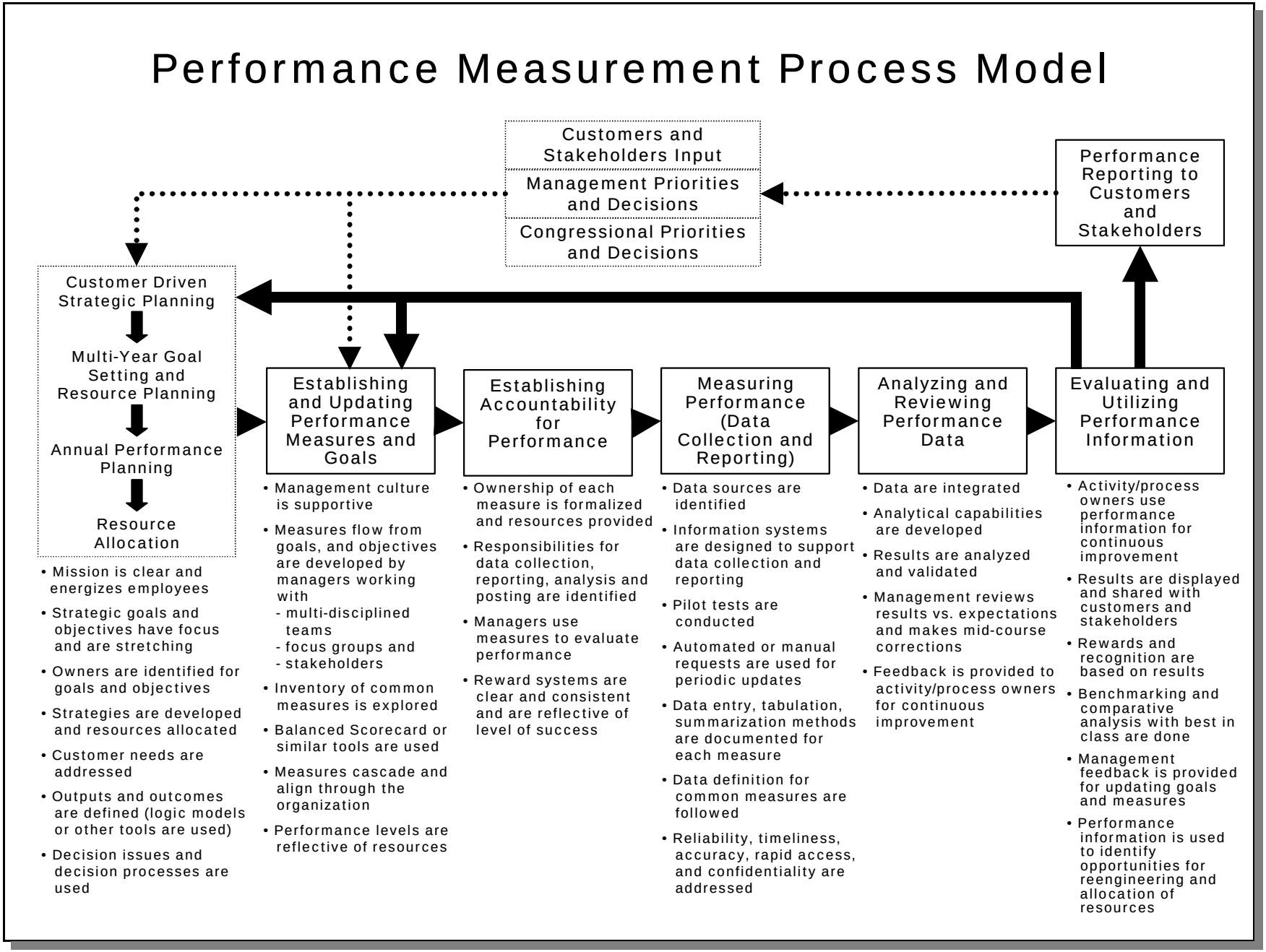

Figure PBM.1

NPR Performance Measurement Process Model

The Performance-Based Management Handbook

The PBM SIG adapted the NPR Performance Measurement Process Model into a performance-based management process model and used this model to structure *The Performance-Based Management Handbook*. The PBM SIG Performance-Based Management Process/Handbook Model is shown in Figure PBM.2 below. Topics covered by each volume are listed after the figure.

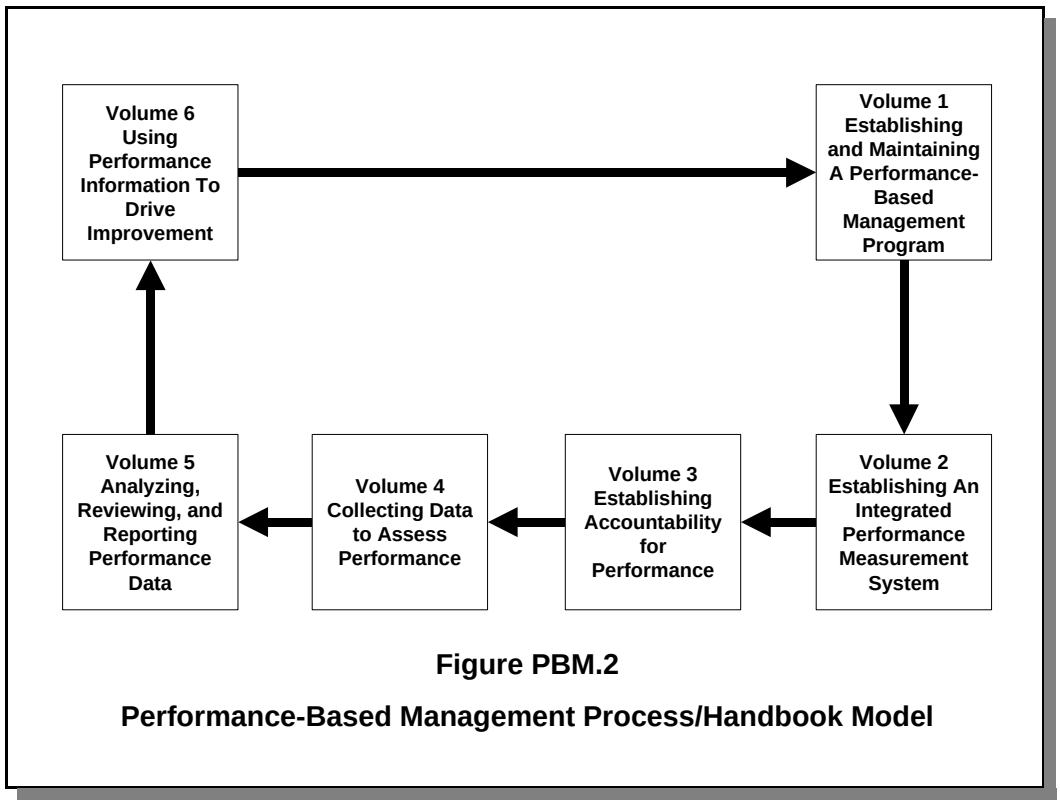

Figure PBM.2

Performance-Based Management Process/Handbook Model

Volume 1: Establishing and Maintaining a Performance-Based Management Program

- An Introduction to Performance-Based Management
- Step 1: Define Organizational Mission and Strategic Performance Objectives
- Step 2: Establish an Integrated Performance Measurement System
- Step 3: Establish Accountability for Performance
- Step 4: Establish a System/Process for Collecting Data to Assess Performance
- Step 5: Establish a System/Process for Analyzing, Reviewing, and Reporting Performance Data
- Step 6: Establish a System/Process for Using Performance Information to Drive Improvement
- Maintaining a Performance-Based Management Program

Volume 2: Establishing an Integrated Performance Measurement System

- Understanding Performance Measurement
- Establishing an Integrated Performance Measurement System
- Choosing a Performance Measurement Framework

- Developing Performance Measures—Getting Organized
- Developing Performance Measures—Sample Approaches
- Maintaining an Integrated Performance Measurement System

Volume 3: Establishing Accountability for Performance

- The Concept of Accountability
- Establishing Accountability for Performance
- Accountability Tools

Volume 4: Collecting Data to Assess Performance

- Determining Data Needs
- Components of a Data Collection Plan
- Data Collection Considerations
- Data Collection Methods
- Suggestions for Measuring R&D Activities

Volume 5: Analyzing, Reviewing, and Reporting Performance Data

- Introduction to Data Analysis
- Training Your Organization in Analysis Skills
- Generating Useful Information - Step 1: Question Review
- Generating Useful Information - Step 2: Data Collection and Organization
- Generating Useful Information - Step 3: Data Analysis
- Generating Useful Information - Step 4: Data Presentation

Volume 6: Using Performance Information to Drive Improvement

- Using Performance Information to Drive Improvement
- Benchmarking
- Reengineering
- Continuous Improvement
- Process Improvement

About This Volume

This volume was edited by: Will Artley, Oak Ridge Institute of Science and Education, and Randy LaBarge, Pacific Northwest National Laboratory. Editorial assistance was provided by Phyllis Baker, University of California; Cynthia Eubanks, Bechtel Jacobs Company; Buck Koonce, University of California; and Suzanne Stroh, University of California.

Volume 6 Overview

The old adage that we ?are either moving forward or we are losing ground" definitely applies in today's world of stiff competition for ever scarcer resources. Simply put, organizations must aggressively seek best practices and reduced cost of operations. Utilizing performance information is how organizations achieve this goal.

Volume 6 provides the key elements to achieving performance improvement through the use of performance information. Specifically, it addresses three areas where management can use this information:

- Driving performance improvement
- Benchmarking (including the use of performance data to accomplish benchmarking and the use of benchmarking data to drive improvement)
- Changing management processes through reengineering, continuous improvement, and process improvement

Performance information is used at all levels of management to drive performance improvement. It tells an organization its present condition. It also allows the organization to objectively measure itself against others through benchmarking. In turn, benchmarking aids in identifying potential areas of performance improvement and in generating innovative ideas to drive that improvement. Reengineering, continuous improvement, and process improvement are systematic approaches used by organizations to develop improved processes and to reduce the cost of operations.

The purpose of Volume 6 is to provide any organization—federal or contractor—with a description of current best practices for driving improved results and reduced costs of operation. In addition, this volume contains extensive appendices of references and resources to assist managers in accomplishing their improvement efforts.

Section I: Using Performance Information to Drive Improvement

This section provides insights and examples for management's use of performance data to drive organizational performance improvement. It addresses the use of performance information for presentation, analysis, planning, decision-making, and motivation of employees.

Data Presentation

There are always many activities being performed within an organization. Performance measurement methods can be developed and used to assist in determining progress for any or all of these activities. Because the resultant performance information can be extensive, it is necessary to develop a strategy for dealing with and presenting these large amounts of data in an effective manner.

This performance measurement information has many uses. Primarily, these data provide management and individual performers with a view of current and past levels of performance. They also can provide an indication of future performance. These levels of performance provide the necessary clarity as to where an organization (or individual performer) stands relative to its goals and aspirations. Therefore, it is incumbent on management to establish an appropriate method for presenting key information in a way that promotes and encourages the behaviors necessary to attain the organization's objectives and vision.

Presentation and Performance Measurement Architecture

At each level of an organization, there are specific objectives that need to be met. In an hierarchical organization, these objectives cascade down from the top to the individual performer. In nonhierarchical organizations, performance objectives are linked in less linear methods, but the concept is consistent. The process of developing an organization-wide performance measurement and presentation architecture is a remarkably effective alignment tool that goes far to provide what Kaplan and Norton describe as ?Achieving Strategic Alignment: From Top to Bottom" (Kaplan and Norton 1996).

This alignment should result in each organization, team, group, and individual knowing and understanding their roles in achieving the overall organizational objective. It is important, in the rigors of day to day work, that there is constant and immediate feedback on progress. This feedback keeps all workers engaged each and every day. One approach to providing this feedback has been touted by many authors and consultants and is best exemplified by the cockpit, dashboard, or gauge metaphors. We will use the cockpit for illustrative consistency, but you can easily translate the metaphor to any analogy you prefer.

As the analogy goes, there are pilots at each organizational level. From the bottom up, you have the individual at the work level that almost always has some level of self direction. The individual, therefore, should have performance indicators for self management. An example might be an Accounts Payable Clerk. This individual has certain performance standards and goals such as the number of invoices processed per day and the number of errors made, discounts taken, etc. The individual can readily see if he/she is making it and will know when additional effort is required without prompting from management. At the next level, the Accounts Payable Supervisor or Team Leader will monitor team performance as the individual statistics are combined for team performance indicators. The individual performance roll-ups may be augmented with other data, such as customer and employee satisfaction, and cost.

At the next level, the Accounting Services Manager is piloting a larger craft and may have data rolling up from each group managed, such as Accounts Payable, Accounts Receivable, Payroll, General Accounting, Reporting and Analysis etc. The Accounting Services Manager will then report to a Controller, Chief Financial Officer, Business Service Manager, or some similar position. This hierarchical relationship continues up to the top executive.

Each pilot or manager should then have a set of performance indicators that are relevant to piloting the craft that he/she is accountable for piloting. The set should be a combination of indicators that provide information on direction, altitude, and speed. In addition, there should be internal cabin environmental measures that indicate the internal conditions lest the craft be flying in the right direction, at the right speed and altitude, but the crew and passengers died because of lack of oxygen.

Mark Graham Brown (Brown 1996) and other leading business writers indicate that no single cockpit should have more than 20 measures. But, as you can see, the cascading effect of the top to bottom alignment creates a lot of data. Fundamentally, the analogy states that there are piloting metrics and metrics that mechanics need to perform their work. Standing at one management level (cockpit), one can see that the next level metrics are mechanic's metrics from that vantage point. But, at that lower level, what are mechanic's measures at the previous higher organizational level are cockpit measures . . . and so on down the organizational ladder.

So, in the example with the Accounting Services Manager (ASM) we are using, he/she may see that the costs of this area are rising and then can look under the hood to see the next level cockpit measures and recognize, for example, that the Accounts Payable and Payroll teams have rising costs. In a mature organization, those team leaders already will be aware of the rising trend, will have analyzed the issues and have the justification in place or an action plan to reverse the trends. The ASM then can provide assistance, reassign departmental budgets, renegotiate budgets with internal customers, or deploy motivational or disciplinary actions in a prompt and effective manner.

At each level then, the pilot is monitoring key indicators that are indices comprised of lower level measures. The pilot need not worry about these lower level measures unless his cockpit measures indicate a problem. Furthermore, the cockpit may be constructed such that the key piloting metrics are always seen (e.g., speed, altitude, etc.) and some key and important mechanics' metrics are only seen if there is trouble (e.g., oil pressure warning lights).

Warning lights primarily address situations in which there are areas of performance that operate with a high degree of reliability but that have serious consequences should systems fail. An illustration, to continue with financial examples: Meeting regulatory and administrative funds control requirements is usually a very dependable activity within the DOE Complex, but failure to meet these requirements may result in serious consequences up to, and including, criminal prosecution.

Measuring this activity usually results in a flat 100 percent performance line, so there is little value in presenting or demonstrating this performance level. But you can see that a warning light type of indicator would be valuable. Many, if not most, DOE Contractors have such a device that usually triggers **?**procurement holds" on affected funds when the organization has expended a certain percentage of them (e.g. 90 percent). Again, these warning lights should appear only at the appropriate cockpit level for prompt and effective management response.

A graphical representation of the architecture that we have been discussing may look like Figure 6.1 (on the following page). (Note: This chart is for illustrative purposes only. Organizations may be bigger, smaller, or may be organized in a nonhierarchical way. The key message is that each level of management needs a similar set of metrics and that these metrics contain indices of performance at lower levels of the organization.)

