

THIRD EDITION

BENCHMARKING BEST PRACTICES

FOR
MAINTENANCE,
RELIABILITY AND
ASSET MANAGEMENT

UPDATED FOR
ISO 55000



TERRY WIREMAN

**Benchmarking Best Practices
in Maintenance, Reliability
and Asset Management:
Updated for ISO 55000**

Third Edition

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Chapter 2

Benchmarking Fundamentals

Benchmarking. Benchmarks. Best Practices. All of these terms are used in business today. But are they just buzzwords, or do the words have real meaning? Are they useful tools that can be used to improve business practices today? Let's begin with some definitions.

Definitions

BENCHMARKING

There are several differing definitions for benchmarking. For example, Xerox Corporation defines benchmarking as follows:

*The search for industry Best Practices
which lead to Superior Performance.*

The key elements in this definition are the terms Best Practices and Superior Performance. What is a Best Practice? It is a series of processes that enables a company to become a leader in its respective marketplace. However, Best Practices are not the same for all companies. If a company is in a declining market, where the pressures are to maximize profits with a fixed sales volume, one set of Best Practices might allow market leadership. If, however, the company is in a

growth mode with profits dictated by gaining rapid market share, another set of Best Practices allows market leadership. Therefore, Best is determined by business conditions, not by a fixed set of business practices.

A note on the term *Best Practices*. To avoid Best Practices just becoming a buzzword in many organizations, the words have been changed to Better Practices. Because no universally accepted Best Practices exist, Better Practices can be utilized in organizations with a continuous improvement business philosophy.

The second key phrase in the Xerox definition is *Superior Performance*. Many companies use benchmarking to be “as-good-as” their competitors. However, there is very little that can be gained if the goal of benchmarking is merely to achieve status quo. Benchmarking is a continuous improvement tool; it should be utilized by companies that are striving to achieve superior performance in their respective marketplace. Only then can benchmarking be properly utilized as a true continuous improvement tool.

An alternative definition for benchmarking proposed by Robert Camp in *The Benchmarking Handbook*, is:

*An ongoing process of measuring and improving
business practices against the companies
that can be identified as the best worldwide*

A key point in this definition is the idea of improving, not maintaining status quo. A second point is the worldwide search for best companies. Most companies have international competitors. It would be naive to think that Best Practices are limited to one country or one geographical location. Logically, information that allows companies to improve their competitive positions must be gathered from Best

companies, no matter where they are geographically located.

Companies striving to improve must not accept past constraints, especially the “not invented here” paradigm. Companies that fail to develop a global perspective will soon be replaced by competitors who had the insight to think globally. In order to make rapid continuous improvement, companies must be able to think outside the box, that is, to examine their business from external perspectives. The more innovative the ideas that are discovered, the greater the potential rewards that can be gained from the adaptation of the ideas.

A third perspective on benchmarking states:

*Benchmarking sources “Best Practices”
to feed continuous improvement.*

This statement adds another dimension to benchmarking, that of having an external perspective. Research shows that major innovations in any business sector comes from an external market sector and is adapted to improve the practices of the company. Because “Best Practices” can be found in any industry section, finding them requires companies to look outside their industrial vertical market. In today’s competitive business environment, the need to develop this external perspective is critical to survival.

A final perspective says that benchmarking is the process of continuously comparing and measuring an organization with business leaders anywhere in the world to gain information that will help the organization take action to improve its performance. The common thread of studying other companies to gain information that allows the company to become more competitive is clear throughout all four descriptions. Unless a company clearly understands the processes and procedures that allow it to become the best, little value is derived from benchmarking.

COMPETITIVE ANALYSIS

There is considerable confusion between the terms benchmarking and competitive analysis. Whereas benchmarking references external business sectors for information, competitive analysis shows how firms compare only with their competitors. A competitive analysis produces a ranking in comparison to direct competitors; it does not show how to improve business processes. This is the major difference between benchmarking and a competitive analysis.

Benchmarking, compared with a competitive analysis, provides a deep understanding of the processes and skills that create superior performance. Unless the deep understanding is achieved, little benefit is derived from benchmarking. The question should be asked “What is your Goal for benchmarking?” If the goal is only to meet some industry standard, then there is little to gain from investing in benchmarking to be superior.

A competitive analysis is unlikely to lead to or highlight significant breakthrough opportunities that could change long entrenched paradigms of any particular market segment. This is because business paradigms are similar for look-alike businesses in similar markets. Whereas a competitive analysis can result in incremental improvements for a business, breakthrough strategies are derived from taking an external perspective. By discovering and understanding external best practices, quantum leaps in business process improvements can be derived.

During the past decades, competitive analyses have helped companies improve their respective market positions. Benchmarking takes over where a competitive analysis ends. Benchmarking will allow companies to move from a parity business position to a superiority position. Lessons learned from the best companies can help any company.

One of the major differences between benchmarking and a competitive analysis is the level of documentation. A competitive analysis focuses on meeting some type of published industry standard. Therefore, all that may be required is some published number. By comparison, benchmarking focuses not on a number, but on the process that allows such a standard not only to be achieved, but also to be surpassed. Process enablers and critical success factors must be clearly understood for any permanent improvement to be achieved and sustained. As mentioned in the preface, ISO-55000 considers these enablers and critical success factors as elements. Some of them included:

- Proper resources
- Competent personnel
- Organizational awareness of the business objectives
- Good organizational communication
- Information collection, analysis, and utilization
- Good documentation

Properly identifying these enablers and their impacts will require extensive data collection, both internally and from the benchmarking partners.

Enablers

Enablers are a broad set of activities or conditions that help to enhance the implementation of a best business practice. Although benchmarking always compares hard processes, an essential part of a true benchmarking approach also includes analyzing the management skills and attitudes that combine to allow a company to achieve best business practices. This hidden narrative is as important during the benchmarking

exercise as are the visible statistical factors.

The enablers, therefore, are behind-the-scene, hidden factors that allow the development or continuation of best practices. Some examples include leadership, motivated workforces, management vision, and organizational focus. These factors have a direct impact on the company's quantified financial performance, but are rarely mentioned by specific statistics. These methods or approaches lead to a company's exceptional performance. Realize that these methods or approaches are relative, not absolute. In other words, they are not perfect; they too can be improved. This highlights a previous note — enablers can be better, but are rarely identified as the best.

Enablers or critical success factors can be found anywhere. They know of no industrial, political, or geographical boundaries.

How do we compare one company to another by enablers? We start with an internal analysis. For companies to be successful, they must have a thorough knowledge and understanding of their internal processes. Without this understanding, it would not be possible to recognize the differences between themselves and their benchmarking partners. It would be virtually impossible to recognize and integrate the differences and innovations that are found in best practice companies.

Defining Core Competencies

Benchmarking, as a continuous improvement tool, is only to be used to improve core business processes. What are core business processes? All the definitions focus on processes that allow companies to differentiate themselves from their competitors. A core business process may have an impact by lowering costs, increasing profits, providing improved service to customers, improving product quality, or improving regulatory compliance.

Several authors have defined core competencies for businesses. In his 1997 text *Operations Management*, Richard Schonberger defines core competencies as “a key business output or process through which an organization distinguishes itself positively.” He specifically mentions expert maintenance, low operating costs, and cross-trained labor.

Another author is Gregory Hines who, in his text, *The Benchmarking Workbook*, defines a core competency as “a key business process that represents core functional efforts and are usually characterized by transactions that directly or indirectly influence the customer’s perception of the company”. He further lists several processes, including:

- Procuring and supporting capital equipment
- Managing and supporting facilities

As can be seen, the maintenance function clearly Hines’s definition of a core business process.

In *The Benchmarking Management Guide*, written by the American Productivity and Quality Center, core competencies are identified as business processes that should impact the following business measures:

- Return on Net Assets
- Customer Satisfaction
- Revenue per employee
- Quality
- Asset Utilization
- Capacity

The maintenance function in any plant or facility fits this definition as well as the previous two.

Still other sources point to a core competency as any aspect of the business operation that results in a strategic market advantage. When evaluating the maintenance process in any company, a core competency point to a strategic market advantage in many ways already mentioned. These include enhancing any quality initiative, increasing capacity, reducing costs, and eliminating waste.

Finally, we have the focus from PAS-55 and ISO-55000. Because maintenance is a key part of the life cycle (Figure P-2), any organization pursuing asset management would have to recognize maintenance as a core business process.

Maintenance and ROFA

The investment a company makes in its assets often is measured against the profits the company generates. This measure is called return on fixed assets (ROFA). Note: Many companies use some form of measure such as ROA (Return on Assets), RONA (Return on Net Assets), etc. These types of indicators are used in strategic planning when a company picks what facility to occupy or the plant in which to produce a product.

Asset management focuses on achieving the lowest total life-cycle cost to produce a product or provide a service. The goal is to have a higher ROFA than your competitor, so as to be the low-cost producer of a product or service. A company in this position attracts customers and ensures greater market share. Furthermore, a higher ROFA will attract investors to a company, ensuring a sound financial base on which to build further business.

It is the responsibility of all departments or functions within a company to measure and control their costs because these costs ulti-

Line of Sight for Asset Management

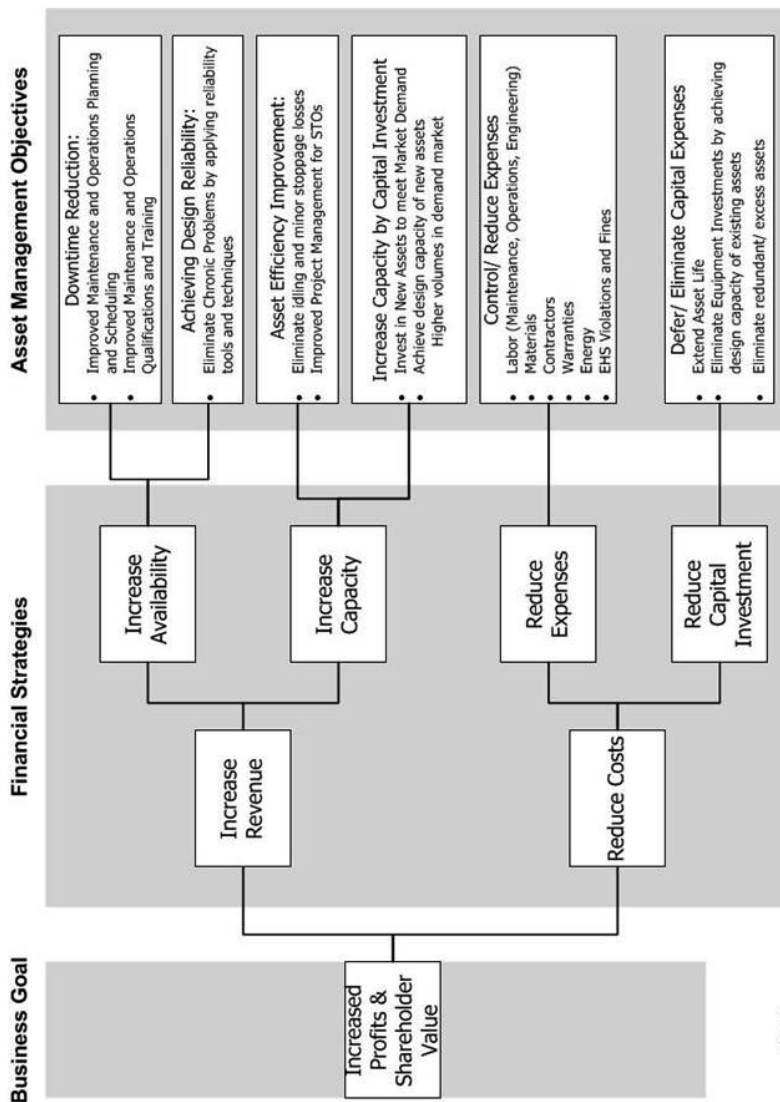


Figure 2-1, Financial Line of Sight

mately will impact the ROFA calculation. It is only when all departments or functions within a company work together that the maximum ROFA is achieved.

If we revisit Figure P-1 (the line of sight diagram), we can reconfigure it to illustrate this point. Figure 2-1 shows the line of sight, with a focus on ROFA.

On the right side of Figure 2-1, the various functional departments that can impact the ROFA calculation are listed. Maintenance, of course, is one of these departments. Because the maintenance function is our focus here, it is beyond the scope of this chapter to deal with all the other areas in detail.

In what ways does maintenance management impact the ROFA calculation? Two indicators may be utilized to show the impact.

MAINTENANCE COSTS AS A PERCENTAGE OF TOTAL PROCESS, PRODUCTION, OR MANUFACTURING COSTS

This indicator is an accurate measure for the costs of manufacturing. It should be used as a total calculation, not a per-production-unit calculation. Maintenance will be a percentage of the cost to produce, but is generally fixed. This stability makes the indicator more accurate for the financial measure of maintenance, because it makes trending maintenance costs easier. If the maintenance cost percentage fluctuates, then the efficiency and effectiveness of maintenance should be examined to find the cause of the change.

MAINTENANCE COST PER SQUARE FOOT MAINTAINED

This indicator compares the maintenance costs to the total amount of floor space in a facility. This is an accurate measure for facilities because the cost is also usually stable. This indicator is easy to use to trend any increases over time. If the percentage of maintenance

costs fluctuates, then the efficiency and effectiveness of maintenance should be examined to find the cause of the change.

These two indicators show that traditional maintenance labor and material costs will have an impact on the ROFA. However, insuring that the equipment or assets are available and operating efficiently can also have an impact on ROFA.

EXPENSES AND CAPACITY

The total impact of the maintenance function is illustrated in Figure 2-2. Because the maintenance function impacts not only expenses but also the capacity, it has a large role in contributing to ROFA. (Figure 2-3 will further clarify this diagram by detailing the blocks of the pyramid.)

Overall, the goal for any company is to increase profitability. This goal holds whether the company is public and has shareholders, or is private and held by an owner(s). The maintenance or asset management function can increase profits in two main ways: decreasing expenses and increasing capacity.

While considering decreasing expenses, it is estimated that 1/3 of all maintenance expenditures are wasted through inefficient and ineffective utilization of the maintenance resources. There are two main divisions of the maintenance costs: labor and materials. If a maintenance labor budget for a company is \$3M annually, and 1/3 of it is wasted, then \$1M could be saved over time. This savings would not necessarily be in headcount reduction. It may be a reduction in overtime, reduction in the use of outside contractors, or deferral of maintenance without additional expenditures.

If the maintenance labor budget is \$3M annually, then studies show that the materials budget will be a similar amount. If a \$3M materials budget can also be reduced by 1/3, then the savings for improv-

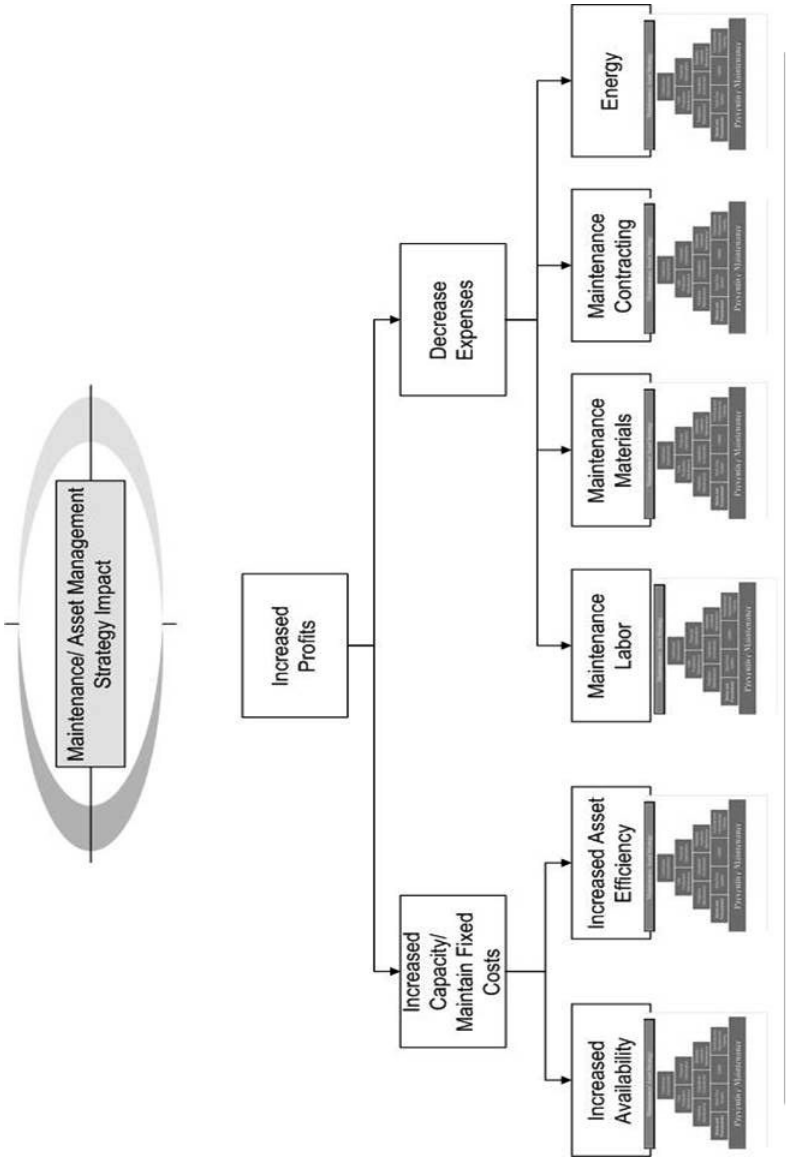


Figure 2-2 Maintenance / Asset Management Strategy Impact

ing maintenance efficiency and effectiveness combined with the materials savings could approach \$2M per year. This amount is actually expense dollars that would not be required. Expense dollars that are not used translate to profit dollars.

Realize that, when improving a reactive maintenance organization, these savings are not immediate. It takes some time to realize these total savings because changing a reactive maintenance organization to a proactive, best practice organization can take from 3 to 5 years. It's not that this transition is by itself technically difficult. Instead, time is required to change the corporate culture or paradigm from one of negativity towards the maintenance function to one that truly treats the function as a core business process.

The pure maintenance contribution to profitability is dwarfed when compared to the savings realized by increasing the capacity (availability) and efficiency of the assets being maintained. For example, in some companies, equipment downtime may average 10 to 20%, and even more. Equipment being down, when it is supposed to be operating, restricts the amount of product that is deliverable to the market. Some companies have gone as far as to purchase backup or redundant equipment to compensate for equipment downtime. This has a negative impact on their return on fixed assets indicator and lowers their investment ratings in the financial community.

Even in markets where there is a cap on volume, downtime increases costs and prevents a company from achieving the financial results desired, whether it is to increase profit margins or to be the low cost supplier. There are some organizations that refuse to calculate a cost of downtime and some that even say there is not cost to downtime. However, they fail to consider the following costs, among others:

In reality, the true cost of downtime is the lost sales dollars of

the product not made on time. Although this amount is significantly higher than the base costs mentioned previously, it is the true cost of downtime. In most companies, the finance departments end up with a compromise number. However, companies need to have a clear understanding of this cost to make good decisions concerning their assets and how they are operated.

For example, if the company discussed previously under maintenance savings examined their unplanned downtime for the previous year, they may find that there was a considerable amount, only part of which can be corrected by improving maintenance. Some of the other causes for equipment downtime could be related to raw materials, production scheduling, quality control, operator error, etc. However, if the maintenance downtime alone was valued at \$38M (downtime loss costs) and a 50% reduction in these costs was achievable if maintenance was improved, the savings could be \$19M. If even \$2M of this amount was spent on maintenance to achieve this savings, the gross savings would still be \$17M in reduced downtime loss costs (throughput). This line of reasoning relegates the projected maintenance savings previously discussed to a minor issue.

- Utility costs
- Cost of idle production / operations personnel
- Cost of late delivery
- Overtime costs to make up lost production to meet schedules

In addition to the cost of pure downtime is the cost of lost efficiency. One company examined the efficiency of its gas compressors on an off-shore operation. It found the compressors were operating (due to age and internal wear) at 61% efficiency. This loss was approximately \$5.4M annually. The overhaul would cost \$450K, including

labor, materials, and downtime production losses. The decision was made to overhaul the compressors serially, to avoid total shutdown. The compressor overhaul was paid back 28.1 days after restart and the \$5.4M in increased production was realized in the next 12 months.

Many Japanese studies (related to total productive maintenance, or TPM) have shown that efficiency losses are always greater than pure downtime losses. However, this fact becomes more alarming when you consider that most efficiency losses are never measured and reported. This leads to many chronic problems that are never solved until a breakdown occurs. Some chronic problems that have a dramatic impact on equipment efficiencies are never discovered. Only when accurate maintenance records are kept are these problems discovered. Then, utilizing the maintenance data combined with the financial data, the root cause of the efficiency problem can be solved.

If asset management is a focus for an organization, it is possible for the maintenance function to contribute to overall plant profitability. Although it takes cooperation and focus of all departments and functions within an organization to be successful, the maintenance department can have a dramatic positive impact on ROFA.

Because maintenance is typically viewed as an expense, any maintenance savings can be viewed as directly contributing to profits. By achieving maximum availability and efficiency from plant assets, a plant or facilities manager insures that a company does not need to invest in excess assets to produce its products or provide its services. The reduction in total assets contributes to overall improvement to ROFA for any company. Additionally, if the true goal of asset management is to maximize the value received from the assets, then a fully functioning maintenance organization is required for PAS-55 or ISO-55000 compliance.

The information in this section clearly establishes maintenance management as a core business process. Therefore, it is a process than could benefit from benchmarking. The next question then is what type of benchmarking should be utilized to gain the maximum benefits?