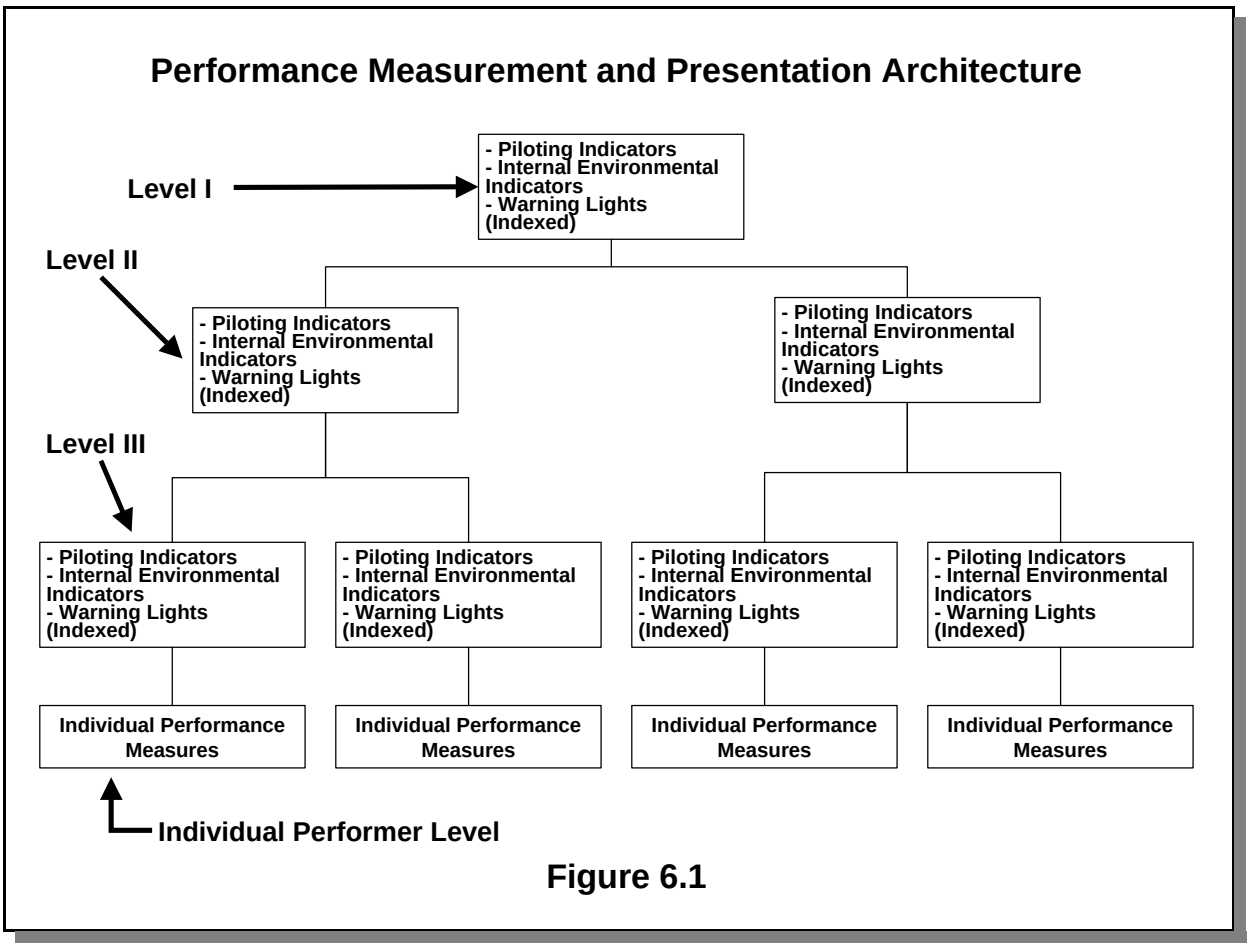

Figure 6.1

Performance Comparisons

As is discussed in the Benchmarking section of this volume and in other sections, any performance measurement architecture should include comparative metrics in order to clarify the organization's position relative to competitors, peers, or colleagues. These comparisons will help target and motivate performance or allow recognition of excellence. Keeping score is only relevant within a comparative context. Additionally, measuring improvement is fine, but the rate of improvement may still be insufficient for the competitive environment in which the organization lives, and the only way to determine that is through comparisons to others.

Other Management Concerns

In addition to monitoring performance through a limited set of indexed measures (cockpit measures), management should continuously analyze the measures in light of its current operating environment to assure itself that the correct measures are being used. Stephen Covey describes it using the analogy of a ladder (Covey, 1989). Your measurement system can tell you if you are climbing the ladder efficiently and effectively, but you must always look to see if your ladder is up against the right wall.

In their book called *The Goal* (1992), Eliyahu M. Goldratt and Jeff Cox illustrate this problem of measuring the right thing very effectively using an example from industry. In a manufacturing environment, key measures were related to individual machine productivity. The productivity measure helped demonstrate a prompt return on investment (ROI) per machine. This measure, however, prompted the manufacturing plant to push through and process as much as each machine could handle. The machine productivity goals were met, the ROI was

demonstrated, but the plant was going bankrupt. The machine productivity measure was incentivizing large amounts of inventories to be accumulated because the metric architecture was misaligned with customer demand and other internal productivity metrics. The message from Goldratt and Cox is **?**avoid measures that incentivize local optimization. Concentrate on more holistic measures."

Returning to financial examples, a similar lesson can be learned from experiences in Accounts Payable activities. In many accounting performance measures, transaction costs are a common measure of performance. If there is an incentive to reduce the cost of processing invoices, there may be a problem if your volume of invoices declines. The use of procurement cards and Just-In-Time (JIT) contracting has done just that. Procurement cards eliminate many invoices as procurement card providers provide only one monthly invoice replacing hundreds or thousands of individual invoices for small purchases. Similarly JIT contracts achieve the same from small dollar/large volume acquisitions of commodities from select vendors. As the more routine invoice transactions leave the Accounts Payable process due to improved procurement processes, the Accounts Payable function is left with fewer but more labor intensive invoices. Even with prompt redeployment of staff, the new composition of the workload results in higher costs per invoice. Yet, the total cost of the Accounts Payable activity is significantly lower. If management does not recognize that the lower overall cost reduction objective is being met even though the cost per invoice is up, the wrong behaviors will be promoted. In this case, the wrong behaviors may be to resist reductions in the number of invoices thus resisting process improvement and reengineering.

Management always should be vigilant of measures that promote local optimizations or that are misaligned with overall objectives. Management should adjust the analysis in the short term and the performance measurement/presentation architecture in the midterm.

Data Display

In addition to management reviews, selected performance information and data should be publicly displayed at the appropriate levels. Team and individual performance information may be posted where the team conducts its work. In a well formed and mature team environment, a public display will increase the team's and individual's motivation to perform well and will create supportive group dynamics like healthy and collaborative competition, playfulness, and commitment to continuous improvement. In an immature environment, however, some public information may create dissension and disenfranchisement. To avoid dysfunctional or immature use of the data, managers should be aware of, and responsive to, indications that support activities and displays are being improperly used or misinterpreted.

Organizational measures should be posted more widely to ensure that all of the organization's individuals understand the overall progress and see a clear linkage between what they are doing and how the organization as a whole is performing. Easy to read graphs and charts should be used. Bar, line, area, and pie charts are a few examples of easy to read charts that can be incorporated into a display strategy.

Types of Data

In general, there are two kinds of data—quantitative and qualitative. *Quantitative* data are related to numbers and are reflective of easily measurable elements. If your target is *x*, you either make it our you don't. If your cost is *y*, assuming the cost was calculated correctly, the cost cannot be disputed. *Qualitative* information or data require analysis in order to interpret their meaning. Customer and employee satisfaction levels, effectiveness of research and development, and effective decision support services are examples of areas that may need to be measured, assessed, reviewed, and interpreted with analytical skills. It is almost always necessary to incorporate both types of data to ensure that local optimization metrics are not being used to incorrectly navigate the activities of the organization.

Management Reviews

Management should review performance information routinely. The frequency of the reviews should be determined by the competitive environment, the nature of the objectives being measured, the level of review, and many other factors. A high-tech organization within a competitive environment, where product innovation happens every 18 months, should have much more frequent access to performance information than an organization in a much more stable industry such as government contracting. However, within each organization, there are objectives that may require more frequent management reviews. There maybe construction projects with tight milestones and tight funding. There may be urgent environmental efforts underway, or, there may be other politically sensitive issues requiring frequent management reviews of progress.

Each organization must determine the frequency of its management reviews of performance information, but, generally speaking, performance measures should not be allowed to deteriorate for too long before management responds. Prompt responses are much less expensive and may avoid crises; late remedial reactions are more expensive and usually do not avoid crises. This point is where the biggest savings are recouped in the Cost of Quality/Non-Conformance calculations and analyses. The push in industry is toward real-time performance information.

Anthony Robbins, a popular corporate and personal development consultant, says that airplanes flying to Hawaii are off course more than 90 percent of the time. Unless the airplane is on a perfectly direct line, navigational information and feedback is critical to making real-time and very frequent adjustments in course. Navigating our organizations is no less important and presents us with similar technological and human challenges requiring prompt or immediate information. The longer it takes to respond with necessary course corrections, the more resources will be consumed in the effort.

Management's analysis of and reaction to performance metrics is critical. If management displays a relative lack of response, individuals naturally will tend to minimize or ignore what the metrics are saying. Management's prompt and ?visible" reaction to shortfalls will cause individuals in the organization to grant the necessary focus and commitment to meeting organizational objectives. It is a key management responsibility for a performance-based organization.

Reaction to Data

As discussed above, the tone for how an organization performs will be set by how management reacts to performance information. When shortfalls are evident, management must demonstrate disappointment and a commitment to the corresponding actions necessary to execute a recovery. Management's attention and interest in the recovery plan and in monitoring the progress towards recovery are of utmost importance. Individuals throughout the organization will respond in concert with management's rigor or lack of it.

Sharing Results With Customers and Stakeholders

End-to-end process reengineering and improvements will often cross organizational boundaries. For example, partnerships with vendors may result in seamless order, delivery, invoicing, and payment processes in which vendors will have access to the inventory databases of its customer. At pre-established inventory levels, the vendor will ship more products. The shipment will, in turn, generate an electronic invoice that causes the customer's payment system to issue an electronic settlement transaction. Once the systems are linked and the rules are programmed, no human intervention will be necessary, save for the physical delivery of the product. This example is indicative of how many, if not most, organizations will need to integrate their processes with vendors, customers, and stakeholders in order to reduce costs and stay competitive.

Success of the newly reengineered processes is dependent on the performance of all parties along the value chain. As the parties depend more and more on their suppliers, customers, and stakeholders, assessment of their performance in the process is absolutely critical. In this example, metrics on shipping accuracy and timeliness will determine the viability of the supplier/partner. Timeliness and accuracy of payments, and

accuracy of the inventory database are critical information for the vendor. Statistics on payment and shipping errors will help auditors and management assess the effectiveness and therefore, the long term usefulness, of these partnerships.

As with this example, there are many end-to-end processes within our organizations that create dependencies between myriad teams and sub-organizations. It is incumbent on the various partners to define and monitor the metrics necessary to perform (and improve) effectively and efficiently.

Within the DOE/contractor world, there are additional nuances that are not often seen elsewhere. Specifically, it is not common for the regulator of an activity also to be the funding entity. This unique structure makes DOE both a regulator and a customer. It also makes information sharing between DOE and the contractor somewhat more complex than elsewhere. As a regulator, DOE is a supplier of guidance and requirements to its contractors. But it is also the customer of its contractors because it receives the benefit of their work. Ideally, performance metrics on the effectiveness of both of these concepts should be maintained and shared.

Using Performance Information to Identify Opportunities

As performance information is gathered and analyzed, opportunities for reengineering and improved allocation of resources will become clear. Benchmarking performance is extremely valuable for targeting initial improvement priorities. Determination of the largest gaps in performance between the organization's current level and the **?**best practitioner" identified makes selection of opportunities much more effective. This information is critical for selecting initial improvement targets. Once the larger gaps are closed or narrowed, continuous improvement is made possible by maintaining, refining, and using performance metrics.

Section II: Benchmarking

This section provides basic information on why organizations should do process benchmarking and how to go about it. This section will not address *performance benchmarking* or *strategic benchmarking*. The characteristics of these types of benchmarking are shown in Appendix D. Additionally, helpful references are provided in Appendix C.

Why Benchmark?

The single most important and valuable benefit of benchmarking is that it allows us to see beyond our existing paradigms of process performance. As we benchmark other organizations, we greatly improve the likelihood of seeing tomorrow's solutions to today's problems. Often these truly new ideas are wholly different from the processes you see in your benchmarking efforts but are inspired by what you have seen. An excellent example can be found in the following vignette:

> In 1912, a curious Henry Ford watched men cut meat during a tour of a Chicago slaughterhouse. The carcasses hung on hooks mounted on a monorail. After each man performed his job, he would push the carcass to the next station. When the tour ended, the tour guide said, **?**Well, sir, what do you think?" Mr. Ford turned to the man and said, **?**Thanks, son. I think you have given me a really good idea." Less than six months later, the world's first assembly line started producing magnetos at Ford's Highland Park plant.
>
> Henry Ford articulated his vision this way: **?**The man who places the part will not fasten it. The man who puts in the bolt does not put in the nut, and the man who starts the nut will not tighten it." Thus, the idea that revolutionized modern manufacturing and made automotive history was imported from another industry.
>
> As a result of Ford's slaughterhouse tour, an entire industry reformed and the economic strength of all other nations increased—all from this single **?**new" idea. Such major results are consistent with true paradigm shifts.

Joel Barker, a self-described **?**futurist," has made two exceptional videos, *The Business of Paradigms* and *Paradigm Pioneers*, which thoroughly discuss the concept of paradigms and offer excellent suggestions on how to overcome them. Tom Malone, the chief operating officer and president of Milliken, an outstanding company and joint sponsor (with Motorola) of DOE's unprecedented 1993 DOE/Laboratory Management Seminars, said he has viewed Barker's *The Business of Paradigms* dozens of times and has never failed to gain a valuable new idea that improves the performance of his company. One of Barker's keys to finding tomorrow's solutions is to look outside of one's existing paradigm. An excellent way to do this **?**looking out" is to benchmark other organizations.

Let's take another example. This one is also from the Ford Motor Company, but decades after the slaughterhouse experience.

> Ford wanted to reduce its overhead significantly, and targeted accounts payable for a 20 percent reduction. In looking for ways to reduce cost, Ford benchmarked its Japanese affiliate, Mazda. It found that Mazda was using a radically different approach to paying its vendors for parts provided. While Ford was paying its vendors as it received the vendor's invoices, Mazda had entirely eliminated the need for billing invoices. Mazda based its payments to vendors, not on an invoice, but on the volume of a product used per automobile manufactured. For example, Mazda paid its tire manufacturer based on the number of tires used per car times the number of cars manufactured. So, for every 100 cars of a specific type that were produced, Mazda would pay the vendor for 500 tires (i.e., 100 cars times 5 tires per car). This process eliminated the need for invoicing and subsequently eliminated the need to maintain a staff of hundreds

of Accounts Payable clerks. In this way, Mazda was achieving the same output as Ford (paying accounts payable) at 80 percent less cost. Ford soon modeled its approach to accounts payable after the Mazda approach and achieved a 70 percent reduction in cost.

This experience is illustrative of both paradigm change and the recognition of opportunities and methods for improvement.

There are a number of reasons why we benchmark:

- Organizations must change to stay ahead of competitors, and benchmarking is a system for managing that change.
- It promotes quantum leaps in performance.
- A minimum amount of time is required to accomplish change.
- It helps to establish effective goals and measures productivity.
- It encourages striving for excellence, breakthrough thinking, and innovation.
- It emphasizes sensitivity to changing customer needs.
- It creates a better understanding of competitors and the dynamics of the industry.
- It provides a sense of urgency for business process improvement.
- It ensures that the best industry practices are included in work processes.

Figure 6.2 below illustrates that benchmarking benefits an organization by providing the process knowledge necessary to effect significant changes.