Types of Benchmarking

There are several types of benchmarking that can be used to conduct a benchmarking project. They are:

1. Internal
2. Similar Industry / Competitive
3. Best Practice

INTERNAL BENCHMARKING

Internal benchmarking typically considers different departments or processes within a plant. This type of benchmarking has some advantages in that the data can be collected easily. It is also easier to compare the data because many of the hidden factors (enablers) do not have to be closely checked. For example, the departments will have a similar culture, the organizational structure will likely be the same, and the skills of the personnel, labor relations, and management attitude will be similar. This will make data comparison quick and easy.

The disadvantage of this type of benchmarking is that it is unlikely to result in any major breakthrough in improvements. However, internal benchmarking will lead to small, incremental improvements and should provide adequate Return on Investment (ROI) for any improvements that are implemented. The successes in internal benchmarking will very likely result in the desire for more extensive external benchmarking.

SIMILAR INDUSTRY / COMPETITIVE BENCHMARKING

Similar industry or competitive benchmarking involves external partners in similar industries or processes. In many benchmarking projects, even competitors are utilized. This may be difficult in some industries, but many companies are open to sharing information, as long as it is not proprietary.

With similar industry / competitive benchmarking, the project tends to focus on organizational measures. In many cases, this type of benchmarking focuses on meeting a “number” rather than improvement of any specific business process. In competitive benchmarking, small or incremental improvements are noted, but paradigms for competitive businesses are similar. This indicates that the improvement process will be slow when relying on competitive or similar industry benchmarking.

BEST PRACTICE BENCHMARKING

Best Practice benchmarking focuses on finding the unarguable leader in the process being benchmarked. This search will cross industry sectors and geographical locations. This approach provides the opportunity for developing “breakthrough strategies” for a particular industry. Organizations study business processes outside their industry, adapt or adopt superior business processes, and make a quantum leap in performance in comparison to their competitors. Being the early adaptor or adopter gives organizations an opportunity to lower costs or aggressively capture market share.

One of the keys to being successful with best practice benchmarking is to define a best practice. Does “best” mean:

- Most efficient?
- Most customer service oriented?
- Most cost effective?
- Most profitable?

When conducting a best practice benchmarking project, an organization must clearly define what is a best practice for that organization. Without this clear understanding, it will take more resources to conduct a benchmarking project; furthermore, the improvements derived from benchmarking will be mediocre at best.

The Best Practices Ad Hoc Committee in the GSA Office of Governmentwide Policy developed the following definition for best practices:

Best Practices are good practices that have worked well elsewhere. They are proven and have produced successful results. They must focus on proven sources of best practices.

It goes on to state:

They should schedule frequent reviews of practices to determine if they are still effective and whether they should continue to be utilized.

This definition indicates that best practices evolve over time. What may have been a best practice in the past is currently a good practice; sometime in the future, it may be a poor practice. Continuous improvement calls for progressive forward movement, not status quo business processes.

When looking for Best Practice companies, understand that no single best practice company will be found. This is simply because all companies have strengths and weaknesses. There are no perfect companies. Because the processes that organizations are trying to improve

through benchmarking vary, the companies identified as the Best will also vary. Benchmarking with the best requires systematic and thorough planning and data collection.

When comparing the three type of benchmarking, Best Practice benchmarking is superior. It provides the opportunity to make the most significant improvement because companies being benchmarked are the best in the particular process. Best practice benchmarking provides the greatest opportunity to achieve the maximum return on investment for the benchmarking project. Most important, best practice benchmarking provides the greatest potential for achieving breakthrough strategies, resulting in increasing a company's competitive position.

Benchmarking — The Process

How does the benchmarking process flow? The following are the steps necessary to conduct a successful benchmarking project. They are:

- Conduct Internal Analysis
- Identify Areas for Improvement
- Find Partners
- Make Contact, Develop Questionnaire, and Perform Site Visits
- Compile Results
- Develop and Implement Improvements
- Do It Again...

When conducting an internal analysis, it is important to use a structured format. The analysis may be a survey, such as the one presented in Chapter 1 in this textbook. The goal in conducting the analysis is to identify weaknesses in the organization, areas that need improvement.

Using the analysis in this text, an organization should find the area where it has the greatest deviation from the averages and begin their benchmarking project in that area.

Once the process areas needing improvement are determined, benchmarking partners who are markedly better in the process must be identified. Contacts with these potential partners need to be made to insure the organization is willing to participate in benchmarking.

Next, a questionnaire should be developed, based on the analysis conducted earlier. The questionnaire is sent to the partners; site visits are scheduled and conducted. The information gathered in this process is compiled and analyzed. In turn, recommendations are made for changes to improve the benchmarked process. Once these changes are implemented and improvements noted, the process starts over again.

It is important to conduct an internal analysis before each benchmarking exercise — do not rely on the previous analysis. When one process is improved, it may cascade improvement to other processes. These improvements would not be noted and a process that does not need improvement could be chosen for the next benchmarking project. The benchmarking project would not produce the projected improvements, in which case the organization may no longer view benchmarking as cost effective.

Benchmarking is an evolutionary process. A company may start with internal partners. Incremental improvements will be noted. Based on these results, the progress is made to better practice partners, whether internal or external to the company. With the next round of results in hand and new areas for improvements identified, the next step is benchmarking with the best.

The key to success is always to find a partner who is measurably better in the process you need to benchmark. Once you have achieved

process parity with the partner, find a new partner who is still even further along in the process. The benchmarking process continues until the ultimate best is found and superiority over this partner's processes is achieved. This leads to your company's process being identified as the best.

There are NO shortcuts!

Developing a Maintenance Strategy

The focus of the maintenance function is to insure that all company assets meet and continue to meet the design function of the asset. An expansion on the role of the maintenance organization within a company is discussed in Chapter 2.

A definition of best practices adapted to the maintenance process reads: "The maintenance practices that enable a company to achieve a competitive advantage over its competitors in the maintenance process."

What are best practices for the maintenance process in a company today? The practices or processes within maintenance can be discussed in the following 10 categories. They are:

1. Preventive Maintenance
2. Inventory and Procurement
3. Work Flow and Controls
4. Computerized Maintenance Management System Usage
5. Operational Involvement
6. Predictive Maintenance
7. Reliability Centered Maintenance
8. Total Productive Maintenance

9. Financial Optimization

10. Continuous Improvement — Benchmarking

Figure 2-3 illustrates the process relationships.

1. PREVENTIVE MAINTENANCE

The preventive maintenance (PM) program is the key to any attempt to improve the maintenance process. This program reduces the amount of reactive maintenance to a level that allows the other practices in the maintenance process to be effective. However, most companies in the United States have problems keeping the PM program focused. In fact, surveys have shown that only 20 percent of U.S. companies believe their PM programs are effective.

Most companies need to focus on the basics of maintenance if they are to achieve any type of best-in-class status. Effective PM activities enable a company to achieve a ratio of 80 percent proactive maintenance to 20 percent (or less) reactive maintenance. Once the ratios are at this level, other practices in the maintenance process become more effective.

2. INVENTORY AND PROCUREMENT

The inventory and procurement programs must focus on providing the right parts at the right time. The goal is to have enough spare parts, without having too many spare parts.

No inventory and procurement process can cost-effectively service a reactive maintenance process. However, with the majority of maintenance work planned several weeks in advance, the practices within the inventory and procurement process can be optimized.

Many companies see service levels below 90 percent, which

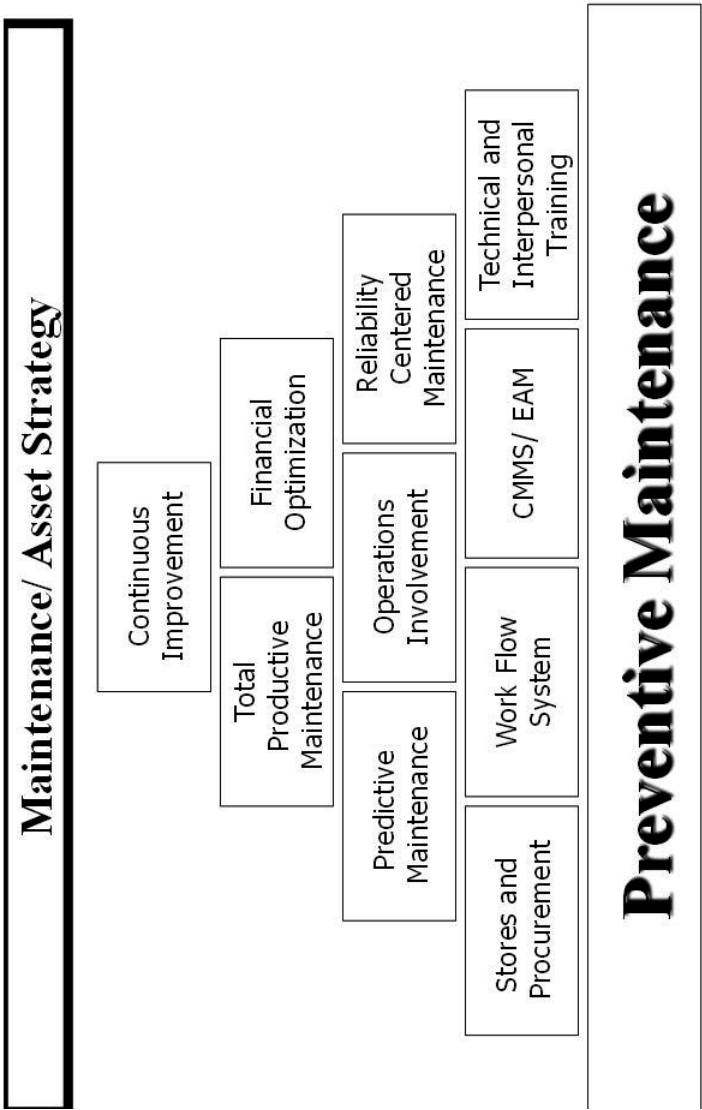


Figure 2-3, The Maintenance Management Pyramid

means stock outs run greater than 10 percent of requests made. This level of service leaves customers (maintenance personnel) fending for themselves, stockpiling personal stores, and circumventing the standard procurement channels to obtain their materials.

To prevent this situation, it is necessary to institute the type of stores controls that will allow the service levels to reach 95 to 97 percent with 100 percent data accuracy. When this level of stores and procurement performance is achieved, you can start the next step toward improvement.

3. WORK FLOWS AND CONTROLS

This practice involves documenting and tracking the maintenance work that is performed. It involves the use of a work order system to initiate, track, and record all maintenance activities. The work may start as a request that needs approval. Once approved, the work is planned, then scheduled, performed, and finally recorded. Unless the discipline is in place and enforced to follow this process, data is lost, and true analysis can never be performed.

The solution requires comprehensive use of the work order system to record all maintenance activities. Unless the work is tracked from request through completion, the data is fragmented and useless. If all of the maintenance activities are tracked through the work order system, then effective planning and scheduling can start.

Planning and scheduling requires someone to perform the following activities:

- Review the work submitted
- Approve the work
- Plan the work activities
- Schedule the work activities
- Record the completed work activities

Unless a disciplined process is followed for these steps, productivity decreases and reduced equipment downtime never occurs. At least 80 percent of all maintenance work should be planned on a weekly basis. In addition, the schedule compliance should be at least 90 percent on a weekly basis.

4. COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS/ EAM SYSTEMS

In most companies, the maintenance function utilizes sufficient data to require the computerization of the data flow. This facilitates the collection, processing, and analysis of the data. The usage of the Computerized Maintenance Management System (CMMS) or Enterprise Asset Management (EAM) System has become popular in most countries around the world. CMMS / EAM software manages the functions discussed previously, and provides support for some of the best practices that are mentioned later in this text .

CMMS / EAM have been used for decades in some countries with very mixed results. Surveys in the United States since 1990 have shown the majority of companies use less than 50 percent of their CMMS/ EAM capabilities. One requirement for a company to be effective in CMMS/EAM usage is complete usage of their system and complete accuracy of the data collected.

5. OPERATIONAL INVOLVEMENT

The operations or production departments must take ownership of their equipment to the extent that they are willing to support the maintenance department's efforts. Operational involvement, which varies from company to company, includes some of the following

activities:

- Inspecting equipment prior to start up
- Filling out work requests for maintenance
- Completing work orders for maintenance
- Recording breakdown or malfunction data for equipment
- Performing some basic equipment service, such as lubrication
- Performing routine adjustments on equipment
- Executing maintenance activities (supported by central maintenance)

The extent to which operations is involved in maintenance activities may depend on the complexity of the equipment, the skills of the operators, or even union agreements. The goal should always be to free up some maintenance resources to concentrate on more advanced maintenance techniques.

6. PREDICTIVE MAINTENANCE

Once the maintenance resources have been freed up because the operations department has become involved, these resources should be refocused on the predictive technologies that apply to their assets. For example, rotating equipment is a natural fit for vibration analysis, electrical equipment for thermography, and so on.

The focus is to investigate and purchase technology that solves or mitigates chronic equipment problems that exist, not to purchase all of the technology available. The predictive maintenance (PDM) inspections should be planned and scheduled utilizing the same techniques that are used to schedule the preventive tasks. All data should be recorded in, or interfaced to, the CMMS.

7. RELIABILITY CENTERED MAINTENANCE

Reliability Centered Maintenance (RCM) techniques are now applied to the preventive and predictive efforts to optimize the programs. If a particular asset is environmentally sensitive, safety related, or extremely critical to the operation, then the appropriate PM/PDM techniques are decided upon and utilized.

If an asset is going to restrict or impact the production or operational capacity of the company, then another level of PM/PDM activities is applied with a cost ceiling in mind. If the asset was allowed to fail and the cost to replace or rebuild the asset was expensive, then another level of PM/PDM activities would be specified. There is always the possibility that it is more economical to allow some assets to run to failure, and this option is considered in RCM.

The RCM tools require data to be effective. For this reason, the RCM process is used after the organization has progressed to the point that ensures accurate and complete asset data.

8. TOTAL PRODUCTIVE MAINTENANCE

Total Productive Maintenance (TPM) is an operational philosophy whereby everyone in the company understands that their job performance impacts the capacity of the equipment in some way. For example, operations may understand the true capacity of the equipment and not run it beyond design specifications, which could create unnecessary breakdowns.

TPM is like Total Quality Management. The only difference is that companies focus on their assets, not their products. TPM can utilize all of the tools and techniques used to implement, sustain, and improve the total quality effort.

9. FINANCIAL OPTIMIZATION

This statistical technique combines all of the relevant data about an asset, such as downtime cost, maintenance cost, lost efficiency cost, and quality costs. It then balances that data against financially optimized decisions, such as when to take the equipment off line for maintenance, whether to repair or replace an asset, how many critical spare parts to carry, and what the maximum-minimum levels on routine spare parts should be.

Financial optimization requires accurate data, because making these types of decisions incorrectly could have a devastating effect on a company's competitive position. When a company reaches a level of sophistication where this technique can be used, it is approaching best-in-class status.

10. CONTINUOUS IMPROVEMENT

Continuous improvement is best epitomized by the expression, "best is the enemy of better." Continuous improvement in asset care is an ongoing evaluation program. This includes constantly looking for the "little things" that can make a company more competitive.

Benchmarking is one of the key tools for continuous improvement. Of the several types of benchmarking practices, the most successful is Best Practice benchmarking, which examines specific processes (most likely the 10 just mentioned) in maintenance, compares the processes to companies that have mastered those processes, and maps changes to improve the specific process. This flow of practices in maintenance is important, because understanding that Benchmarking is a Continuous Improvement tool enhances the understanding that it is a technique employed by a mature organization, one that is knowledgeable about the maintenance business process.

KEY PERFORMANCE INDICATORS (KPIs), BENCHMARKING, AND BEST PRACTICES

Performance indicators, or measures, for best practices are misunderstood and misused in most companies. Properly used, performance indicators should highlight opportunities for improvement within companies today. Performance indicators should highlight a “soft spot” in a company, then enable further analysis to find the problem that is causing the low indicator, and then ultimately point to a solution to the problem.

Performance indicators are valuable tools in highlighting areas that are potential processes to be benchmarked. For example, if a certain set of performance indicators show that a maintenance process, such as preventive maintenance needs to be improved, and the internal personnel for the company can not identify the changes necessary to improve, then a benchmarking project may be the answer.

However, it is necessary to clarify that benchmarks are not performance indicators and performance indicators are not benchmarks. Using performance indicators is an internal function for a company. A benchmark is an external goal that is recognized as an industry or process standard. However, the number in itself is meaningless, unless there is an understanding of how the benchmark is derived. Understanding the enablers and success factors behind the benchmark is what is important.

Also, it must be clearly understood that there is a difference between a benchmark and the process of benchmarking. The benchmark is again a number. Benchmarking is a process of understanding a company’s processes and practices, so they can be adapted or modified, and then adopted by a company, in order to be superior in the process or practice being studied.

CONTINUOUS IMPROVEMENT — THE KEY TO COMPETITIVENESS

Because benchmarking is a continuous improvement tool, it should only be started if a company wants to make changes to improve. Companies can not develop the attitude “We have always done it this way.” They must be willing to change to meet the challenges of increasing competitive pressure.

Benchmarking is a continuous improvement tool that can facilitate change. As Best Practice companies are examined and their processes understood, the gap between a company’s present practices and Best Practice promotes dissatisfaction and desire for change. Seeing, understanding, and learning from Best Practice companies helps companies identify what to change and how to make the changes to maximize their return on their investment in the changes. Witnessing Best Practices provides a realistic and achievable picture of the desired future. However, this takes resources, both in human and financial capital to be successful. It is necessary to explore with the benchmarking partners, the tangible and intangible factors that combine to produce superior performance. It is also necessary to involve those people most directly connected with the business process being benchmarked, because they have to take ownership in the changed process.

Conducting a Benchmarking Project

In considering how to conduct a benchmarking project, it is necessary to review the goals of benchmarking. Benchmarking should:

1. Provide a measure for the benchmarked process
 - a. This measure allows for an “Apples to Apples” comparison
2. Clearly describe the organization’s performance gap when compared to the measure

3. Clearly identify the Best Practices and enablers that produced the superior performance observed during the benchmarking project
4. Set performance improvement goals for the benchmarked processes and identify actions that must be taken to improve the process

Quantifying the organization's current performance, the Best Practice for the process, and the performance gap is vitally important. There is a management axiom that says:

“If you don't measure it, you don't manage it.”

This is true of benchmarking. There must be quantifiable measures if a clear strategy to improve is going to be developed. This details the “SMART” requirements for a benchmarking project. The acronym SMART means:

1. Specific — this insures the project is focused.
2. Measurable— this requires quantifiable measures.
3. Achievable — This insures that it is within a business objective.
4. Realistic — Again, focused on a business objective.
5. Time framed — The benchmarking project should have a start and end date.

GAP ANALYSIS

One of the key components of a benchmarking project that helps the project achieve the SMART objectives is a Gap Analysis. The Gap Analysis is divided into three main phases. They are:

1. Baseline —the foundation or where the company is at the present time.
2. Entitlement —the best that the company can achieve with effective utilization of their current resources
3. Benchmark —the Best Practice performance of a truly optimized process

To be effective in utilizing the Gap Analysis, the benchmarking project must be able to produce quantifiable results. All of the measures must be able to be expressed clearly and concisely so that the improvement program can be quantified.

The first step of the Gap Analysis is to compare the company's process in quantifiable terms to the Best Practice results that were observed. It is best to plot this information as shown in Figure 2-4.



Figure 2-4, Gap Analysis

Note that the gap between the observed Best Practice and the organization's current performance is plotted on the vertical axis of the chart. The horizontal axis shows the time line. Figure 2-4 highlights the need for the measures to be quantifiable if they are going to be properly graphed on the Gap Analysis.

The second part of the Gap Analysis sets the time (T1) to reach what is called a current parity goal. This goal focuses on achieving the current level of performance that the Best Practice Company has reached at the current time. This graph also recognizes that the Best Practice Company will have made improvements during this time period and will still be at a higher level of performance. This relationship is shown in Figure 2-5.