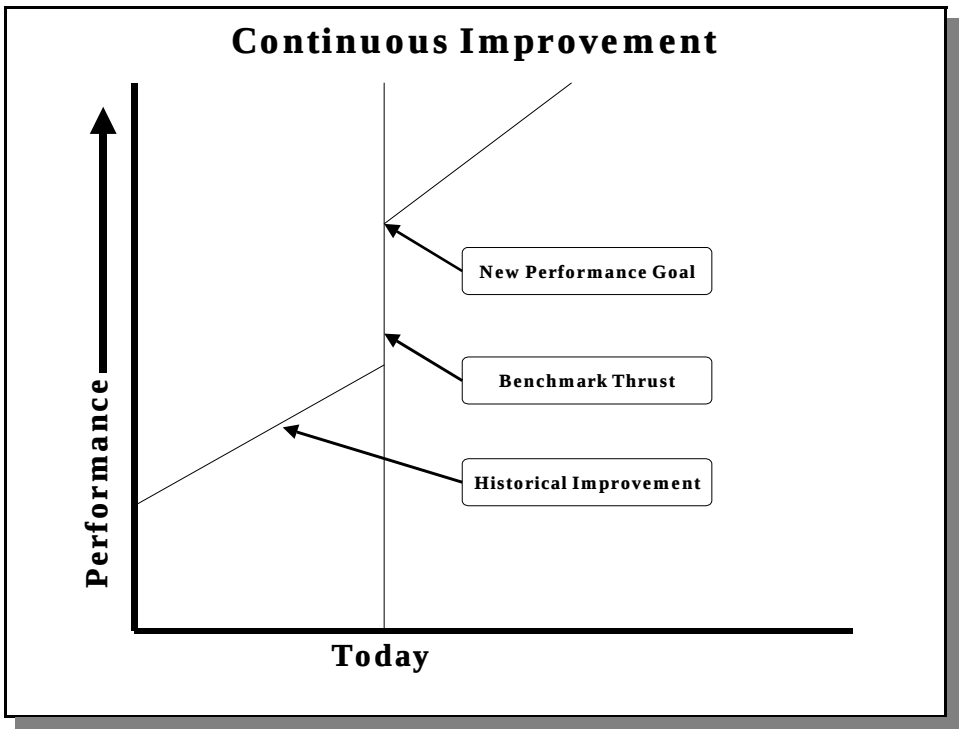

Figure 6.2

Benchmarking Stimulates Dramatic Changes in Process Improvement

Table 6.1 below provides an excellent overview of the many benefits of benchmarking. These charts are part of AlliedSignal's, ?Introduction to Benchmarking," a facilitated approach for using benchmarking to achieve improved process performance. The entire presentation is available in at the PBM SIG Web site located at http://www.orau.gov/pbm in the ?Performance-Based Management Handbook" section.

	Without Benchmarking	With Benchmarking
Defining Customer Requirements	• Based on history/?gut feel" • Acting on perception	• Based on market reality • Acting on objective evaluation
Establishing Effective Goals	• Lack external focus • Reactive • Lagging industry	• Credible; customer-focused • Proactive • Industry leadership
Developing True Measures of Productivity	• Pursuing ?pet" projects • Strengths and weaknesses not understood	• Solving real problems • Performance outputs known; based on ?best in class"
Becoming Competitive	• Internally focused • Evolutionary change • Low commitment	• Understand the competition • Revolutionary ideas with proven performance • High commitment
Industry Practices	• Not invented here • Few solutions • Continuous improvement	• Proactive search for change • Many options • Breakthroughs

Table 6.1

Why Benchmark? Let's Compare Scenarios

The Expected Benefits of Benchmarking

The expected benefits of benchmarking include:

- Improving processes that are critical to our business, such as enhanced customer satisfaction, cost reductions, cycle time reduction, and enhanced employee satisfaction.
- Establishing market-driven goals.
- Gaining professional development and personal enthusiasm from seeing ?the best" in action.
- Identifying additional opportunities for improvement beyond the scope of the benchmarking project.
- Establishing professional contacts.
- Challenging ?the way it's always been done."
- Becoming more competitive.
- Shortening the process improvement cycle itself (accelerated learning).

What Is Benchmarking?

What is benchmarking? Here is a list of working definitions. Benchmarking is . . .

- An alliance between partners to share information on processes and measures that will stimulate innovative practices and improve performance.
- A process of finding and implementing best practices that accelerate the rate of improvement by providing real-world models and realizing improvement goals.

- The search for those best practices that will lead to the superior performance of a company.
- A positive, proactive, structured process that leads to changing operations and eventually attaining superior performance and a competitive advantage.
- A fundamental business skill that supports quality excellence.
- The continuous process of measuring products, services, and practices against the toughest competitors or those companies recognized as industry leaders.
- A process for rigorously measuring your performance versus the best-in-class companies and for using the analysis to meet and surpass the best-in-class.

Recognized benchmarking companies describe benchmarking as . . .

AlliedSignal Aerospace: **?**Benchmarking is a systematic process for understanding and evaluating the business practices or organizations that are recognized for achieving premier performance. We continuously use benchmarking to accelerate innovation and improvement in our work processes."

Xerox: **?**(Formal) benchmarking is the continuous process of measuring products, services, and practices against the toughest competitors or those companies recognized as industry leaders. (It is) the process of consistently searching for new ideas for methods, practices, processes; and either adopting the practices or adapting the good features, and implementing them to become the best of the best."

IBM: **?**The ongoing process of comparing one's own process, practice, product, or service against the 'best' known similar activity. Then, challenging but attainable goals can be set and a realistic course of action implemented to efficiently become and remain the best of the best in a reasonable time."

Texas Instruments: **?**Benchmarking is a quality improvement tool that enables us to measure our products, services, and practices against those of our toughest competitors or other leading companies. Once a benchmark is identified, it provides a 'stretch goal' or vision of what is possible for business process improvements."

Types of Benchmarking

The seven types of benchmarking and a description of each are given below.

1. *Internal benchmarking* provides comparisons between yourself and similar operations within your own organization.
2. *Competitive benchmarking* provides comparisons among competitors for a specific product/service.
3. *Functional benchmarking* provides comparisons to similar functions within the same industry.
4. *Generic benchmarking* provides comparisons of processes independent of industry or overall functions.
5. *Process benchmarking* focuses on work processes or operating systems (e.g., billing, recruitment, customer complaint, procurement) to produce bottom line results, such as increased productivity, reduced cycle time, lower costs, improved sales, reduced error rates, and improved profit.
6. *Performance benchmarking* focuses on product and service comparisons, such as price, technical quality, ancillary product or service features, speed, and reliability. Tools used in performance benchmarking include reverse engineering, direct product or service comparisons, and analysis of operating statistics.
7. *Strategic benchmarking* examines how companies compete and is seldom industry focused. A key objective is to identify the winning strategies of highly successful companies.

When to Use/Not Use Process Benchmarking

As was noted in the introduction to Section II, this section will focus on *process benchmarking*. The information below is designed to help a company or organization determine when it should or should not use process benchmarking for improvement.

USE Process Benchmarking When:

- The targeted process is critical to your organization's success.
- Analysis indicates your performance is not competitive.
- Significant growth opportunities exist of which you currently cannot take advantage.
- You understand your current process and its performance measures.
- The process owner is committed to change (even radical change).
- Stakeholders will be part of the benchmarking team.

DON'T USE Process Benchmarking When:

- You aren't targeting a process.
- You don't know how your performance compares with the competition.
- You don't know what your customers require from this process.
- You haven't mapped your own process and you have no metrics or don't understand them.
- There is strong organizational resistance to changing the process.
- Only one or two people will conduct the study.

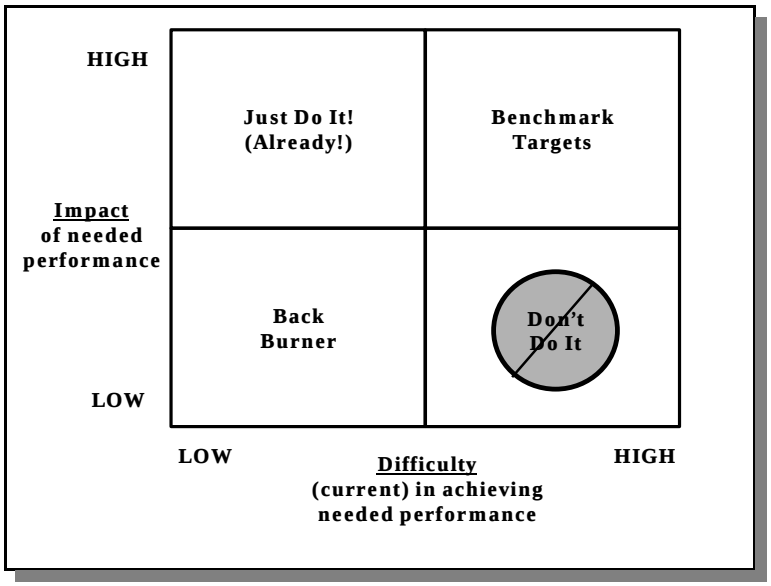

Figure 6.3

AlliedSignal Decision Grid

Another way to determine whether or not to benchmark is through the use of a decision grid, such as the one AlliedSignal has developed (shown in Figure 6.3 to the right).

What Costs Will Be Incurred?

Benchmarking is not free. While it does have a cost, the potential return on a company's investment can be dramatic. The following is a list of possible costs—some obvious and some hidden—that can be incurred during a benchmarking activity:

- Direct labor for team members
- Data gathering/data analysis
- Research to identify potential benchmarking partners

- Publication and distribution of final report
- Training on specific skills and tools
- Long-distance telephone and fax charges
- Travel expenses
- Consultant fees for third-party competitive benchmarking
- Implementation costs

What Are Benchmarking's Critical Success Factors?

Critical benchmarking success factors are those actions or activities that are absolutely necessary to successfully conduct and benefit from a benchmarking initiative. Several critical success factors are listed below.

Obtain Management Support

In order for a benchmarking effort to be successful, management must:

- Focus on the processes that are critical to their business.
- Desire to use benchmarking in conjunction with strategic planning.
- Be willing to admit that they're not the best.
- Be open to new ideas from potentially unexpected sources.
- Be committed to provide resources and to overcome resistance to change.
- Recognize those teams that are successful benchmarking teams.
- Understand the benchmarking process.
- Communicate the objectives of the benchmarking project to the entire organization.
- Be willing to change.

Overcome Barriers

To have a successful benchmarking effort, the following barriers must be overcome:

- A belief that the targeted process is not critical to the business.
- Unreasonable fear of sharing information with benchmarking partners.
- Inadequate resources committed to the benchmarking effort.
- The assumption that a person always has to travel to do benchmarking.
- Not doing the required ?homework" before contacting benchmarking partners.
- Benchmarking a company rather than a process.
- Unwillingness to change (?Not Invented Here" syndrome).
- Poor selection of benchmarking partners.
- Lack of up-front plans for implementing findings and follow-through to implementation.
- Not involving key stakeholders in the benchmarking project.
- Expecting results too quickly.

Understand Your Process Before Benchmarking Others

In order for your benchmarking effort to be successful, you need to understand your process(es) first. Before benchmarking others, you need to:

- Use process mapping tools to define your current process, including top-down flowcharts, wall maps, product process maps or value-added flow analysis.

- Identify customer expectations for your process by reviewing existing process performance measurements against customer expectations.
- Define process performance (usually done in terms of cycle time, defects per unit produced, and cost).
- Use analysis tools to understand the causes for inefficiencies in the process. Examples of these tools include cause and effect diagrams, Pareto diagrams, run charts and control charts.
- Identify benchmarking targets based on analysis. Typical targets include entitlement (cycle time), a competitor's performance, and customer expectations.

Consider Adaptability

Adaptability is critical to the success of a benchmarking effort. Ask yourself and others the following question: How easy will it be for your organization to adapt to a new way of doing business? If the results of your queries show that it would not be easy for your organization to adapt, you may want to reconsider your benchmarking effort.

Align Strategic Goals

Another critical success factor is alignment to strategic goals. Ask yourself and others the following question: Is the benchmarking effort targeted at a business area that is aligned with your organization's strategic goals? If the results show that the benchmarking effort is not aligned with your organization's strategic goals, you may want to reconsider proceeding any further.

Develop and Ensure Trust

Each organization must trust that the information they are providing will not be shared with unauthorized competitors or misused.

Beware of the ?Wolf at the Door"

In many cases, a dire need to benchmark in order to get back into the competitive race or to accomplish that which is failing will provide significant impetus to a benchmarking team.

Getting Started

The following material provides a sequential list of actions that should be taken in preparation for a benchmarking project:

1. Understand what benchmarking can and cannot do for you.
2. Prioritize what to benchmark. Start with the ?low hanging fruit." That is, begin where you will have the greatest probabilities of success. To implement an initial benchmarking effort, only to achieve minimal results, will seriously endanger future benchmarking efforts.
3. Get management buy-in and resource commitment.
4. Based on the process that is selected, identify a team and a leader. Ideally, the team leader will be knowledgeable in the process being benchmarked.
5. Understand the current process. This action is critical. If you do not understand your own process, you will not recognize areas of significant difference between your process and the process being benchmarked.
6. Be familiar with the benchmarking process.
7. Identify possible benchmarking partners and contact them.
8. Do it!

Deciding What to Benchmark

Involve senior management in identifying candidate benchmarking targets. These targets usually can be identified as being areas of business that are clearly ailing. Identify your key business processes. Excellent criteria for deciding what to benchmark include:

- Does the process have strategic importance to the organization?
- Will improvement of the process result in a significant improvement in customer satisfaction, quality, cost, or cycle time?
- Is there a high potential for success?

How to Do Benchmarking

Companies often design their own benchmarking process to adapt to their specific culture. For example, Xerox and Texas Instruments have 10-step processes. IBM and AlliedSignal, however, use four-step processes. Other companies use six, seven, or even 14 steps. Regardless of the number of steps, all have common elements. Perhaps the simplest and most successful model available was designed by the American Productivity and Quality Center (APQC). In this volume, we will use the APQC's four phase model:

1. **Plan:** Prepare the benchmarking study plan, select the team, select partners, and analyze your process.
2. **Collect Data:** Prepare and administer questions, capture the results, and follow-up with partners.
3. **Analyze:** Analyze performance gaps and identify Best Practices, methods, and enablers.
4. **Adapt and Improve:** Publish findings, create an improvement plan, and execute the plan.

Planning Phase

Planning a benchmarking effort is as critical an activity as the actual gathering of the data, perhaps even more so. Benchmarking efforts that are not clearly planned and communicated to all team members can easily wander off track causing the team to lose sight of the intended objective. A number of items need to be considered when planning a benchmarking effort. They are:

- Form (and train, if needed) the benchmarking team.
- Analyze and document the current process.
- Identify the area of study on which your team will focus.
- Identify your most important customer.
- Identify your smaller sub-processes, especially problem areas.
- Identify the critical success factors (CSFs) for the area and develop measures for the CSFs.
- Establish the scope of the benchmarking study.
- Develop a purpose statement.
- Develop criteria for determining and evaluating prospective benchmarking partners.
- Identify target benchmarking partners.
- Define a data collection plan and determine how the data will be used, managed, and distributed.
- Identify how implementation of improvements will be accomplished.

You may also wish to conduct an organizational self-assessment survey to help you understand key elements of your organization and your organizational strengths or weaknesses as you proceed with your benchmarking process. An excellent example of such a survey is included in Appendix E of this volume.

Process Mapping

The last step in the planning phase is to analyze your processes. A key benchmarking tool for performing this analysis is the process map. There are three types of process maps: Top-Down Map, Wall Map, and Product/Process Map. Characteristics of each are given below. This information comes from AlliedSignal and illustrates the important elements of this tool (see Reengineering and Process Improvement sections for related information).

- The Top-Down Map is used to show phases and the ?big picture."
- The Wall Map is used to show participants in the process and time and activities.
- The Product/Process Map shows the process from the product's perspective and shows value added.

‘

Top-Down Map

The Top-Down Map presents a high level overview and identifies inputs and outputs; defines major phases; describes sub-steps under each phase; and uses verb-noun format. There are seven steps to building a Top-Down Map as shown in Figure 6.4 below. The seven steps are:

1. Draw process boxes and name processes
2. Identify output
3. Identify customer
4. Identify last step
5. Identify input
6. Identify intermediate steps
7. List sub-steps

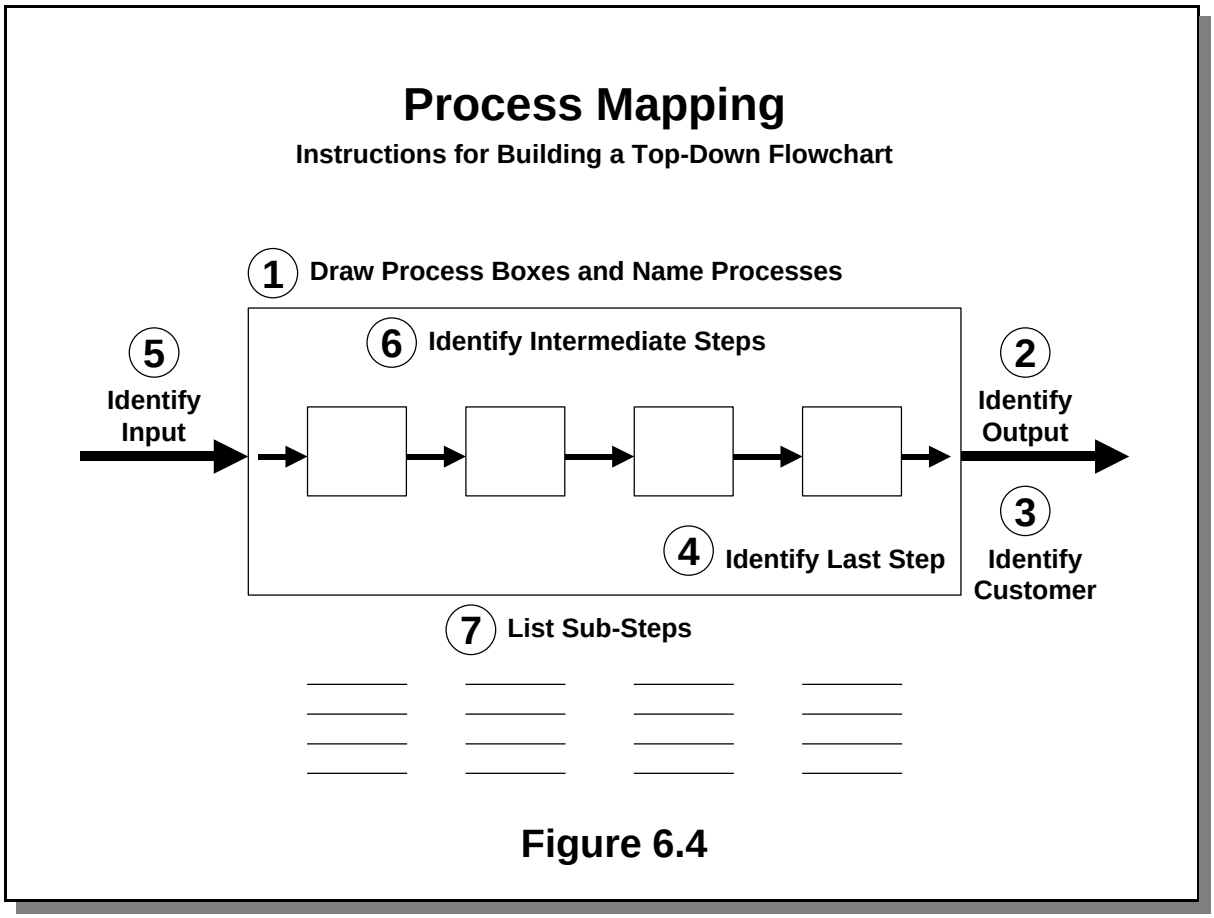

Figure 6.4

- **Wall Map**

  The Wall Map shows activities, participants, timing, sequence and dependencies, and loops and rework. To make a Wall Map:

  1. Tape a large piece (3' X 20') of chart paper to a wall.
  2. Draw a horizontal scale for time phases and a vertical scale for participants.
  3. Put the process name at the top.
  4. Determine time scale and divide horizontal scale into time increments.
  5. List participants (suppliers, customers, workers, manager) in chronological order.
  6. Group participants, breaking down functional barriers.
  7. Create each activity on an index card and attach it to the proper participant and time.

- **Product/Process Map**

  The Product/Process Map shows what happens from the product's perspective. It includes such things as operation, transport, inspection, wait, storage, distance, and time. It also indicates value-added activities. (Consider a step value-added if the customer recognizes the value, it changes the product, or it is done right the first time.) To make a Product/Process Map, think of yourself as the product, then:

  1. Walk the process and see what happens to you.
  2. Identify each activity.
  3. Determine if you are being operated on, transported, inspected, waiting, or stored.
  4. Determine how far you were moved.
  5. Determine how long each activity took.
  6. Determine what value-added work was done on you.
  7. Summarize the information.

Collection Phase

The collection phase of a benchmarking effort is twofold: the collection of secondary benchmarking information and the collection of the primary benchmarking data. Secondary benchmarking information is information gathered via Web searches, libraries, and professional organizations. This information helps the benchmarking team determine who to target as prospective benchmarking partners by identifying those organizations that use the same or similar processes. Primary benchmarking data is collected from a benchmarking partner. It is the data you will use to improve your process or program. Primary data can be collected via correspondence, telephone conferences, or site visits.

Collection of Secondary Benchmarking Information

The process steps to collection of secondary benchmarking information are:

1. Conduct a secondary research based on select/sort criteria. Sources of this information include libraries, business journals, and experts.
2. Evaluate the results of the secondary information collection and identify potential benchmarking partners. These can include common interest groups; established business, industry, or research alliances; and local chambers of commerce.
3. Develop data collection instruments such as forms, questionnaires, or matrices.
4. Pilot the collection instruments internally to insure usability.
5. Review the secondary information for usability and applicability.
6. Identify and contact best practice partners and enlist participation.

7. Screen partners and evaluate for best ?fit" with criteria. A tool that can be used here is the Best Practice Matrix (see Appendix F for a detailed example).

Collection of Primary Benchmarking Data

The process steps to collection of primary benchmarking data are:

1. Develop a detailed collection questionnaire based on the results of your secondary information collection.
2. Conduct the benchmarking investigation using the detailed questionnaire and telephone conferences or site visits, as appropriate.

Guidelines for Working With Partners

Now that you've identified your benchmarking partner, you need to make contact with them and ?get to work." Here are some guidelines for working with your partners.

- **Before Contacting the Partner, Prepare**:
  - An opening statement (i.e., an introduction) and summary of purpose
  - An explanation of why that partner has been selected
  - What you are willing to share with partner
- **When Making the Contact**:
  - Determine who is the process owner for that process
  - Recognize that person's sense of pride/level of knowledge about the process
  - Let the contact know what he/she can do to prepare for the visit
- **When Finalizing an Interview Plan**:
  - Set the objectives
  - Review all available data
  - Prepare a list of concise, non-leading questions
  - Be prepared to explain why a particular question is asked

Things to Watch for During a Site Visit

Before planning a site visit, make sure you understand and subscribe to the Benchmarking Code of Conduct (see Appendix G). Here are some things to avoid when planning the site visit and during the actual visit.

- **When Planning the Site Visit, Avoid:**
  - Initiating contact and setting up a visit without first doing your internal benchmarking ?homework." Know your own process well enough to be able to explain the differences to your partner(s).
  - Bypassing the designated host of your benchmarking partner to change the agenda or to set up side activities beyond the scope of the agreed upon benchmarking event.
  - Requesting last minute changes or additions to the visit agenda.

During the Site Visit, Avoid:

- Referring to another organization or to its information while visiting a third party organization.
- Giving information in a public forum about a benchmarking partner without the partner's specific permission.
- Asking for information that you are not willing to provide in return. Benchmarking is an exchange process. In most cases, your partners will want to get a copy of the results of your study. Be prepared to offer them one.

Key Elements of Questionnaire Design

The development of an effective and efficient questionnaire to collect benchmarking data is critical to collecting the necessary data while minimizing the time that will be spent with the partner. Remember that the time a benchmarking partner spends with you is time that he or she could be spending doing other work. Suggestions that should be considered when designing benchmarking questionnaires include:

- Be specific: determine whether the intent of the questionnaire is to screen potential benchmarking partners or to obtain specific process-related information.
- Include a brief explanation of your purpose and how the responses will be used.
- Be specific about the process under study. When in doubt, include a simple process flowchart to aid in further explanation.
- Whenever possible, ask for objective information.
- Be neutral in your language. Don't ask questions that presuppose the answer.
- Use open-ended questions that encourage dialogue. Steer away from ?yes/no" answers.
- Test the questionnaire internally on people who are unfamiliar with your project. Be sure the questions are clear and that the responses they provide really address your issues.
- Test drive the questionnaire by answering the questionnaire about your own process.
- Ask yourself, ?What kind of response do I expect from this question, and what will I do with the information when I get it?" Focus on the critical issues. Don't wander into other areas because of curiosity about their company.
- Don't use acronyms or company-specific terminology.
- Determine who the respondents are likely to be and indicate that those on the distribution list may forward the questionnaire to others who are better able to respond to the questions.
- Provide a contact from the benchmarking team and an address or fax number where the questionnaires should be returned. Indicate whether the respondent should expect any further contact from your team.
- Keep the questionnaire simple, preferably no more than two pages. Attach blank pages for additional notes and references, if necessary.
- Thank the participants for their cooperation.

Benchmarking Skills, Etiquette, and Illegal Practices

In addition to the formal aspects of developing benchmarking questionnaires, gathering secondary information, refining the questionnaire, and conducting the benchmarking survey(s), there are a number of informal skills that are also important to the success of any benchmarking effort. Included are the use of networking and observational skills of the benchmarking team members as well as an understanding of benchmarking etiquette and illegal benchmarking practices.

Networking Skills

Networking—the interaction between individuals for purposes of gathering information or establishing long-term relationships—is an important skill to have during benchmarking efforts. The skills that lead to the relationship building that takes place during site visits can result in successful, long-term relationships that can be productive for both parties. On the other hand, a lack of knowledge of networking skills, even during the initial telephone contacts with a potential partner, can result in an unwillingness to provide you with any information. Networking skills that should be considered include:

- Be prepared. Know your own process and its performance measurements. Be familiar with the questions you will be asking, and have other questions thought out that would help you elicit additional information.
- Be sensitive to the protocol and culture of your benchmarking partner. Follow his/her lead.
- Use a standard set of questions with each benchmarking partner, but be flexible in the discussion to permit them to share additional information. You may want to ask, **?**Is there anything that we've failed to ask you that might be useful to us?"
- Practice active listening skills and listen more than you speak. Never argue, either among yourselves or with your partners.
- Gather facts, but be open to hearing opinions as well.
- Be candid about the deficiencies of your own process, but don't assign blame.
- Be considerate of your benchmarking partners' schedule constraints. Never take more time than you have scheduled unless you are encouraged to do so by your partners.
- Thank your partners for their cooperation, and indicate if or when they should expect any further contact from your team.

Observation Skills

While it is easy for a benchmarking partner to hand you a print-out or a report that includes hard data, this information typically provides the results or outcomes of a process. What is frequently as important as the hard data is an understanding of the process that created the data. While questions on the questionnaire can prompt a discussion, actual observation of the process in action can answer questions that no one even thought to ask.

Site visits provide opportunities to observe process enablers—those factors that allow or encourage a process to move to completion—in place at your benchmarking partner's location. These enablers can be divided into three major groups: resources, process characteristics, and cultural attributes. Examples of process enablers in each of these three groups can be found in Table 6.2 below.

Resources	Processes	Culture
• Facilities • Equipment • Supplies • Training • Investment in R&D	• Work flow • Procedures • Strategy	• Management involvement • Empowerment • Risk taking • Decision-making approach • Internal communication • Amenities (offices, parking, etc.)

Table 6.2

Examples of Process Enablers

Benchmarking Etiquette

As more and more companies or organizations become identified as ?best-in-class" or ?world-class," more and more companies are looking to benchmark their performance in order to improve performance in response to the pressures of today's market place. And, as benchmarking efforts mature throughout the business, government, and research worlds, a formal etiquette has evolved that is expected of benchmarking partners. Failure to conform to the benchmarking etiquette can result in a loss of benchmarking privileges in certain industries. The eight key aspects of benchmarking etiquette are:

1. Don't ask for data that you aren't willing to provide in return.
2. Remember that you and your team represent your whole company in the eyes of your benchmarking partners.
3. Send questions in advance of telephone conversations or site visits. It helps your partner prepare for your conversation and will result in your getting the information you need.
4. Inquire up-front about confidentiality issues or topics that are ?off-limits."
5. Never press for information that is not willingly given.
6. Share only with permission. Don't reveal information that other benchmarking partners have given you unless you are certain it was meant to be shared with other companies.
7. When offering to share findings of the study, keep in mind any issues of confidentiality between partner companies.
8. When in doubt, don't ask.

Illegal Benchmarking Practices

While benchmarking can be a powerful data gathering and process improvement tool, it can also be abused. Illegal benchmarking practices include:

- Phony requests for information submitted in order to obtain pricing information.
- Reverse engineering performed when the product is obtained illegally.
- Covert photography or tape recording.
- Violations of Antitrust Law/Unfair Trade Practices. This illegal practice includes requesting information from direct competitors on marketing strategies, sales incentives, cost or pricing data (other than commercially available price lists), and contract terms and conditions.
- Unethical practices such as:
  - Misrepresenting yourself, your company, or your intentions in obtaining information.
  - Querying job candidates about practices of their present employers.
  - Using information that was given to you for a specific purpose for another reason without first obtaining permission from the benchmarking partner who provided it.

Finding Benchmarking Partners

Where do you start the search for the best? You start by focusing on the process you are interested in improving, not on the company you think you might want to visit. All of the processes at world-class companies aren't world-class processes. The expectation that, if one process at a company is considered to be ?world class," then all processes at the same company must also be ?world-class" is called the ?halo" effect. For this reason, it is important to focus on the process and not on the company. In addition, companies considered mediocre can have a world-class process or two.

Identifying Candidate Partners

To determine which companies have processes similar to the one that you are interested in benchmarking, ask, ?Whose livelihood depends on this process?" Examples might include routine machinery maintenance for safe operation, fast and accurate distribution of products across the country, or fast turnaround of equipment.

Once you have identified a number of companies that are possible benchmarking partners, weigh the ease of getting access to information against possible performance compromises. It is important here to understand the spectrum of possible comparisons from parity: another company may do something that is simply ?different," while another might offer options that would result in some improvement over the current process. Still other companies might be considered a ?best practice," ?best-in-class," or even ?world-class."

Finally, you are encouraged to make your decision about who to benchmark based on fact, not on opinion. Some reputations are the result of clever advertising; others have been earned. Be alert and be cautious. The possible rewards are too great to not proceed with care. On the down side, a lot of effort spent on benchmarking a partner that has not been selected carefully can result in a lot of lost time and a lot of wasted dollars.

Screening Potential Partners

When screening the list of potential benchmarking partners to determine which would be most suitable for your benchmarking effort, it is important to consider the characteristics of each of the companies that can have an effect on your study. The model provided in Figure 6.5 below provides a structured approach to evaluating the critical characteristics of prospective benchmarking partners.