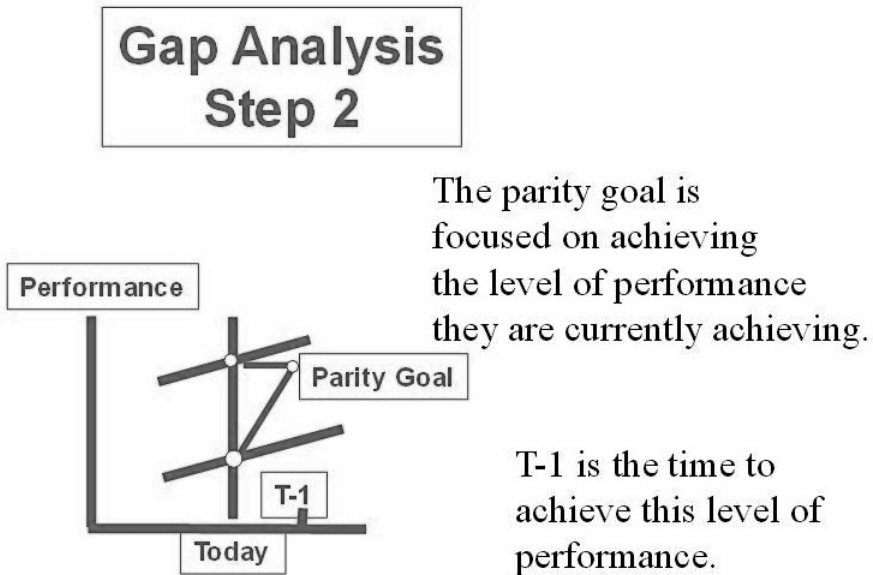


Figure 2-5, Gap Analysis Step 2

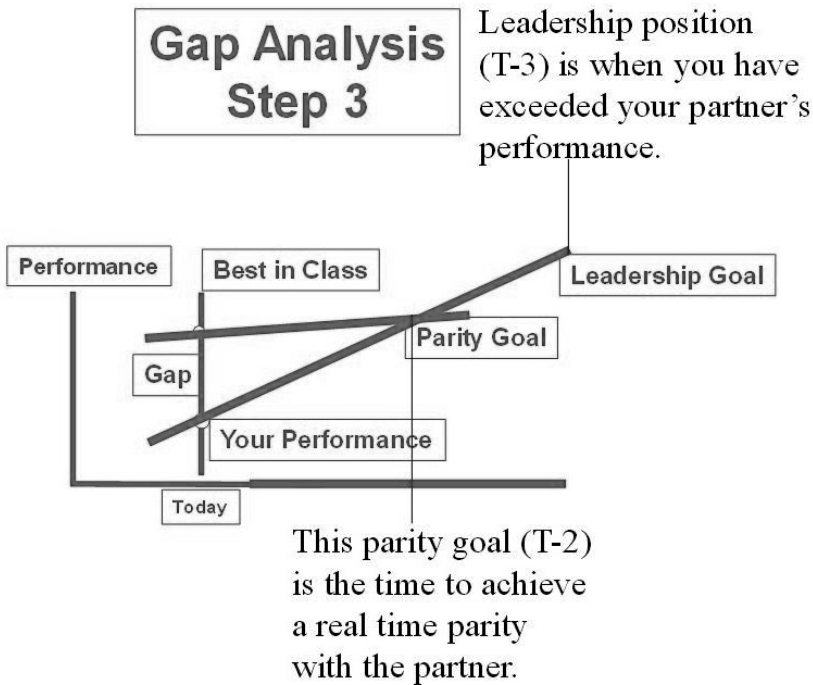


Figure 2-6, Gap Analysis Step 3

The next step is to set a real time parity goal. During this step, your company will achieve parity on the benchmarked process with the Best Practice Company. This time is highlighted in Figure 2-6 as T-2. The final goal is the leadership position, which occurs when your company's performance in the benchmarked process is recognized as having exceeded your partner's performance. At this time, noted on the graph as T-3, your company will be recognized as the Best Practice company when it comes to the benchmarked process.

If a company is to be effective in utilizing the Gap Analysis, all of the parameters must be quantifiable and time framed. Otherwise, the Gap Analysis would be meaningless.

The Benchmarking Process

What process should be used to insure that a benchmarking process is quantifiable? The following checklist can be used. If it is followed, it allows for the benchmarking process to be successful. If a disciplined approach is not utilized, it is unlikely that the benchmarking process will produce any long-term results. The Benchmarking Checklist is as follows:

1. Plan
2. Search
3. Observe
4. Analyze
5. Adapt
6. Improve

The checklist can then be further expanded into the following detail.

1. PLAN

A. What are our Maintenance Mission or Goals and Objectives?

- i. This information insures that everyone involve has a clear understanding of the maintenance business function.

B. What is our maintenance process?

- i. This step involve work flows, business process flows, etc.

C. How is our maintenance process measured?

- i. What are the current KPIs or performance indicators?

D. How is our maintenance process perceived as performing today?

- i. What is the level of satisfaction for the service that maintenance performs?

E. Who is the perceived customer for maintenance?

- i. Is it operations or the shareholders/ owners? The answer to this question can prove insightful in determining the level of understanding of maintenance within the organization and the time it will take to make improvements.

F. What services are expected from the maintenance function?

- i. What service does maintenance perform? What is outside contracted? What isn't being done that needs to be done?

G. What services is the maintenance function prepared to deliver?

- i. Are they capable of more? Is the staffing, skill levels, etc. at the correct level to perform the services?

H. What are the performance measures for the maintenance function?

- i. How does maintenance know if they are achieving their objectives?

I. How were these measures established?

- i. Were they negotiated or mandated?

K. What is the perception of our maintenance function compared to our competitors?

- i. Internal perceptions — worse than, as good as, or better than?

2. SEARCH

A. What companies are better at a maintenance process than our company?

- i. Utilize magazine articles and internet sites

B. Which company(s) is considered to be the best?

- i. Consider NAME (North American Maintenance Excellence) Award Winners—<http://www.nameaward.com>

- C. What can we learn if we benchmark with this company?**
 - i. Understand their Best Practices and how they could help your company
- D. Who should we contact to determine if they are a potential benchmarking partner?**
 - i. Look for a contact in the article or on the internet site

3. OBSERVE

- A. What are their Maintenance Mission or Goals and Objectives?**
 - i. How does this compare to your company's?
- B. What are their performance measures?**
 - i. How do they compare to your company's?
- C. How well does their maintenance strategy perform over time and/ or at multiple locations**
 - i. Are their current results an anomaly or are they sustainable?
- D. How do they measure their maintenance performance?**
 - i. Are their measures different from your company's?
- E. What enables their Best Practice performance in maintenance?**
 - i. Plant Manager, Corporate Culture, etc?
- F. What factors could prevent our company from adopting their maintenance policies and practices into our maintenance organization?**
 - i. Your culture, work rules, maintenance paradigm, etc?

4. ANALYZE

- A. What is the nature of the performance gap?**
 - i. Comparing their Best Practice to your practice

- B. What is the magnitude of the performance gap?**
 - i. How large is the benchmark gap?
- C. What characteristics distinguish their processes as superior?**
 - i. Detail the enablers you discovered
- D. What activities do we need to change to achieve parity with their performance?**
 - i. This is the plan for change

5.ADAPT

- A. How does the knowledge we gained about their maintenance process enable us to make changes to improve our maintenance process?**
 - i. What do you need to do to improve?
- B. Should we adjust, redefine, or completely change our performance measures based on the Best Practices that were observed?**
 - i. What were the differences and how could you benefit by the change?
- C. What parts of their Best Practice maintenance processes would have to be changed or modified to be adapted into our maintenance process?**
 - i. You need to be an adaptor – not a copy cat

6.IMPROVE

- A. What have we learned that would allow our company to achieve superiority in the maintenance process that was benchmarked?**
 - i. What can you change to eventually achieve the superiority position?

B. How can these changes be implemented into our maintenance process?

- i. Develop the implementation plan

C. How long should it take for our company to implement these changes?

- i. Timeline the implementation plan

To gain maximum benefits from benchmarking, a company should conduct a benchmarking exercise only after it has attained some level of maturity in the core competency being benchmarked. Clearly, a company would have to have some data about its own process before it could perform a meaningful comparison with another company. For example, in equipment maintenance management, common benchmarks are:

1. Percent of maintenance labor costs spent on reactive activities versus planned and scheduled activities.
2. Service level of the storeroom — percent of time the parts are in the storeroom when needed.
3. Percentage of maintenance work completed as planned.
4. Maintenance cost as a percentage of the estimated replacement value of the plant or facility equipment.
5. Maintenance costs as a percentage of sales costs.

Without accurate and timely data and an understanding of how the data is used to compile the benchmark statistics, there will be little understanding of what is required to improve the maintenance process. And this is true whatever process is benchmarked.

When partnering with companies considered to be the best in a certain aspect of a competency, it is also important to have an example

of an internal best practice to share with them. Benchmarking requires a true partnership, which includes mutual benefits. If you are only looking and asking during benchmarking visits—with no sharing—what is the benefit to the partners?

The final step to ensure benefits from benchmarking is to use the knowledge gained to make changes in the competency benchmarked. The knowledge gained should be detailed enough to develop a cost/benefit analysis for any recommended changes.

Benchmarking is an investment. The investment includes the time and money to complete the ten steps described earlier. The increased revenue generated by the implemented improvements pays for the investment. For example, in equipment maintenance, the revenue may be produced through increased capacity (less downtime, higher throughput) or reduced expenses (efficiency improvements).

The revenue is plotted against the investment in the improvements to calculate the return on investment (ROI). To ensure success, the ROI should be calculated for each benchmarking exercise.

BENCHMARKING CODE OF CONDUCT

1. Keep it legal.
2. Be willing to give any information you get.
3. Respect confidentiality.
4. Keep the information internal.
5. Use benchmarking contacts.
6. Don't refer without permission.
7. Be prepared from the start.
8. Understand your expectations.
9. Act in accordance with your expectations.
10. Be honest.
11. Follow through with commitments.

Although this list of suggestions for the code of conduct may seem to be common sense, it is surprising the number of companies that fail to apply them. This results in everything from minor disagreements between individuals to major legal battles. Recognizing that the other companies are your partners and treating them as such is key to successful benchmarking relationships.

TRAPS TO BENCHMARKING

When benchmarking is used properly, it can make a major contribution to the continuous improvement process. However, it can also be completely devastating to a company's competitive position when used improperly. Some of the improper uses of benchmarking follow:

1. USING BENCHMARKING DATA AS A PERFORMANCE GOAL.

When companies benchmark their core competencies, they can easily fall into the trap of thinking a benchmark should be a performance indicator. For example, they focus all of their efforts on cutting costs to reach a certain financial indicator, losing focus on the real goal.

A company receives greater benefits when the tools and techniques used by a partner to achieve a level of performance are understood. This allows the company not only to meet a certain number, but also to develop a vision of how to achieve an even more advanced goal.

By focusing on reaching a certain number, some companies have changed their organizations negatively (by downsizing or cutting expenses). However, they have also removed the infrastructure (people or information systems) and soon find they are not able to sustain or improve the benchmark. In such cases, benchmarking becomes a curse.

2. PREMATURE BENCHMARKING.

When a company attempts to benchmark before the organization is ready, it may not have the data to compare with its partners. So, someone makes a “guesstimate” that does the company no good.

The process of collecting data gives an organization an understanding of its core competencies and how it currently functions. Premature benchmarking will lead back to the first trap — just wanting to reach a number. Companies stepping into this trap become “industrial tourists.” They go to plants and see interesting things, but don’t have enough of an understanding to apply what they see to their own businesses. Then, the end results are reports that sit on shelves and never contribute to improved business processes.

3. COPYCAT BENCHMARKING.

Imitation benchmarking occurs when a company visits its partners and, rather than learning how the partners changed their businesses, concentrates on how to copy the partners’ current activities. This is detrimental to a company because it may not have the same business drivers as its benchmarking partners. Also, there may be major constraints to implementing the partner’s processes. Such constraints might include incompatible operations (7 days @ 24 hr/day versus 5 days @ 12 hr/day), different skill levels of the work force, differences in union agreements, different organizational structures, and different market conditions.

4. UNETHICAL BENCHMARKING.

Sometimes a company will agree to benchmark with a competitor and then try to uncover proprietary information while on the site visit or by use of the questionnaire. Clearly, this kind of behavior will lead to problems between the companies and virtually ruin any chance of

conducting a successful benchmarking exercise at a later date.

A second type of unethical benchmarking involves using the benchmarking partners' names or data in public without receiving prior permission. This, too, will damage any chance for ongoing benchmarking between the companies. Even worse, the bad experience may prevent management from ever commissioning further benchmarking exercises with other partners.