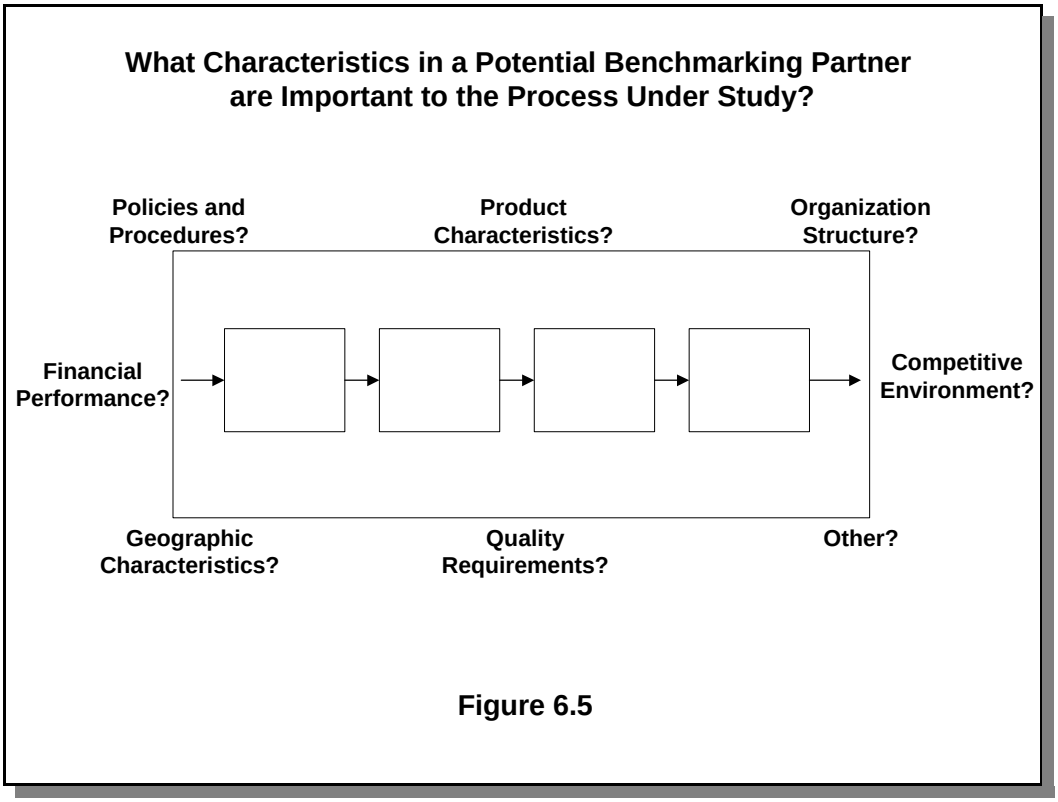

Figure 6.5

Tapping Into ?Hidden" Resources

When looking for background information about prospective benchmarking partners, myriad resources are available. In many cases however, teams often overlook a large number of ?hidden" resources. These resources are those that are internally accessible and those that require external contact.:

- **Internally Accessible Resources**
  - Library databases and literature searches
  - Employees who have worked at other companies and in other industries
  - Sales and marketing personnel
  - Field service personnel
  - Media attention: articles, shows
  - Other divisions within your organization

- **External Resources**
  - Professional associations
  - Industry publications
  - Customers
  - Suppliers
  - American Marketing Association
  - Seminars and conferences
  - Universities and alumni associations
  - Benchmarking clearinghouses
  - Consultants

Companies Active in Benchmarking

The following companies currently are active in benchmarking and could be considered as prospective benchmarking partners:

Alcoa
Amoco
AMP Inc.
AT&T
Bath Iron Works
Boise-Cascade
Chase Manhattan
Chevron
Compac
Corning
Dow Chemical
Dow Corning
DuPont
Eastman Kodak
Electronic Data System
First Chicago Bank
Florida Power and Light
GTE Directories
Hewlett-Packard
IBM
Kaiser Associates
McDonnell Douglas
Medtronic
Nalco Chemicals
New York Times
Northrop (Aircraft)
Pacific Bell (Corporate)
Pacific Gas and Electric
Phillips Petroleum
Public Service Electric and Gas
Servistar
Sprint
Texaco
Texas Instruments
U. S. West
Xerox

Making Contact

When making an initial contact with a prospective benchmarking partner it is important that your first contact establishes your expectations of your partner. Specifically, you should clarify as many of the following issues as is possible:

- The benchmarking effort will be of mutual benefit to both companies.
- The use of provided information will be effective and disciplined.
- Corporate cultural fit between the two companies will be ensured.
- Thorough preparation will result in better site visits and information exchange.
- A willingness to share information by both partners exists.
- Both partners respect any issues of confidentiality with respect to the use of the provided data.

Contacting Potential Benchmarking Partners: A Checklist for the Initial Phone Call

Here is a checklist to assist in addressing all of the necessary topics during an initial telephone contact:

1. Initial contact
   - Identify the right person.
   - Gain his/her interest in participating in your benchmarking effort
   - Cite the other benefits of participating in the information exchange
2. Clarification
   - Establish clearly what is to be benchmarked
   - Establish a mutual understanding of the scope of the study
   - Develop a procedure and set a time line
   - Establish both companies' expectations
3. Exchange
   - Clarify what information you want
   - Identify what you will provide in exchange
   - Establish an information exchange for the next step in the process
4. Action Plan
   - Agree on actions, timing, and roles and responsibilities
   - Document the agreements and transmit a copy of the document to your partner

Establishing a Relationship With Benchmarking Partners: Getting to Know You

As you develop a relationship with your benchmarking partner, it is important to give systematic consideration to what information you want from your partner and what information about your process(es) you are willing and capable of sharing. Process-specific information might include:

- Process maps
- Performance measurements (including Statistical Process Control data)
- Physical layout of the process (including floor space)
- Lot sizes, defect rates, and cycle times
- Pictures of equipment and equipment/materials lists
- Associated procedures, forms, standards, and specifications
- Customer and supplier requirements
- Any special skills that might be required
- Syllabus from associated training
- Descriptions of any associated regulations, environmental factors, and health and safety data requirements

- Calibration criteria, procedures, and standards
- Maintenance requirements and data
- Product samples

You may also want to offer brochures describing your company, your organization charts, and your company's newsletters, and may want to ask for similar information from your benchmarking partners.

The Site Visit

The three phases to a site visit are advance preparation, the site visit, and follow-up. Requirements of each phase are given below.

Advance Preparation

When preparing for a site visit:

- Get agreement on the agenda.
- Send a confirmation letter restating your intentions. This practice will assure that the right people are present. Provide your host with a copy of your questionnaire to allow him to review your questions.
- Clarify any issues of confidentiality.
- Ensure that each member of your team understands his/her areas of responsibility.

The Site Visit

During the site visit:

- Pay attention during introductions, especially to names, responsibilities and experience.
- Ask to tour the facilities, if possible, in addition to the areas involved in the subject process.
  - Clarify the protocol for talking with employees/associates during the tour.
- Take thorough notes.
- Use breaks and lunch to build rapport with your host(s).
- Be observant; look for the process enablers.
- Be prepared for the unexpected.

Follow-Up

After the site visit:

- Send a letter of appreciation.
- Ensure your host that any concerns he/she may have raised have been addressed.
- When it has been completed, send a courtesy copy of your final report.

The Analysis Phase

The analysis phase of a benchmarking project can be the most tedious and yet the most rewarding. The following information will enable you to take a structured approach to the process of sorting, understanding, and drawing conclusions about the data you have collected:

- Compare your current performance data to your partner's data.
  - Sort and compile the data.
  - Make your performance data comparable, i.e., normalize it in a way that provides comparability.
  - Identify any gaps in the data and assign actions for the collection of missing data.

- Identify any operational best practices you observed and any process enablers.
  - What are the participants doing that you are not doing?
  - How do they do it?
  - What enablers—factors and practices that facilitate superior performance—allow them to do what they do?
- Formulate a strategy to close any gaps you have identified.
  - Assess the potential adaptability of your process to the new practices and enablers.
  - Identify opportunities for improvement.
- Develop an implementation plan.

Analysis Phase Tools

Three tools have proven to be extremely useful during the analysis phase of a benchmarking effort:

1. Brainstorming (see Appendix H)
2. Cause and effect diagram (see Appendix H)
3. Root cause analysis (see Appendix H)

Determining Performance Gaps

To determine performance gaps, compare your performance for a certain aspect of the process being benchmarked to the same (or as similar as possible) aspect of your benchmarking partner's process. When significant gaps between your performance and the best practices have been identified, establish a future performance goal to allow you to achieve parity with the best practices companies. As you make progress toward your parity goal, progress can be plotted to provide feedback of closing the performance gap(s). When the parity goal has been reached, a new goal can be established to take you to a position of leadership. Figure 6.6 below and Figures 6.7 and 6.8 on the next page provide a pictorial view of determining performance gaps, establishing a parity goal, and plotting progress toward the goal, leading to a long-term leadership goal.

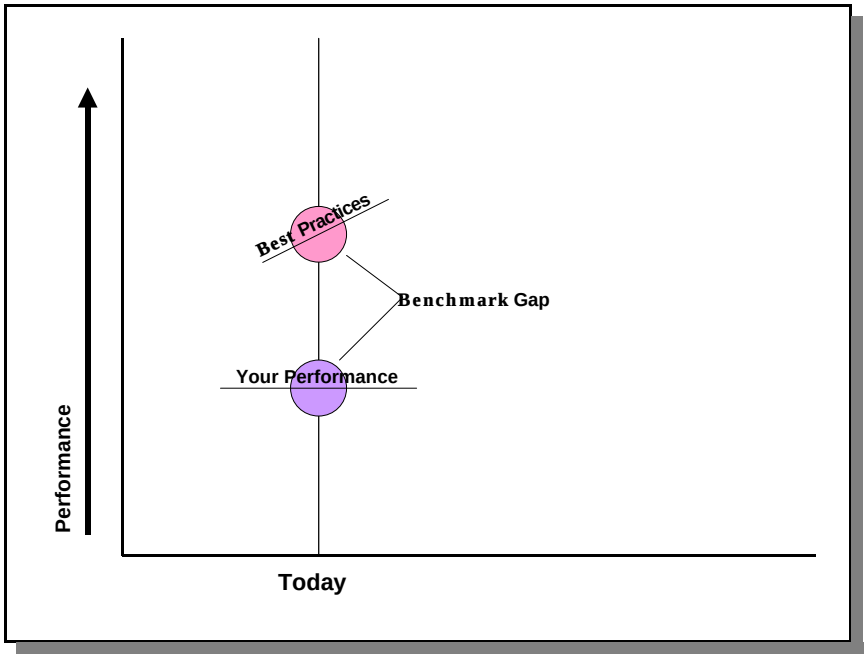

Figure 6.6

Determining a Performance Gap

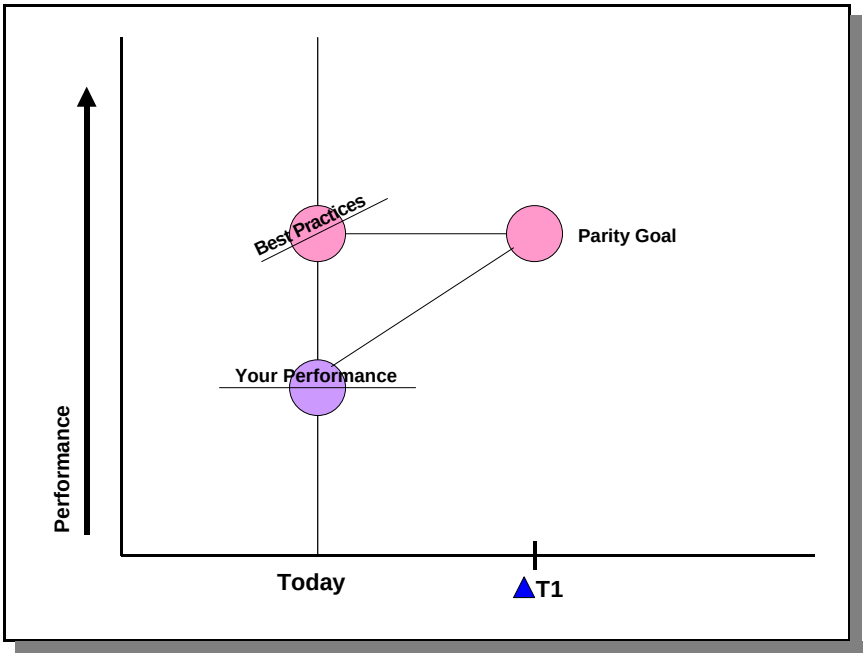

Figure 6.7

Establishing a Parity Goal

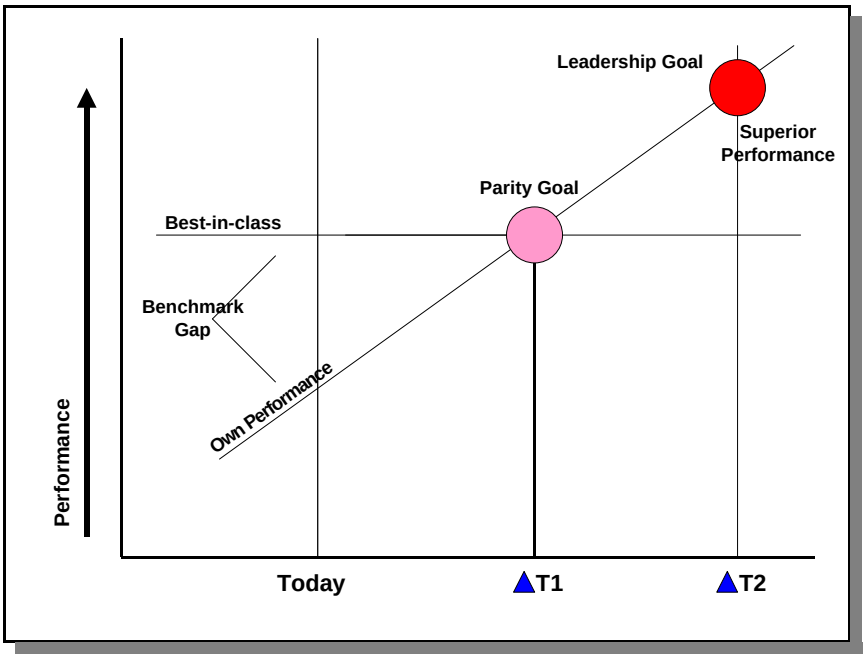

Figure 6.8

Plotting Progress Toward a Parity Goal

Learning from the Best: Translating Information Into Action

To complete the analysis phase:

- Analyze the data and insights gathered from your benchmarking partners:
  - Compare the process performance measurements
  - Review your goals
  - Prepare a gap analysis report
- Understand the factors that contribute to your partners' superior performance:
  - Which can be adopted in your company?
  - Which can be adapted to suit your needs?
- Develop a picture of what the modified process will look like and map the "to be" process.
- Use the project management skills to identify tasks, resources, and schedules to implement process changes.
- Identify who must be "sold" on process changes and communicate the changes to them.
- Implement, monitor, and communicate process performance.

Adapting Improvements: The Most Difficult Step

Adapting performance improvements identified during the analysis phase of benchmarking is the point at which most unsuccessful benchmarking efforts falter. Failing to take this next step in the process can lead to wasted staff time and money, a demoralized benchmarking team, and, perhaps more importantly, a general sense that benchmarking efforts don't work. The four requirements for adapting improvements are:

1. Implementing the plan
   - Set realistic improvement goals
   - Gain support for change from both upper management and staff doing the work
   - Coordinate the improvement effort
2. Monitoring and reporting progress
   - Celebrate successes
   - Acknowledge the efforts of the benchmarking team
3. Documenting the study
   - Communicate the results both internally and to your benchmarking partners
   - Assist in the internal communication and transfer of best practices
4. Planning for continuous improvement
   - Identify new benchmarking opportunities
   - Set new goals

The End of the Line: Last Steps in Benchmarking

What do you do when you've done your benchmarking study? Here are five key steps to take:

1. Document the benchmarking study in a final report. Make sure to capture any lessons learned that can be of future value as well as a variety of process information.
2. Communicate the results of your benchmarking effort to management and staff.
3. Send a copy of your final report to your benchmarking partners.
4. Routinely review your benchmarked process performance to ensure that goals are being met. If your goals are not being met, understand why they are not and take whatever corrective action(s) that might be necessary to bring the process performance into line with your goals.

5. Move on to what's next by identifying other candidate processes for benchmarking. Remember, if your experience with your partner was positive, there is always the potential for additional exchange with benchmarking partners. Build on your successes.

Benchmarking Lessons Learned

Many **?**benchmarkers" have learned that:

- The goal of any benchmarking effort is superiority, not equality.
- Benchmarking, like any quality effort, requires a sustained, top-down commitment.
- No one company will yield all the answers. Different organizations excel in different disciplines and only by working to be the best in each of many categories can an organization hope to attain a leadership position.
- It is essential to establish a reliable system of measuring your own performance, as well as others.
- The process of benchmarking is continuous. What is **?**best performance" today may be inadequate performance tomorrow.
- Benchmarking can only succeed in an environment that rewards honesty and openness.

Section III: Reengineering

Section III provides basic information on why organizations should do reengineering and how to do it. In addition to the text of this section, references to useful information are provided in Appendix C.

Why Reengineer?

Reengineering can make dramatic process improvements, often amounting to cost reductions of 20-90 percent, cycle time reductions of 60-100 percent, and dramatic improvements in customer satisfaction leading from these cost and cycle time reductions. Companies often reengineer when they want to dramatically change their way of doing business or when their current way of doing business is not working.

Many business processes are so complicated that only a few people in the organization can actually understand the process and make the processes work. That is why reengineering—simplifying these complex processes—has such a high payback in terms of costs and time saved. It is also why reengineering can often increase the quality of work life by improving these processes such that individual employees can accomplish things on their own. Reengineering actually takes workers who are a small cog in a large, complex process they couldn't even understand and makes them a key part of a simpler and more understandable process. The workers often end up feeling much more empowered and fulfilled.

Safety can be dramatically improved when it becomes one of the reengineering focuses, as processes are simplified and made more understandable by the workers. Additionally, the reengineering of an organization's business processes can increase the organization's flexibility to respond to unexpected events in the business environment by educating the participants as to what the process is and what it is intended to accomplish. Prior to reengineering, many employees do not understand either what the process consists of or what it is trying to accomplish. Lastly, by improving the responsiveness to customers and stakeholders, reengineering can have a lasting and positive influence on these customers and stakeholders.

What Is Reengineering?

Reengineering is the radical redesign of current business processes with the intent of reducing cost and cycle time resulting in increased customer satisfaction. Reengineering is possible because most business processes in large organizations cross departmental boundaries, have no individual process owner, and are often completely out of control. As a result, costs and cycle time are not good and the customer is likely not satisfied with the results that he or she sees. Thus, reengineering becomes a win-win for both the organization and its customers.

How Does Reengineering Compare to TQM and When Is Each Appropriate?

Total Quality Management (TQM) basically is continuous improvement, that is, continually making small, incremental changes to a process that will eventually lead to making it a world class process. Each incremental change may make a one or two percent improvement in cost and cycle time, often an even smaller change. In contrast, reengineering is a one-time, radical change, often decreasing the cost and cycle time in excess of 50 percent.

Both continuous improvement and reengineering can be appropriate, depending on the situation. If you have been doing continuous improvement but need a much bigger change in performance, reengineering may be appropriate. If an organization just reengineered, it should continue doing continuous improvement to obtain still needed improvement. Both are important, but each is appropriate in different circumstances, depending on the outcome desired. Excellent organizations need to do both reengineering and TQM.

What Costs Will Be Incurred?

Reengineering requires significant up-front investment. It typically requires a team (in-house or an in-house/consultant mix) working for six months to a year to devise and implement a reengineering plan. However, when compared to the probable outcome of not reengineering—lost customers, lost market share, and lost revenues—the cost is relatively small. Additionally, cost and cycle time reductions of 50 percent or more and corresponding increases in customer satisfaction far outweigh the costs incurred in preparing and implementing the plan. Obviously, if large consulting firms do much of the work, the cost could be higher than if an in-house team is used.

In addition to the direct cost of the team working to implement reengineering, there will also be an indirect cost in disruption to the organization. This indirect cost can be controlled best by being well organized (the effort is quick and well administered) and by communicating constantly with the people in the organization to let them know what is happening.

Getting Started

Before starting a reengineering effort, management must determine its critical success factors and what to reengineer.

Determining Critical Success Factors

The first step in any reengineering effort is to determine if reengineering is what the organization really wants to do. Top management needs to attend one of the several available one- to two-day courses on reengineering taught by a variety of consultants for the purpose of understanding reengineering enough to determine if it is what the organization really wants to do. Michael Hammer is generally considered to have the best courses available in this regard.

If top management understands what reengineering involves and still wants to do it, the next thing they need to do is commit to doing it as well as to doing it right. There will be a lot of foot dragging and outright sabotage, as this involves REAL CHANGE, well beyond any change involved in the prior experience of the organization. It will also involve really significant results.

The next step is to decide if you want to bring in outside consultants or use in-house talent to perform the reengineering. If in-house talent is used, the team needs to be selected, then trained as an intact team. Even if consultants are used, some in-house people will need to participate on reengineering teams with the consultants. Again, the best training is generally considered to be the Michael Hammer's training, which is offered regularly in Boston.

Deciding What to Reengineer

In organizations that have committed to reengineer, deciding what to reengineer has varied all the way from deciding to reengineer the entire organization or company, down to reengineering one process. The decision really depends on the situation in which the organization finds itself. If the entire organization considers that it may go out of business unless it does something drastic, it may well be an ?all or nothing" decision. In this case, the organization may well decide it needs to reengineer everything to survive.

At the other extreme, if the organization feels that it is doing reasonably well but would like to see if reengineering is the thing for itself to do, it may want to select one process and reengineer it well. In this case, if the results are good, the same reengineering team could then expand and do two processes the next time.

In both extremes, the decision is based on the situation in which the organization finds itself and where the organization needs to be in the future. Either extreme or something in the middle may be right, depending on the situation within the particular organization.

Phases of Reengineering

There are four phases to reengineering:

1. Organizing the organization
2. Analyzing the current process
3. Developing new concepts
4. Moving from the current organization to the new model

(See also the Benchmarking and Process Improvement sections for related information).

Organizing the Organization

This first phase is the point where the organization needs to decide just what process or processes will be reengineered. Depending on the number of reengineering efforts being undertaken, a team or teams will need to be put together. The teams will need to be organized according to the skill mixture the team needs to have, as well as include people who are and aren't familiar with the process.

The organization needs to define a champion, preferably a **?**heavy hitter," who can move roadblocks out of the way, someone who has a vested interest in the outcome and will guide the teams. The teams need to be given scopes of work and schedules, then need to be trained as a group prior to starting their efforts.

Analyzing the Current Process

The next phase is to analyze the current process enough to understand how it works and what are its cycle times. The process needs not be **?**analyzed to death," as understanding and moving on with speed are of the essence. (It becomes a trade-off of detail for speed.) The team needs to keep in mind that those who want to keep the status quo always will be able to make a good explanation why the current process is the correct one.

The team needs to keep in mind that processes start and end with a customer, so it is important that the processes being reengineered really are complete processes. A typical process starts with the customer ordering something and ends with the customer receiving and paying for the product. Since the goal of reengineering is to revise a process in order to serve the customer better, the team needs to keep asking two questions: **?**Who is the customer?" and **?**What does he/she want?"

In understanding the current process, the team needs to keep in mind what works and what doesn't work in the process and decide what part of the process needs to be fixed. This phase should take one to two months, depending on the complexity of the process being reengineered.

Developing New Concepts

One consultant called this phase of the process **?**The Big Aha." This phase is the time for **?**Out of the box thinking." Remember, reengineering is not incremental change, and that cost and cycle time changes of greater than 50 percent are possible. Often, the group tends to want to be less radical, but it needs to keep in mind their objective. Often the concept involves some type of computer system or perhaps a common database as the centerpiece of the new process.

Moving from the Current Organization to the New Model

When the new model has been defined, a strategy needs to be developed to deploy the new concept. Most often, the best way is to pilot the change in a small part of the organization to ?get the bugs out" of it, then to deploy it to a bigger unit, then to the whole organization. Remember, if this change is radical, there will be unexpected things happening. If the change is being done in a controlled environment, problems can be corrected. The important thing to remember is that, when the change is rolled out into the whole organization, it needs to work because there will be critics who don't want it to work and will be looking for excuses to put it down.

Companies That Have Done Reengineering

Many consultants currently are doing reengineering, including Computer Sciences Corporation, Electronic Data Systems Corp (EDS), Perot Systems, the Big Five accounting firms, IBM, and more. Companies that have reengineered themselves include Taco Bell, USAA, AlliedSignal, IBM, and National Aeronautic and Space Administration's (NASA's) Jet Propulsion Lab. Here are some ?real life" stories:

- In the insurance industry, USAA was able to reengineer their claims process. Their existing process called for specialists to handle each phase of the process, with customers being passed from one specialist to another. The revised process called for one generalist to handle each case in its entirety, with specialists and computer databases available to assist them if needed. This change made for better customer service and a more cost effective, smoother process. It and other reengineering changes cut costs at USAA by $500 million.
- The Jet Propulsion Lab (JPL) is run for NASA by the California Institute Of Technology (Cal Tech). They reengineered in order to meet increasing demands and decreasing budgets. Initial results were promising, but no dollar figures on savings are yet available.
- Taco Bell is a prime example of the positive results that can be seen with reengineering. Taco Bell initially had a very complicated command and control system, with a lot of effort being put into things that added no value for the customers. Taco Bell reengineered, making the system much simpler and making each location manager responsible for how his/her location is run and eliminating many layers of management.

  Taco Bell also reengineered the entire layout and functionality of their typical restaurant. Locations initially prepared their meals from scratch at each location, with 70 percent of the location floor space in the kitchen with only 30 percent for the restaurant. By preparing the food centrally and delivering it to the individual Taco Bell location kitchen to be heated and served, the kitchen area was able to be reduced to 30 percent of the floor space, allowing 70 percent of the floor space to be used for customer seating. This modification doubled the seating area while keeping the building the same size as before. These cost savings allowed Taco Bell to reduce their food prices by 25 percent. After reengineering, Taco Bell sales increased by 22 percent per year and earnings increased by 31 percent per year. The results indicate that this reengineering was certainly a success story.

Reengineering Lessons Learned

Reengineering is very difficult to accomplish, both because it is a complex undertaking involving many people working together and because it involves change. Due to the fact that many staff in the organization will not consider this change to be in their best interest, there will be enormous resistance to the effort. There is a huge payoff to be had if the reengineering effort works, with cost savings and cycle time reductions in excess of 50 percent often being the norm.

Due to the anticipated resistance, reengineering will not work unless top management gives 100 percent ?buy-in" to the effort and is willing to ?roll the heads" of those who fight it. The entire effort needs to be planned

to ensure it doesn't fail. Also, because those in-house people who work on the reengineering effort will not be very popular, they may need to have guaranteed new positions, since they may not be able to return to their old jobs.

Four critical areas for consideration are leadership, environment, technical systems, and people systems. These four were provided by AlliedSignal and are based on its reengineering efforts.

- **Leadership**
  Leadership is THE critical item to address if you want reengineering to work. And to make this effort work, you will need to communicate, communicate, communicate. Leadership needs to provide a clear definition of the desired outcome, be honest in stating what they are trying to accomplish, and set a time table and stick to it.

- **Environment**
  Management needs to know and involve customers and stockholders, link the process to the customers, and review the best practices of others who have previously reengineered. There also has to be a ?burning platform," i.e., something terrible will happen if the reengineering is not successful, something which is even more terrible than the reengineering itself. This ?dire presence" encourages changes by forcing the workers to leave the comfort of what they now have to strike into the unknown future.

- **Technical Systems**
  Management needs to seek and find outside sources of help so that their effort can be successful. They also need to follow a proven process and to develop an implementation plan for the entire process.

- **People Systems**
  Reengineering will only work if the people in the organization are considered and involved at all levels. Teams need to be empowered, and cross-functional teams need to work all the issues.

Section IV: Continuous Improvement

This section of the handbook provides basic information on why organizations should do continuous improvement and how to do it. In addition to the text of this section, references to additional useful information are provided in Appendix C of this document.

What Is Continuous Improvement and Why Do It?

Continuous Improvement is defined in the DOE Quality Management Implementation Guidelines as:

> **?***The unending betterment of a process based on constant measurement and analysis of results produced by the process, and the use of that analysis to modify the process."*

The basis of continuous improvement is usually diagramed as the Continuous Improvement Cycle and is also known as the Plan-Do-Check-Act Cycle or the Shewhart Cycle.

Why do it? Continuous improvement is undertaken to improve the efficiency of a process while reducing costs and cycle time, i.e., reducing the waste or those portions of a process that do not contribute to the end result.

How Do You Do Continuous Improvement?

Most work is accomplished through repeatable processes consisting of many steps. One way of looking at a process is through the use of an input-output model, with the process taking some sort of inputs, adding value to the inputs in a work process consisting of many steps, and turning them into outputs or finished products. In a manufacturing business, the inputs would be raw materials and power to run the machines; the process would consist of many manufacturing steps, and the manufactured product would be the output.

Processes also take place in service industries, whether they are processes to handle claims in an automobile insurance company or preparing fast food at a McDonald's or Taco Bell. Because these processes are often very complicated and involve many steps and many people, there are usually many opportunities to improve these processes.

The concept of continuous improvement is that a small improvement in the cost and time to complete one cycle of the process, when multiplied by the many times the cycle is repeated, can lead to great savings over time. After a process has been improved many times in a small way, it will begin to become a much better process, eventually perhaps even becoming a **?**world class" process. Each improvement of the process reduces the excess time and cost in the process, i.e., the unproductive waste.

The three major quality experts—Crosby, Deming, and Juran—believe that 85 percent of the problems in any organization are the problems caused by the systems the organization uses (which are controlled by management). Since the people who use the systems are the workers—the machine operators in a manufacturing plant, the clerks in an insurance claims process, or the food handlers at McDonald's—they are the best people to fix the problems. The way the workers fix the problems is through the use of continuous improvement.

The most commonly used technique to do continuous improvement is through use of the Plan-Do-Check-Act Cycle, initially developed by Walter Shewhart of Bell Labs in the 1930's. This cycle, also called **?**The Shewhart Cycle" (See Figure 6.9 on the next page), says that you continually go through the cycle with a process, each iteration of which improves the process slightly. First, you plan the process or change, then you do it, i.e., the process or change. After the process or change is completed, next you check your results, usually by taking measurements. Then, based on the results of the measurements, you act. You continue with the process or change you developed or re-enter the cycle and improve on the initial change by going through the cycle again.

What Tools Are Used?

There are many tools to use in continuous improvement. Examples of some commonly utilized tools for continuous improvement are given below.

- Pareto Chart
- Histogram
- Brainstorming
- Scatter Diagram
- Fishbone Diagram
- Check Sheet
- Benchmarking
- Flow Chart
- Run Diagram
- Force Field Analysis
- Nominal Group Technique
- Gantt Chart
- Control Chart

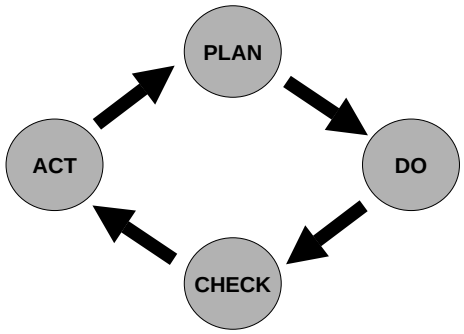

Figure 6.9

Plan-Do-Check-Act Cycle

Excellent sources of more detailed information on these and additional tools for continuous improvement include The Memory Jogger, which is published by Gaol/QPC, and Waste Chasers, which is published by Conway Quality, Inc. AlliedSignal's Kansas City Plant has produced an excellent series of tapes teaching 12 of the tools, each tape having a duration of three to five minutes, which are great for inclusion in a tools training session.