OTHER PITFALLS

Not every company is ready for benchmarking. However, it is a trap not to do it because of a previous bad experience or because of an attitude of "We are already the best" or "We are different than everyone else." Companies in which responsible individuals have such a mindset will have little chance of improving.

Benchmarking is valuable because trying to reinvent the wheel is an expensive way to try to make improvements. Once a company has the proper view of the benchmarking process, and disciplined guidelines are established and followed, desired improvements should follow. However, if the company does not benchmark for the right reasons, benchmarking efforts will become a curse.

PROCEDURAL REVIEW

Benchmarking opportunities are uncovered when a company conducts an analysis of its current policies and practices. Benefits are gained by following a disciplined process, composed of 10 steps:

1. Conduct an internal audit of a process or processes.

- a. Education of key personnel in Benchmarking processes is crucial at this point. They must fully understand and support the process.

2.Highlight potential areas for improvement.

- a. This requires understanding the cost of Benchmarking compared to the financial benefits that will be derived. This should be presented in a return on investment business case.

3.Do research to find 3 or 4 companies with superior processes in the areas identified for improvement.

4.Contact those companies and obtain their cooperation for benchmarking.

5.Develop a pre-visit questionnaire highlighting the identified areas for improvement. (See Step 2.)

- a. This step requires a carefully planned approach to Benchmarking. You then will need the discipline to adhere to the plan.

6.Perform the site visits to the 3 or 4 partners. (See Step 3.)

- a. An interim report should be prepared after each visit and presented to the executive sponsor.

7.Perform a gap analysis on the data gathered compared to your company's current performance. (See Figure 2-4.)

8.Develop a plan for implementing the improvements.

- a. This includes the changes required, personnel involved, and the timeline

9.Facilitate the improvement plan.

- a. This means that one or more members of the benchmarking project team will oversee the implementation of the plan to insure the changes are properly implemented.

10. Start the benchmarking process over again (i.e., go back to Step 1).

Benchmarking helps companies find the opportunities for improvement that will give them a competitive advantage in their marketplaces. However, the real benefits from benchmarking do not occur until the findings from the benchmarking project are implemented and improvements are realized.

Final Points

1. It is necessary to explore the tangible and intangible factors that combine to produce a superior performance and involve those people most directly concerned in the activity being examined.
2. Benchmarks are not the end-all. A benchmark performance does not remain a standard for long. Continuous improvement must be the goal.

After having examined the benchmarking process, it is necessary to clearly understand the process being benchmarked. Chapters 3 through 11 will examine all aspects of the maintenance management function. These chapters will further highlight the methodology behind the analysis that was included in Chapter 1. Chapter 12 will then present some current industry benchmarks for maintenance. With the understanding of the benchmarking process and the maintenance process, any company should be able to conduct a successful benchmarking project.



Chapter 12

Benchmarking Best Practices in Maintenance Management

When benchmarking, it is best to determine early in the process what you are trying to accomplish. Are you really trying to improve or are you just trying to find some number to reach? If you are truly trying to benchmark, then self-assessment is an important prerequisite.

Finding Benchmarking Partners

One of the most difficult challenges when benchmarking is finding legitimate partners. Although a variety of articles and Internet sites might suggest potential partners, it is important to find a legitimate benchmarking partner, one who has documented best practices in a particular process of maintenance management. The benchmarking partner should have had the desired process under control for a period of time and should also show sustainable results over the same time.

Once you identify the benchmarking partner, you must determine what you have to share with the partner. For you to have an interchange of ideas, you must have a best practice that you can share.

This practice does not necessarily need to be superior, but it should be something of interest to the partner. Otherwise, the benchmarking exercise is a one-way learning experience and partners can quickly sour on the experience.

During the benchmarking process, key data about best practices will be identified; this data should only be shared among those participating in the study. Sharing the data with someone outside of the benchmarking study is both unwise and unethical, and can turn many companies away from benchmarking.

Variables in Benchmarking

Achieving accurate comparisons requires both data and a clear understanding of the processes and parameters that are being measured. Only then can there be an apples-to-apples comparison. This section examines some of the variables that can be challenging to the benchmarking process.

EQUIPMENT AVAILABILITY

One of the first challenges is identifying the true meaning of equipment availability. Is equipment availability measured only when the equipment is required to run but does not run? How does idle time factor into the measurement, when the equipment is not running, but is not scheduled to run. How is equipment availability different in a market that is sold out, where capacity is deficient, compared to a marketplace which has excess capacity, providing the company the ability to work around the equipment being down? Unless these issues are clearly defined and understood, any benchmarks that would be derived are meaningless.

PLANNING AND SCHEDULING

Another challenge is defining planning and scheduling efficiency. The definition of planned is itself extremely important. How far in advance must a job be identified and scheduled for it to be considered as planned: 30 days in advance, a week, or some other length of time? In some instances, companies determine a job as planned even if it has only four hours notice. This short-term planning window will not improve the cost-effectiveness of performing maintenance. The planning window should be at least seven days to be considered planned. If a company that uses a short-term planning window benchmarks with a company that uses a long-term planning window, the comparison is meaningless.

Comparing planning efficiency — what is planned — can be challenging. Are contractors, or equipment and tools, part of the plan? Does the plan include labor and materials? Is the plan penalized if unplanned graphs or unplanned materials used to perform the job? These issues must be discussed during a face-to-face meeting with a benchmarking partner. They are factors that do not show up when examining only benchmarking numbers.

Another consideration is whether or not preventive maintenance activities are counted as planned work. Companies that include preventive maintenance as part of planned work have higher planned work percentages. When preventive maintenance activities are not counted, planned work percentages are lower. Understanding what is actually included as part of the planned work calculation is important.

INVENTORY AND PURCHASING BENCHMARKS

Another benchmarking challenge is to understand the inventory and purchasing numbers. For example, what defines a stock out? Is an item considered out of stock if it is not available when the job is

planned? Or is it only considered a stock out if the part is not available for issue when the job is ready to be executed? The difference between these two definitions makes an enormous difference between the two stores service levels calculations.

Another typical stores benchmark is the calculation of the total amount of dollars tied up in the stores investment. The lower the dollar value of the spare parts a company carries, the lower the stores investment number. Conversely, a higher value of spare parts that a company carries in stock leads to a higher stores investment number. Some parameters automatically penalize companies. For example, companies that use a lot of foreign equipment must stock a larger number of spare parts. If they do not overstock these parts and an equipment breakdown occurs, the lead time to get the spare parts could be extremely long. In fact, some equipment suppliers only make spare parts during one time of the year. Therefore, if a company uses foreign equipment, it is required to keep more spare parts. Even though this higher inventory is legitimate, it will inflate the stores investment.

Another factor that has a dramatic impact on the stores investment benchmark is the relationship that companies are able to develop with suppliers. In large metropolitan areas, companies may actually have consignment relationships with suppliers. In these cases, the supplier will actually stock spare parts for the company, which does not own the spare parts until it actually uses them. This relationship is much more difficult to develop in remote rural areas. Suppliers are not close to the plants and the downtime that would be required to procure the spare part and then have it delivered to the plant is cost prohibitive. Unless these factors are clearly understood, benchmarking numbers is meaningless.

A third factor is the amount of spares that a company may capitalize. In some companies, major spares are capitalized as part of the

overall equipment acquisition costs. These spares will no longer show up with an attributed value on the inventory. If a company does not capitalize these types of spares, their value of inventory on hand will be much greater than a company that did capitalize the spares. This is a “hidden factor” that must be investigated if there is a large difference in the value of spares between benchmarking partners.

MAINTENANCE LABOR RESOURCES

Another challenge is understanding what is calculated as part of the maintenance labor resources. Are only the actual craft technicians counted as maintenance labor? Or are all those who perform some maintenance activities translated into full-time equivalents and then included as maintenance labor? Because they are paid from a separate budget, are contractors calculated as part of the maintenance labor force? There can be a large difference in how different companies calculate manual labor.

Similarly, comparing the cost of operator-based maintenance can be challenging. To calculate this amount of maintenance properly, companies should convert the operator-based activity hours into full-time equivalents and add their hours to the maintenance labor costs. If a company does not do this, but its benchmarking partners do, they would face a large difference in the amount of maintenance labor costs needed to staff the plant.

MAINTENANCE COST COMPARISONS

Total maintenance costs are a measure commonly used for benchmarking. They may be compared to a production parameter or to some type of square-foot measurement. Without understanding the way in which the maintenance organization operates, this measure

will be used incorrectly. Reactive maintenance activities usually cost between two to four times more than proactive maintenance activities. Therefore, a proactive maintenance organization automatically gains when comparing costs to benefits. However, if a proactive organization is compared to a reactive organization on the basis of costs only, senior management may determine that maintenance costs are too high and immediately begin ordering cuts. To improve the maintenance cost benchmark, increased spending is required to move an organization from a reactive to a proactive position. After proactive status is achieved, the maintenance costs should normalize when compared to the benchmark. However, if senior management makes cuts prematurely, the needed maintenance resources will not be available and the desired benefits will not be realized.

Another way to look at maintenance costs is to compare labor costs to material costs. Standard comparisons should show maintenance and materials each with 50% of the costs. In certain industries, labor could be 60% and materials 40%, or the reverse. However, if there is a deviation to a 70 to 30% ratio, then perhaps too many parts are being changed or a lot of labor is nonproductive. Without this comparison, a simple look at maintenance expenses would be incomplete. An initial analysis of your organization and a detailed analysis of the benchmarking partner's organization are both needed before any true benchmarking can be valuable.

Another maintenance process that can have a tremendous impact on the cost ratio is the effectiveness of the planning and scheduling activities. The more effective that planning and scheduling activities are in the maintenance organization, the lower the overall maintenance costs will be. Conversely, the more reactive that the maintenance organization is, the higher its overall maintenance costs.

Unplanned work will cost two to four times as much as planned work. The organization that is efficient at planning and scheduling maintenance activities will receive a cost-benefit. Conversely, a maintenance organization that is reactive automatically incurs an additional cost penalty. The efficiency of the planning and scheduling program must be examined during any maintenance benchmarking.

PREVENTIVE MAINTENANCE

Another area in maintenance that is often benchmarked is the preventive maintenance program. However, this benchmarking is not as easy as it may seem. What is considered a preventive maintenance activity? In some companies, preventive maintenance programs include repairs that are needed while doing a preventive maintenance inspection task. In other companies, preventive maintenance is only an inspection service. Once the inspection is made, work orders are written, and then the repairs are planned, scheduled, and executed. Some preventive maintenance programs that perform minor repairs during the inspection will experience lower costs than an organization that merely does an inspection and then comes back and writes the work order to have the service performed.

However, if an organization performs excessive repairs during preventive maintenance inspections, then its overall preventive maintenance costs will be higher than an organization that limits itself to a fixed amount of maintenance repairs. It is not the purpose of this discussion to say which method is right or wrong. It is only to highlight that unless the operating policy for preventive maintenance activities is clearly understood, getting an accurate benchmark comparison will be difficult.