What Costs Will Be Incurred?

Because continuous improvement requires training in the use of specific tools and processes, as well as champions to ensure that the right things are accomplished, there will be initial costs to start a continuous improvement effort. However, because the intent of this effort is to reduce waste, its cost—if done vigorously and correctly—should be considerably less than the cost of the waste that is eliminated. Thus, after the effort is kicked off and has run for a period of time, perhaps one year or less if done correctly, continuous improvement should be a big money-maker for any organization.

What are the Critical Success Factors?

Without a doubt, the most critical factor in ensuring success of a continuous improvement effort is the enthusiastic support of the top leadership of the organization. If the leadership is not 110 percent behind the effort, it is doomed to failure. The leadership must make it clear to the entire organization why continuous improvement is necessary, that they support it very strongly, that those in the organization who support the effort will be rewarded, and that those in the organization who either try to stop it or do not support it will be punished or even removed from the organization. If the top leadership is not willing to give this level of support, there is really no reason to even start the effort.

Assuming top leadership enthusiastically supports the effort, the following additional actions are also necessary for the success of a continuous improvement effort:

- Clarify the process to be followed so that everyone understands what is being done and what is expected of them.
- Provide the necessary resources to ensure success. It will let the skeptics know that the organization is committed.
- Visibly reward those who support the effort and work toward its success.
- Establish new measures and stretch goals that fit the new direction.

Deciding What to Take On

Every employee in the organization needs to be empowered to fix or improve any of the processes in which he or she is involved. When this empowerment happens, the employees decide to fix or improve the processes they feel need to be improved, eliminating managers trying to fix the wrong things or not noticing the things that really need to be fixed the most. Employees need to be able to fix everything.

?If It Ain't Broke, Break It!"

The saying, ?If it ain't broke, don't fix it," needs to be changed to, ?If it ain't broke, break it!" Just because a process appears to be working well does not mean it cannot be improved. Additionally, problems—when they do arise—need to be looked at as opportunities, since they point out areas that are ripe for improvement. Continuous improvement is really removing the waste from the processes. As some experts have estimated that all processes contain at least 20 to 40 percent waste, there should be a lot of opportunities for continuous improvement—removing the waste—in most organizations.

Section V: Process Improvement

Section V provides basic information on why organizations should use process improvement, how it differs from continuous improvement and from reengineering, and how to use it. In addition to the text of this section, references to additional useful information are provided in Appendix C.

What Is Process Improvement and Why Do It?

A process is an ongoing, recurring, and systematic series of actions or operations whereby an input is transformed into a desired product (or output). This transformation is also referred to as ?adding value." Process improvement then can be defined as a set of management techniques for controlling and improving the effectiveness and efficiency of the process. The U.S. Navy views a process as the steps and decisions involved in the way work is accomplished. Process improvement then can be viewed as a management technique for making the result better. In order to be measured, monitored, and analyzed, the process must be repeated frequently, perhaps weekly or monthly at a minimum. It must also have measurable inputs and outputs, and the process must be controllable.

Process improvement can be used to make significant improvements in repetitive actions or operations. Managers often use process improvement when they need to increase the value added to an operation without changing the basic organization or the basic business systems in place. The three major quality experts—Crosby, Deming, and Juran—agree that more than 85 percent of all problems associated with quality can be attributed to management policy or action (because management controls the systems). Process improvement is an excellent tool to reduce these problems.

How Does Process Improvement Compare to Continuous Improvement and When Is Each Appropriate?

Continuous improvement—the quality technique of continually making small, incremental changes to a process—is different from process improvement only in the scale of the change being made. As discussed in the reengineering section, each incremental change of the continuous improvement process may make a one or two percent improvement in cost and cycle time. In contrast, process improvement may be selected when the basic organization and business systems will remain but the entire process under review could be radically altered. When to use continuous improvement and process improvement depends on the magnitude of the change required. If you have been doing continuous improvement but need a much bigger incremental change, process improvement may be appropriate.

How Does Process Improvement Compare to Reengineering and When Is Each Appropriate?

Reengineering is the one-time, radical redesign of current business processes. The intent of any reengineering effort is to reduce the costs and cycle time, which will result in increased customer satisfaction. Reengineering may include a change in organizational structure and systems and can lead to dramatic process improvements leading to equally dramatic cost and cycle time reductions. Companies often reengineer when they want to change their way of doing business. Reengineering requires a significant up-front investment of time and capital. Organizations often find that there is a major indirect cost in disruption to the organization. Some authors view reengineering of a single process and Process Improvement as one in the same. Reengineering of a single process, or process improvement, can lead to reengineering of major segments of the business. Both are important management tools, but each is appropriate in different circumstances, depending on the outcome desired. Excellent organizations need to be able to use a mixture of continuous improvement, process improvement, and reengineering in order to improve.

What are the Critical Success Factors?

Without a doubt, the most important factor to the success of a process improvement effort is for the senior leadership to make it one of the organization's highest priorities. The importance of process improvement must be communicated from the top. Senior leadership must participate by attending training sessions and ensuring that everyone else receives the appropriate level of training.

Getting Started: Coming to Agreement

In order for process improvement—or any other form of quality improvement—to be successful, the organization must agree that:

- Customer satisfaction, whether internal or external, will determine the success of the improvement.
- Management of processes must be by fact, not by intuition.
- Continuous improvement must become a way of life for the organization.
- Each individual is accountable for the quality of the work he/she performs.

Deciding What Process to Improve

In order to be most effective, the most important core process—those processes that interact with or have an influence on other processes—should be addressed first. But deciding what the most important processes are requires management to first define the customer and the customer's goals. Management must also establish the priority of the process, the degree of improvement needed, and a baseline of the current level of performance.

How to Do Process Improvement

Assuming that management has identified the primary customer, the core process to be improved, and the process to control and improve, it is time to get started. There are seven phases to go through in process improvement. They are:

1. Organize the team
2. Analyze the current process
3. Simplify the process
4. Develop outcome indicators
5. Determine if the process is stable
6. Determine if the process capable
7. Determine if further improvement is feasible

(See Benchmarking and Reengineering sections for related information.)

Organize the Team

The process improvement team will need to be organized according to the types of skill-mix the team needs to have. Team members will probably require additional specific training. A small process may only require a single individual, the process owner. Complex processes, however, may require a large, multi-disciplinary team.

Analyze the Current Process

The next phase of process improvement is to analyze the current process by constructing a process flowchart. This tool is used to generate a step-by-step map of the activities, actions, and decisions that actually occur. It is important to talk to the individual who does the individual actions. Frequently, policies and procedures have not been updated to reflect valid changes and requirements have been altered. In some cases, you may find that individuals have modified the procedure without communicating to other individuals involved in the process. The author of Volume 6 has participated in a study that documented a major monthly report effort on the part of an organization that was unseen by higher management and filed without any review or action.

Simplify the Process

The team must remove redundant or unnecessary activities. There will be a tendency for some individuals to try to keep some steps because they feel their job is threatened or they believe, often incorrectly, that there is a requirement for their step in the process. It is important to both validate and challenge requirements.

Develop the Outcome Indicators

For each valid requirement in the process, there should be a measurable indicator. For example, if the requirement is to produce an accurate report on the 15th of each month, the process should have an outcome indicator that measures the conformance to the accuracy and an outcome indicator that measures your conformance to the delivery specification (see Volume 2, *Establishing And Updating Performance Objectives And Measures*, for development of measures).

If the team can not define a measurable outcome indicator, they need to review the requirement. If the team or your client can not define the requirement enough to determine whether or not your output conforms to it, you may be able to eliminate it. Outcome indicators often begin with the words **?**numbers of. . . ," **?**temperature of . . . ," **?**weight of . . . ," or even **?**cost of. . ." In general, when conformance is high, measure non-conformance. Avoid averages when the consequence of failure is high because it tends to provide a false feeling of security. None of us would be happy with a process allowing our paychecks to be accurate plus or minus a dollar per hundred dollars paid.

Determine If the Process Is Stable

Team members should look for seasonal variation, or periodic variation caused by other processes. Are there outside influences that cannot be removed and that prevent the conformance? If so, the process may not be suitable for process improvement. (Control charts or run charts are often used to determine if the outcome is predictable. See Volume 5, *Analyzing And Reviewing Performance Data*, for additional information on reviewing performance data.)

Determine If the Process Is Capable

Can we meet the objectives? The team should use one or more statistical techniques to determine how frequently the process outcome conforms with the client's expectation as measured by the outcome indicator. Process elements should be rearranged or changed in order to reduce the number of non-conformances [(i.e., reduce the variation) (see Crosby 1979 for more information)]. Often a Cause-and-Effect diagram (also called an Ishikawa Diagram or a Fishbone Diagram) or a Root Cause Analysis can help organize the information in such a way as to identify those elements that produce the majority of the variation (see Ishikawa 1982 for more information).

Elements producing the variation should be addressed using the Plan-Do-Check-Act cycle (also called Shewhart cycle or Deming cycle) emphasized by Deming (see Deming 1986 for additional information). The P-D-C-A cycle relies on stability and good measurements, so it is important to have addressed the preceding paragraphs first. It is important to only change one factor at a time, and multiple authors have pointed out that a change that reduces variation without changing the average is better than one that

changes the average but leaves a wide variation. The fact is, reduced variation makes other improvements easier to find.

Determine If Further Improvement Is Feasible

The goal of process improvement is to achieve a stable process, reduce the variation, and to increase the conformance with customer expectations.

The team leader should be alert to two possibilities. First, further process improvement may not justify the work of the team. The process owner should continue using continuous improvement to make small incremental improvements. The second possibility is that the process itself may not be adequate to achieve the needed results. Benchmarking may demonstrate that others have significantly better processes that need to be imported, or management may need to turn to reengineering for a more radical change in the way business is being conducted.

Organizations That Have Done Process Improvement

A large number of commercial companies are currently doing process improvement. The benchmarking section of this volume contains a list of 36 firms that are all engaged in some form of process improvement. Within the federal government, the Department of Energy, Department of Defense, the U.S. Navy, the U.S. Air Force, and others have established formal offices and programs to conduct quality improvement, including process improvement. The Department of Energy's Office of Quality Management (now the Office of Performance Excellence) published Quality Management Implementation Guidelines (July 1997), laying out an overall quality journey for the Department of Energy. (This document is available at the following Web site: http://www.ma.doe.gov/HR6/Toc.html.)

Appendix A: Definitions

Because people often associate different meanings to ?common" terminology, definitions are always tricky and controversial. Such may be the case with the definitions given herein. Please remember that many of these definitions are applicable with respect to the U.S. Department of Energy and its operations. The intent here is to define terminology such that the reader can get a general understanding of it. The PBM SIG does not intend to be prescriptive or inflexible, nor does it admit to being the highest source of information.

Accountability
The obligation a person, group, or organization assumes for the execution of assigned authority and/or the fulfillment of delegated responsibility. This obligation includes: answering—providing an explanation or justification—for the execution of that authority and/or fulfillment of that responsibility; reporting on the results of that execution and/or fulfillment; and assuming liability for those results.

Activity
Actions taken by a program or an organization to achieve its objectives.

Assessment
An all-inclusive term used to denote the act of determining, through a review of objective evidence and witnessing the performance of activities, whether items, processes, or services meet specified requirements. Assessments are conducted through implementation of activities such as audits, performance evaluations, management system reviews, peer reviews, or surveillances, which are planned and documented by trained and qualified personnel.

Baseline
The initial level of performance at which an organization, process, or function is operating upon which future performance will be measured.

Benchmarking
1. To measure an organization's products or services against the best existing products or services of the same type. The benchmark defines the 100 percent mark on the measurement scale.
2. The process of comparing and measuring an organization's own performance on a particular process against the performance of organizations judged to be the best of a comparable industry.

Bottom Up
Starting with input from the people who actually do the work and consolidating that input through successively higher levels of management.

Cascaded Down
Starting with a top level of management, communicated to successively lower levels of management and employees.

Characteristics
Any property or attribute of an item, process, or service that is distinct, describable, and measurable.

Continuous Improvement
1. The undying betterment of a process based on constant measurement and analysis of results produced by the process and use of that analysis to modify the process.
2. Where performance gains achieved are maintained and early identification of deteriorating environmental, safety, and health conditions is accomplished.

Corrective Action
Actions taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

Criteria
The rules or tests against which the quality of performance can be measured.

Goal
1. The result that a program or organization aims to accomplish.
2. A statement of attainment/achievement, which is proposed to be accomplished or attained with an implication of sustained effort and energy.

Guideline
A suggested practice that is not mandatory in programs intended to comply with a standard. The word ?should" or ?may" denotes a guideline; the word ?shall" or ?must" denotes a requirement.

Impact
Characterization of the outcome of a program as it relates to specific objectives.

Item
An all-inclusive term used in place of the following: appurtenance, sample, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, unit, documented concepts, or data.

Lessons Learned
A ?good work practice" or innovative approach that is captured and shared to promote repeat application. A lesson learned may also be an adverse work practice or experience that is captured and shared to avoid recurrence.

Line Manager
Includes all managers in the chain of command from the first-line supervisors to the top manager.

Management
All individuals directly responsible and accountable for planning, implementing, and assessing work activities.

Measurement
The quantitative parameter used to ascertain the degree of performance.

Metric
A standard or unit of measure.

Objective
A statement of the desired result to be achieved within a specified amount of time.

Occurrence
An unusual or unplanned event having programmatic significance such that it adversely affects or potentially affects the performance, reliability, or safety of a facility.

Outcome
The expected, desired, or actual result to which outputs of activities of an agency have an intended effect.

Outcome Measure
An assessment of the results of a program activity or effort compared to its intended purpose.

Output
A product or service produced by a program or process and delivered to customers (whether internal or external).

Output Measure
The tabulation, calculation, or recording of activity or effort and can be expressed in a quantitative or qualitative manner.

Performance-Based Management
A systematic approach to performance improvement through an ongoing process of establishing strategic performance objectives; measuring performance; collecting, analyzing, reviewing, and reporting performance data; and using that data to drive performance improvement.

Performance Expectation
The desired condition or target level of performance for each measure.

Performance Indicator(s)
1. A particular value or characteristic used to measure output or outcome.
2. A parameter useful for determining the degree to which an organization has achieved its goals.
3. A quantifiable expression used to observe and track the status of a process.
4. The operational information that is indicative of the performance or condition of a facility, group of facilities, or site.

Performance Measure
A quantitative or qualitative characterization of performance.

Performance Measurement
The process of measuring the performance of an organization, a program, a function, or a process.

Performance Objective
1. A statement of desired outcome(s) for an organization or activity.
2. A target level of performance expressed as a tangible, measurable objective, against which actual achievement shall be compared, including a goal expressed as a quantitative standard, value, or rate.

Performance Result
The actual condition of performance level for each measure.

Process
An ongoing, recurring, and systematic series of actions or operations whereby an input is transformed into a desired product (or output).

Process Improvement
A set of management techniques for controlling and improving the effectiveness and efficiency of a process. In order to be measured, monitored, and analyzed, the process must be repeated frequently, perhaps weekly or monthly at a minimum. It must also have measurable inputs and outputs, and the process must be controllable.

Program Evaluation
An assessment, through objective measurement and systematic analysis, of the manner and extent to which federal programs achieve intended objectives.

Quality
A degree to which a product or service meets customer requirements and expectations.

Quality Management
The management of a process to maximize customer satisfaction at the lowest cost.

Reengineering
The radical redesign of current business processes with the intent of reducing cost and cycle time resulting in increased customer satisfaction.

Root Cause
The basic reasons for conditions adverse to quality that, if corrected, will prevent occurrence or recurrence.

Root Cause Analysis
An analysis performed to determine the cause of part, system, and component failures.

Self-Assessment
A systematic evaluation of an organization's performance, with the objective of finding opportunities for improvement and exceptional practices. Normally performed by the people involved in the activity, but may also be performed by others within the organization with an arms-length relationship to the work processes.

Senior Management
The manager or managers responsible for mission accomplishment and overall operations.