Hidden Factors in Benchmarking

This section considers hidden factors that enable a company to achieve superior numbers in benchmarking. However, these factors are not discernable without close scrutiny. Each should be closely examined during any benchmarking project.

ORGANIZATIONAL IMPACT

When examining maintenance organizations, it is necessary to understand several factors. The first is the deployment model. Should the organization be centralized, decentralized, or a combination of the two? If an organization is in the wrong deployment model, its costs will be higher either in wasted labor resources or excessive equipment downtime. Furthermore, if the organizational deployment model is not clearly tied to the maintenance business plan, it will be difficult to match the results of one benchmarked organization to another.

A second factor is the reporting structure. As was discussed in Chapter 3, there are multiple ways for maintenance to report within an organization. The organizational reporting structure has a dramatic impact on overall maintenance benchmarks. Therefore, the organizational reporting structure must be clearly defined and understood among the benchmarking partners before any meaningful comparison can be achieved.

No organization that employs an operating team strategy or a business unit strategy of distributed maintenance is among the low-cost producers in any market. When operating team or business unit approaches are utilized, the distributed maintenance model results in redundant resources and excessive costs. If this model is in use by any company involved in a benchmarking project, a close examination of the model's impact on any statistics is needed.

MANAGEMENT AND EMPLOYEE ATTITUDES

Employee attitudes are extremely important when considering benchmarking data. The overall attitude of the salary and hourly employees is critical to achieving Best Practices. One survey showed that employee's attitudes impacted the benchmarking results more than any other factor. Suppose a plant has an attitude that maintenance is a necessary evil, and not a contributor to overall profitability. The benchmarking data will differ significantly from another plant where maintenance is considered to be a contributor to profitability and a valued partner in operating the plant.

There are also significant differences in benchmarking results at plants where there is an adversarial union-management relationship. When comparing this type of the plant to one with a cooperative attitude, the results from benchmarking maintenance will differ. Yet in many benchmarking studies, this factor is never clearly presented. To gain any insight into the enabling factors behind a benchmarking statistic, this area must be examined.

While considering employee attitudes, it is also necessary to examine management attitudes. Senior management's understanding of maintenance management varies dramatically from plant to plant. In plants where senior management understands maintenance and manages it correctly, maintenance efficiency and effectiveness allows the plant to be competitive. However, in plants where senior management does not understand maintenance management, the resources are squandered and the overall maintenance cost is much higher when compared to other plants. In many cases, senior management is seen throwing resources at problems, rather than understanding and correcting the root cause of the problem. This has led to excessive expenses in the maintenance function with little or no long term improvement. It is important when benchmarking different plants to

understand the senior management perspective on maintenance. This perspective can be a factor that will enable or disable the maintenance function.

Studies have shown that organizations with the highest maintenance costs typically keep their technicians busy repairing failures. At these plants, the technicians have no opportunity to take time to examine the root causes of failures; they are unable to take the time to make the repairs permanent or devise a preventive and predictive solution when the problems can't be prevented. From a financial perspective, these plants are typically the worst performers from a financial perspective.

Plants tend to divide into two categories. The first is a repair-focused organization, one that assumes equipment will fail and maintenance's mission is to respond quickly to equipment in distress. This type of plant is typically known as a firefighting, or reactive maintenance organization. It has no opportunity to examine failure causes, but rather focuses on just "fixing it." When maintenance is not busy fighting fires, it focuses on low priority work to appear busy. This method is used to protect an already overworked staff.

The second category is a reliability-focused organization. Here, equipment breakdowns are not expected to happen. When they do, they are viewed as an exception and typically result from some flaw of maintenance policy or management focus. The vision of re-occurring failures and the related costs is deemed unacceptable. Reliability-focused organizations are always a low-cost producer in their respective marketplaces. Before beginning a benchmarking exercise, it is necessary to understand which approach an organization has as well as its philosophy toward equipment failure.

Additional Best Practice Enablers

The management at Best Practice companies purposefully manages reliability for results. They make permanent repairs when needed, but relentlessly assess equipment condition. Thus, they are continuously analyzing plant data. Their decisions are based not on guesswork, but on actual plant data, allowing them to make optimal financial decisions based on real-time data, not assumptions.

Another management enabler is the recognition that plant reliability is not a repair effort. Maintenance is not status quo. Instead, maintenance focuses on eliminating the root cause of the failure. Any less effort is not acceptable in a Best Practice organization. Maintenance is tied to improvement and optimization.

Another enabler for Best Practice companies is the operating information and its value. These companies recognize that data is a company asset in which they have invested; this data must be utilized, both at the current time, and in the future. These organizations do not accept excuses for not recording data, nor do they accept excuses for not using the data when planning future activities. Informed decision making eliminates the “I think” and “I feel” syndromes. All activities are financially justified based on data.

Accountability is also a management enabler. Best Practice organizations view maintenance as a core business process. They detail a three-to-five-year business plan for maintenance. They set reliability performance targets, organizational objectives, maintenance budgets, reliability improvement goals, and spending to improve equipment. Once these goals and objectives are set, the maintenance manager is held accountable for achieving results. If accountability is absent, then cost-effective, organized problem-solving and results compared to budgets are never observed. In best practice companies, the mainte-

nance manager is a key position and must be staffed by an appropriate person.

A practice that is being implemented in many best practice companies is operational ownership of the equipment or process. Instilling equipment ownership in operating personnel helps the maintenance department optimize equipment effectiveness. This practice — increasing operating awareness to their role as equipment owners — improves equipment and plant capacity; it also has a significant impact on profitability. When benchmarking any company, examine this area because it will have an impact on any benchmarks.

As far back as 1989, a summary of the Best of the Best Maintenance Organization Award (Sky Magazine, September 1989) highlights areas that are still as relevant today when benchmarking.

1. The Best do the basics very well; but even among the Best, there is still room for improvement. Studies have shown that up to half of all plant equipment failures can be traced to the neglect of basics. If the Best focus on the basics, then shouldn't all organizations? It will be apparent when benchmarking with a Best Practice company that the basics are given great attention. This is an area that should be considered as a hidden enabler when benchmarking a Best Practice company.

2. No significant advances in maintenance management technology were found in the Best companies. This observation is important and links directly to the first observation. There is no magic black box that will make an organization the best. Focusing on the basics and giving attention to detail will help differentiate a company and make it the best. No amount of technology can do that. Only with focused management, as well as a highly motivated and empowered work force, can this occur.

3. Individual leadership was the most common factor among the best. Motivated leadership with a focus on maximizing equipment effectiveness is crucial in producing results that will qualify a plant to be the best. In organizations that are recognized as the best, a common element is always a motivational and business-oriented maintenance manager. Without this individual, it is difficult, if not impossible, to achieve Best Practice results.

BEST PRACTICE BENCHMARKS: ASSET VALUE-BASED BENCHMARKS

One benchmark that is rapidly gaining acceptance divides the total maintenance cost by the estimated replacement value (ERV) of a plant or a facility. The maintenance costs are easily derived from either the maintenance budget or accounting. The estimated replacement costs of the plant or facility are more complex. However, many organizations start with the insurance value. Although this figure is usually not the exact answer, it is a good starting point. Some organizations have this information available in their financial group.

A derivative of this indicator is the stores investment (in spare parts) as a percentage of the estimated replacement value. This benchmark divides the total dollar valuation (in current dollars) for the maintenance spare parts by the estimated replacement value of the plant or facility. This value is almost always equivalent to half of the total maintenance costs divided by the estimated replacement value. This benchmark adds credibility to the maintenance budget guidelines discussed earlier in the textbook.

Another derivative of the estimated replacement value indicator is the value of assets maintained per maintenance technician. This benchmark is essentially the average dollar value of assets that each maintenance technician is responsible for maintaining. It is a fair benchmark because it does not involve ratios such as maintenance

headcount to plant headcount. These benchmarks are summarized in Figure 12-1.

FIGURE 12-1 ASSET VALUE BASED BENCHMARKS			
Indicator	Low Range	High Range	Best Practice
Maintenance Cost / ERV	2%	5%	2%
Stores Investment / ERV	.8%	1.2%	1%
ERV / Maintenance Technician	\$4 M	\$10 M	\$7 M

BEST PRACTICE BENCHMARKS: MAINTENANCE STAFFING

Three staffing benchmarks are important to consider. The first is the maintenance technician to supervisor ratio. This ratio may range from 8 to 15 technicians per supervisor, with a Best Practice average being about 10 technicians per supervisor.

A second staffing ratio is the number of technicians to maintenance planner ratio. The range for this ratio should be 15 to 25 maintenance technicians per planner. The Best Practice average is about 20 maintenance technicians per planner. Anything above the 25:1 ratio could be disastrous for the planning program. In this case, the planner would no longer plan, but become an expeditor. This level will not enhance the efficiency of the maintenance organization.

A third staffing benchmark looks at the estimated replacement value of the assets for which each maintenance engineer is responsi-

ble. In Figure 12-2, the ratio is quite broad, with a range of \$50 million to \$250 million per maintenance engineer. The Best Practice average is about \$100 million per engineer. The range is broad because there is no consistent job description for a maintenance engineer. As this position becomes more clearly defined (See Chapter 3) in organizations, the ratio will approach the Best Practice average of \$100 million per engineer. These numbers are summarized in Figure 12-2.

FIGURE 12-2 STAFFING BENCHMARKS			
Indicator	Low Range	High Range	Best Practice
Technicians to Supervisor	8:1	15:1	10:1
Technicians to Planner	15:1	25:1	20:1
ERV / Maintenance Technician	\$50 M	\$250 M	\$100 M

MAINTENANCE AND SALES COSTS

Another way of examining maintenance cost is to compare it to the total cost of sales. This cost comparison is not as effective as comparing maintenance to the estimated replacement value of the asset. However, because many organizations do utilize this comparison, it is mentioned in this context. It is not a fair evaluation of the maintenance costs because the total cost of sales is variable and maintenance cannot always control the other variables in the cost calculation.

The range for this measure is from 1 to 5%, with a Best Practice average of about 2%. Similarly, the maintenance labor costs and the maintenance stores costs compared to sales costs are about 50% each. These figures are summarized in Figure 12-3

FIGURE 12-3 MAINTENANCE COSTS COMPARED TO TOTAL COST OF SALES			
Indicator	Low Range	High Range	Best Practice
Total Maintenance Costs/Sales Cost	8	5%	2%
Maintenance Labor Costs / Sales Costs	.6%	2.5%	1%
Maintenance Stores Costs / Sales Costs	.4%	2.5%	1%

MAINTENANCE PERFORMANCE

The next series of benchmarks are related to maintenance performance. The first, work order coverage, represents the percent of maintenance work that actually is reported to a maintenance work order. Benchmarks range from 60 to 100%. The Best Practice would actually record 100% of all work performed for future reference and reporting analysis.