Situation Analysis
The assessment of trends, strengths, weaknesses, opportunities, and threats, giving a picture of the organization's internal and external environment to determine the opportunities or obstacles to achieving organizational goals. Performed in preparation for strategic planning efforts.

Stakeholder
Any group or individual who is affected by or who can affect the future of an organization, e.g., customers, employees, suppliers, owners, other agencies, Congress, and critics.

Strategic Planning
A process for helping an organization envision what it hopes to accomplish in the future; identify and understand obstacles and opportunities that affect the organization's ability to achieve that vision; and set forth the plan of activities and resource use that will best enable the achievement of the goals and objectives.

Task
A well-defined unit of work having an identifiable beginning and end that is a measurable component of the duties and responsibilities of a specific job.

Total Quality Management
1. A management philosophy that involves everyone in an organization in controlling and continuously improving how work is done in order to meet customer expectations of quality.
2. The management practice of continuous improvement in quality that relies on active participation of both management and employees using analytical tools and teamwork.

Validation
An evaluation performed to determine whether planned actions, if implemented, will address specific issue(s) or objective(s).

Verification
1. A determination that an improvement action has been implemented as designed.
2. The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services, or documents conform to specified requirements.

Appendix B: Acronyms

ABM . . . . . Activity-based management
AOP . . . . . Annual Operating Plan
APQC . . . . . American Productivity and Quality Center
ARL . . . . . Army Research Laboratory
ASQC . . . . . American Society for Quality Control
BMOP . . . . . Business Management Oversight Pilot
CEO . . . . . Chief Executive Officer
CFO . . . . . Chief Financial Officer
CIO . . . . . Chief Information Officer
COO . . . . . Chief Operating Officer
CPI . . . . . Consumer Price Index
CRT . . . . . DOE Contract Reform Team
CSF . . . . . Critical success factor
DOE . . . . . U.S. Department of Energy
ES&H . . . . . Environment, safety and health
EVA . . . . . Economic value-added
FY 19xx . . . . . Fiscal Year 19xx
GAO . . . . . General Accounting Office
GPRA . . . . . Government Performance and Results Act of 1993
IBM . . . . . International Business Machines
IRG . . . . . Initial Review Group
ISO . . . . . International Standards Organization
JIT . . . . . Just-in-time
JPL . . . . . Jet Propulsion Laboratory
MBNQA . . . . . Malcolm Baldrige National Quality Award
M&I . . . . . Management and Integrating
M&O . . . . . Management and Operating
NAC . . . . . National Advisory Council
NASA . . . . . National Aeronautics and Space Administration
NIH . . . . . National Institutes of Health
NPR . . . . . National Performance Review
NRC . . . . . Nuclear Regulatory Commission
NSF . . . . . National Science Foundation
OMB . . . . . Office of Management and Budget

OSHA . . . . . Occupational Safety and Health Administration
PBM SIG . . . . . Performance-Based Management Special Interest Group
PDCA . . . . . Plan-Do-Check-Act Cycle
POCMs . . . . . Performance objectives, criteria, and measures
QCDSM . . . . . Quality, cost, delivery, safety, and morale
R&D . . . . . Research and development
ROI . . . . . Return on investment
S&T . . . . . Science and technology
SAI . . . . . Strategic Alignment Initiative
SPC . . . . . Statistical process control
TQM . . . . . Total Quality Management
UC . . . . . University of California
UCOP . . . . . University of California Office of the President
URL . . . . . Universal Resource Locator
WWW . . . . . World Wide Web

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Appendix D: Types of Benchmarking

Process Benchmarking
Focuses on discrete work processes and operating systems. Subdivided into:

- Internal - Comparison of internal operations
- Competitive - Specific competitor-to-competitor comparisons for the product or function of interest
- Functional - Comparisons to similar functions within the same broad industry
- Generic - Comparison of business functions or processes that are the same regardless of industry

Performance Benchmarking
Focuses on product and service comparisons, such as:

- Price
- Technical quality
- Ancillary product or service features
- Reliability

Strategic Benchmarking
Focuses on how companies compete. Characteristics include:

- Seldom industry focused
- What companies are really good?
- Influences the longer-term competitive patterns of a company

Appendix E: Example of an Organizational Self-Assessment

The following example was provided by the University of California, Laboratory Administration Office, Office of the President.

1. How would you characterize your organization for the following features? Rank your organization's current situation on a scale of 1-5, as indicated below, for each of the following features:

Feature	Rank	Low 1	2	Medium 3	4	High 5
Decision Making	_____	Autocratic		Participative		Consensus
Structure	_____	Centralized		Decentralized		Multi-Business Conglomerate
Teamwork	_____	Functional Only		Project and Functional Only		Cross Functional
Flexibility	_____	Static Reluctant		Open		Dynamic
Information Handling	_____	Hard Copy Files		Central Computer Files		Local Network Files
Strategic Change Management	_____	Management Directed		Middle-Management Initiated		Employee Initiated
Information Use	_____	Internal Information Only		Internal Plus Traditional External Sources		Robust Use of All Sources

2. What are the top three organizational strengths that you anticipate to be able to build benchmarking upon?

_____

_____

_____

_____

_____

3. What alliances among strategic business partners, suppliers, and major accounts will be most useful to your benchmarking efforts?

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

4. Which managers in your company would benefit most from benchmarking? Rank these managers using a scale of 1-5 (low to high) in terms of importance of their personal buy-in to benchmarking and their potential ability to serve as an executive champion for benchmarking.

Name	**Buy-In Importance**	?**Champion" Ability**

5. What are the top five reasons for benchmarking outside of your organization?

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

6. What are the potential objections to benchmarking? How would you handle these?

Appendix F: An Example of a Best Practice Matrix

The following example was provided by the University of California, Laboratory Administration Office, Office of the President.

COMPANY	Understand-ing of Process	Process Innovation	Measures	Customer Satisfaction	Information Technology	Quality Improvement Initiative	External Search for Improvement	Company Average
A	3	4	1	3	3	3	3	**2.9**
B	3	1	1	2	2	1	1	**1.6**
C	2	2	3	2	2	1	1	**1.9**
D	3	1	3	2	2	1	3	**2.1**
E	2	1	2	3	2	3	1	**1.9**
F	3	2	3	2	1	2	1	**2.0**
G	3	3	4	3	1	4	4	**3.1**

1 = Weak in This Area 2 = Roughly at the Same Level as Our Company 3 = Above Average 4 = Excellent Performance

Appendix G: Brainstorming, Cause and Effect Diagram, and Root Cause Analysis

The following information was provided by the University of California, Laboratory Administration Office, Office of the President.

Brainstorming: What Is It?

Brainstorming is a technique for generating ideas. A good metaphor for brainstorming is to imagine sparks lighting a fire. Ideas are thrown out, igniting more ideas. As thoughts begin to come together, innovative solutions are born.

How Do I Do It?

Here are the steps to brainstorming:

1. Assemble a group of five to seven people.
2. Identify a problem to solve or a desired goal.
3. Throw out as many ideas as possible relating to your purpose. Encourage a freewheeling, relaxed atmosphere. Consider all ideas; don't be judgmental.
4. Record the team's progress on a flipchart, overhead, or whiteboard.
5. When all thoughts have been exhausted, begin grouping similar ideas.

Cause and Effect Diagram: What Is It?

A cause and effect diagram (also called a **?**fishbone diagram" due to its shape, and **?**Ishikawa Diagram" after the man who championed its use), is a brainstorming tool that guides you in organizing your thoughts. The cause and effect diagram takes a consequence (the effect), and explores all possible causes. The diagram is a visual aid in helping you flesh out ideas through branching.

How Do I Do It?

Here are the steps to creating a cause and effect diagram:

1. Determine the effect that the team is addressing. This effect could be either a problem you are trying to solve, or a goal you are trying to achieve.
2. Put the effect in a box to the right-hand side of the paper, drawing an arrow from left to right pointing to the effect.
3. Decide upon major categories around which to group your ideas. Typically, these categories include: people, materials, methods, equipment, and environment.
4. Put the major categories in boxes and direct a branch arrow from each box to the main arrow. Brainstorm causes under each category, branching out from each idea. Categories of large clusters indicate problem areas.
5. Remember that the goal is to cure the causes, not the symptoms.

An example of a Cause and Effect Diagram is provided in Figure H.1 on the following page.

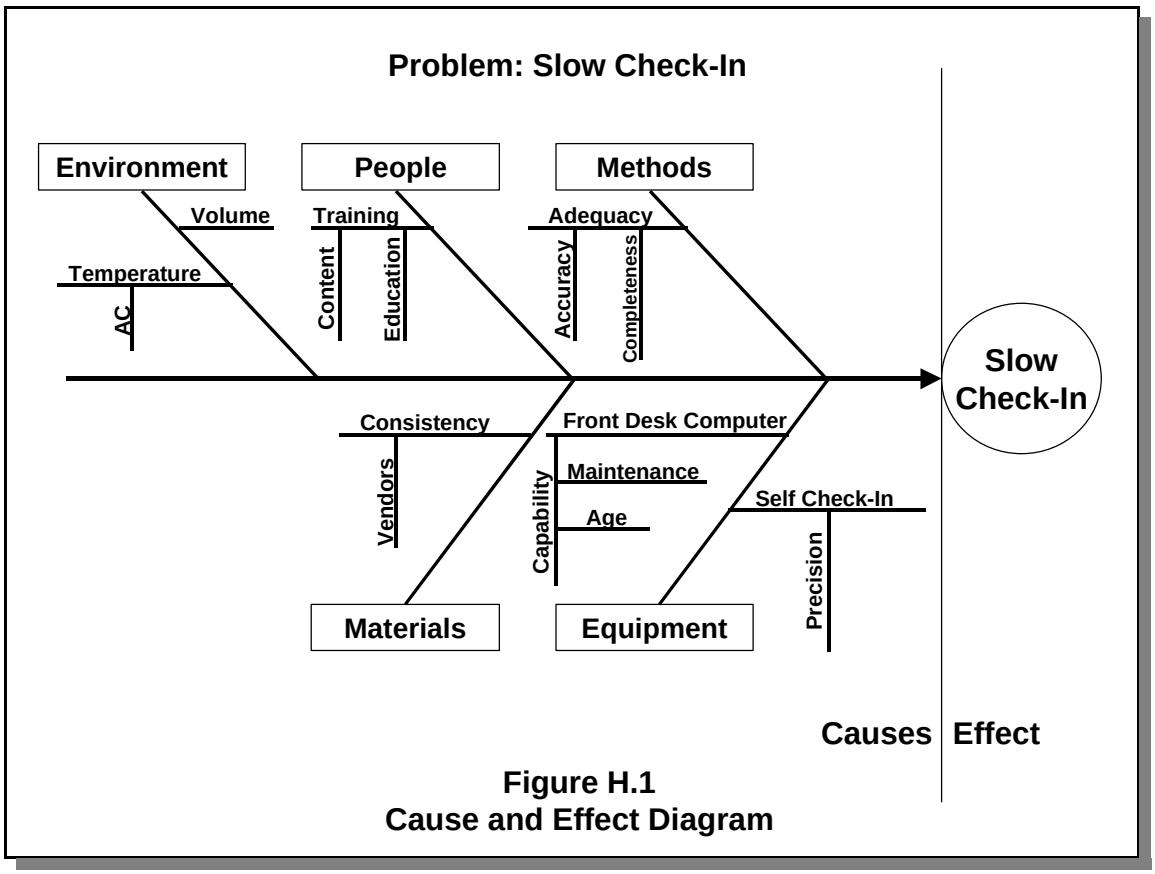

Figure H.1
Cause and Effect Diagram

Root Cause Analysis: What Is It?

Root cause analysis breaks down a problem into component causes. The causes are evaluated as problems themselves to ensure that the root cause has been identified. Once the root cause is corrected, the problem shouldn't reoccur again.

How Do I Do It?

Here are the steps to performing a root cause analysis:

1. Clearly define the problem to be solved.
2. Using either brainstorming or a cause and effect diagram, identify a list of possible causes.
3. For each cause you have identified, ask, **?**Why is this a problem?" Continue to explore the causes until you get to the root. A general guideline is to ask, **?**Why?" at least five times.
4. Collect data to verify that you have identified the root cause.
5. After implementing a solution, check back periodically to ensure that you stopped the problem at its root.

An example of a root cause analysis is given in Figure H.2 on the following page.

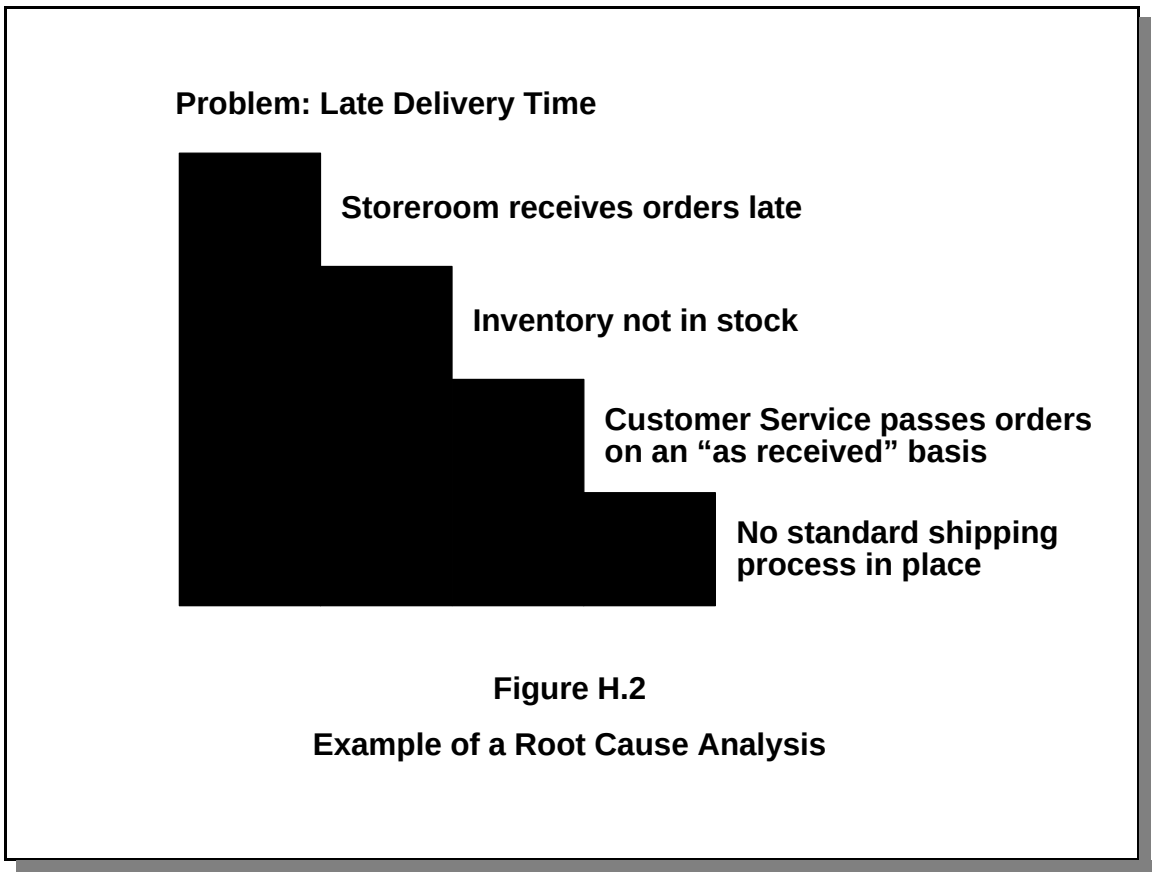

Figure H.2

Example of a Root Cause Analysis

Appendix H: The Benchmarking Code of Conduct

(Note: This information must be downloaded from the Internet. It is available at the American Productivity & Quality Center's International Benchmarking Clearinghouse Web site located at http://www.apqc.org. It is also available at the PBM SIG's Web site located at http://www.orau.gov/pbm.)