The next benchmark is the preventive maintenance compliance benchmark. Its range is from 65 to 100% completion rate. The Best Practice would be to complete 100% of all the preventive maintenance tasks that are scheduled. If anything less is accomplished, the

impact would be seen on equipment availability.

For the maintenance schedule compliance benchmark, the indicator range goes 35 to 95%. The Best Practice benchmark is 95%. Although it may seem that 100% should be the benchmark, an organization is unlikely to ever achieve 100%, due to the reactive work that is encountered during the execution of the weekly schedule. An organization that achieves 95% has achieved a Best Practice. These benchmarks are summarized in Figure 12-4.

FIGURE 12-4 MAINTENANCE PERFORMANCE			
Indicator	Low Range	High Range	Best Practice
Work Order Coverage	60%	100%	100%
Preventive Maintenance Compliance	65%	100%	100%
Maintenance Schedule Compliance	35%	95%	95%

Another maintenance performance benchmark is planned maintenance work, maintenance activities that are planned, rather than reactive. The benchmarks range from 35 to 95%. The Best Practice range is above 80%. This range is not more specific because the type of business dictates the amount of planned work that can be accomplished. As long as less than 20% of the work is reactive, which means 80% or more is planned and scheduled, the organization is considered to be in a Best Practice category.

Another maintenance performance benchmark is the amount of operator involvement in the preventive maintenance program. The benchmarks range from 10 to 40%. The Best Practice benchmark actually varies because the type of work, the type of equipment, the operator skill level, safety and health regulations, and the union agreements vary. All of these variables impact the amount of involvement that operators can have in preventive maintenance activities. The goal of operator involvement is to free up some maintenance resources for redeployment in the predictive and condition based activities. As long as this is achieved to the optimum, an organization can be considered in the Best Practice category.

Another area that is examined under maintenance performance is the amount of contract maintenance that is performed. Benchmarks show a range of contractor usage from 10 to 100%. The Best Practice percentage varies depending on the business needs. In some organizations, a business decision is made to contract out more of the maintenance. In other organizations, it is preferred to keep the maintenance activities in-house. Whatever decision is made, it should be based on financial parameters. As long as the decision is properly made, the organization has achieved the optimum balance of contract versus in-house maintenance and is at its Best Practice. These benchmarks are summarized in Figure 12-5.

A third group of indicators that examine maintenance performance is found in Figure 12-6. The first of these indicators is the percentage of hours spent on preventive and predictive maintenance activities compared to the total hours worked. The benchmarks range from 20 to 50%. The Best Practice average is 50%, which allows for 30 to 40% additional corrective work and less than 20% reactive work.

FIGURE 12-5 MAINTENANCE PERFORMANCE: 2

Indicator	Low Range	High Range	Best Practice
Planned Maintenance Work	35%	95%	80+%
Operator Involvement In PM	10%	40%	Varies
Contractor Costs / Total Maintenance Costs	10%	100%	Varies

A second indicator in this group is the percent of reactive hours compared to total hours. This indicator ranges from 5 to 50% or more. A Best Practice is less than 10% reactive work. Most organizations are doing quite well if they have less than 20% reactive work. However, they should not be satisfied with these results. Less than 10% is the optimum number. If an organization has achieved this low percentage of reactive work, it is considered to be a Best Practice organization.

The last indicator under maintenance performance is the productivity rate for what is commonly referred to as a wrench time. This is the amount of hands-on time a technician spends working per hour. The benchmarks show a low range of 20% for reactive organizations to a high range of 60% for proactive organizations. The more planned and scheduled an organization is, the closer it will come to the Best Practice percentage of 60%. An organization with 20% wrench time is spending about three times the amount of money that it should to accomplish the same work that a Best Practice organization could accomplish. These statistics are summarized in Figure 12-6.

FIGURE 12-6 MAINTENANCE PERFORMANCE: 3

Indicator	Low Range	High Range	Best Practice
PM/PDM Hours/ Total Hours	20%	50%	50%
Reactive Hours/ Total Hours	5%	50%	<10%
Productivity Rates (Wrench Time)	20%	60%	60%

EQUIPMENT PERFORMANCE

The next series of indicators, which focus on equipment performance, are categorized under maintenance because maintenance impacts the performance of the asset. The first of these indicators is equipment availability. This benchmark ranges from 65 to 99.9%. In reality, the Best Practice percentage varies because the higher the equipment availability is, the more expensive it is. Therefore, the cost of production should be used to determine the level of availability required. If a company strives for 99.9% availability when only 90% availability is needed, then it is spending too much for its maintenance program. The Best Practice percentage must be determined by each company for each piece of equipment or process.

The next benchmark is equipment efficiency. It compares the actual output of a piece of equipment to its design output. This benchmark ranges from 75 to 95%. The Best Practice percentage is 95% or more. As with equipment performance, whether or not 95% is sufficient depends on the product. It may not be cost effective to try to

FIGURE 12-7 EQUIPMENT PERFORMANCE			
Indicator	Low Range	High Range	Best Practice
Equipment Availability	65%	99.9%	Varies
Equipment Efficiency	75%	95%	95+%
Overall Equipment Effectiveness	<20%	85+%	Varies

gain the last percent or two of efficiency from a piece of equipment. That decision is one that company officials must make. But 95% is a Best Practice threshold.

The final benchmark in this series is the overall equipment effectiveness. The low range on overall equipment effectiveness has been observed at less than 20% with a high range of more than 85%. The Best Practice percentage varies depending upon the organization's needs. For some processes, companies spend too much to get to 85% and the decision is not cost justifiable. In other organizations, 85% is too low of a percentage. All business factors must be considered when setting the Best Practice threshold for a particular process or piece of equipment. These figures are summarized in Figure 12-7.

MAINTENANCE STORES

The next series of benchmarks focuses on maintenance stores. The first benchmark, the maintenance spare parts to inventory turns ratio, ranges from 0.5 to 1.4. The Best Practice benchmark varies, but trends closer to 1.4. Factors that determine this range include foreign

equipment, availability of spare parts, and location of suppliers. Any of these factors can drive the turns ratio to the low range.

A second related benchmark is the stores service level which ranges from 80 to 99%. A Best Practice value is between 95 and 97%. This value is based on a business decision. A service level below 95% will result in unnecessary downtime due to parts outages. A service level above 97% usually indicates that too many spare parts are being carried. The proper balance for determining the Best Practice level depends on financial considerations of downtime versus holding cost.

The last benchmark in this category is the value of stores transactions per stores personnel. This benchmark indicates whether or not a storeroom is properly staffed. The benchmark ranges from \$350,000 to \$600,000 per year. The Best Practice benchmark varies based on a business decision. This decision involves factors such as storeroom locations, production shifts serviced, maintenance shifts serviced, and location. In some organizations, where the maintenance stores organization does not match the maintenance organization, the lower range

FIGURE 12-8 MAINTENANCE STORES			
Indicator	Low Range	High Range	Best Practice
Spare Parts Inventory Turns	.5	1.4	Varies
Stores Service Level	80%	99%	95-97%
Value of Stores Transactions per Store Personnel	\$350K	\$600K+	Varies

is an acceptable number. In a location that is optimized, the storeroom attendant would be able to issue a higher dollar value of spare parts. Because there is no definitive benchmark in this category, these figures indicate possible ranges. These benchmarks are presented in Figure 12-8.

MAINTENANCE TRAINING

The final group of benchmarks look at maintenance training. The first benchmark is training expenditures per employee. This expenditure ranges from \$607 to \$2000 per employee. The Best Practice varies on this indicator as it will on the following ones. This expenditure is based on the current skills of the employees and their identified training needs. If an organization has a highly trained workforce and is not currently modernizing the plant at the current time, the low range of training dollars may be acceptable. However, if an organization has identified skills deficiencies and is modernizing its plant, the high range may be insufficient. This benchmark needs to be balanced against both the current business climate and the condition of the employee skills at the plant.

The second benchmark is training as a percentage of payroll; it ranges from 1.65 to 4.39%. As noted above, the Best Practice percentage will vary.

The last benchmark measures technical training as a percent of total training expense. It ranges from less than 20 to more than 50%. The Best Practice percentage will vary. Technical training should not be sacrificed for compliance or soft skills training. It should be specified, based on the skills deficiencies noted as well as new equipment being brought into the plant. These benchmarks are summarized on Figure 12-9.

FIGURE 12-9 TRAINING

Indicator	Low Range	High Range	Best Practice
Training Expenditure per Employee	\$607	\$2000	Varies
Training as a Percentage of Payroll	1.65%	4.39%	Varies
Technology Training / Total Training Expense	<20%	50+%	Varies

Conclusion

Why should we benchmark? The gap between present practices and Best Practices promotes dissatisfaction and the desire for change. Visiting a benchmarking partner — seeing, understanding, and learning from the Best Practice — helps to identify what you can change and how to change; it provides a realistic, yet achievable picture of what the future could be. Without this vision, many people will never fully comprehend the direction that would mean for the success of the company.

Organizations considering change always face the argument “We have always done it is way.” Yet why should this argument be a reason for continuing to do something the same way? Annual objectives based solely on past performance plus or minus 10% are meaningless and destructive in a period of rapid change.

It is necessary to explore the tangible and intangible factors that

combine to produce a superior performer. Those people who are most directly concerned in the activity being benchmarked should be involved. Without this level of involvement, these individuals are unlikely to embrace the vision. Without their support, no benchmarking exercise will ever be truly successful.

Benchmarking is not without its own limitations. Benchmarks can be too fluid because world standards are rapidly improving. They are often too modest for corporate goals. Too often benchmarks simply become numbers to achieve, and the real goal — the opportunity for continuous and rapid improvement — quickly diminishes.

In order to gain the maximum benefit from benchmarking, four factors must be remembered:

- A benchmark provides a measure for the benchmark process among the benchmarking partners.
- A benchmark describes the organization's gap in performance compared to the measure of the benchmark partners.
- A benchmark identifies the Best Practices and enablers that produced results that were observed during the benchmarking study.
- A benchmark sets performance goals for the benchmarked process and identifies actions that can be taken to improve performance.

A benchmark performance does not remain standard for long. In this age of continuous and rapid improvement, a benchmark today will be a standard tomorrow, and a mediocre performance in the future. Only by seeing benchmarks as part of a continuous improvement program will any company make the progress necessary to stay in business.

Benchmarks, therefore, are good for finding process improvements, arousing people to a challenge, and setting milestone targets. They are not the end-all of the business, nor should they ever be. If a company fails to learn during a benchmarking project, it likely made mistakes. It will not be successful in future benchmarking endeavors without reviewing the project and looking for, finding, and correcting the mistakes.

An additional mistake made when benchmarking is conducting an extensive analysis beforehand. This delays improvements. An extensive upfront audit is often a way people postpone doing something useful. Benchmarking does not require this audit. Many changes can be quickly identified and implemented. Benefits can be derived in a rapid fashion.

In conclusion, ask yourself the following questions:

- Will you help your company achieve the benefits available by improving maintenance?
- Will you utilize benchmarking as a tool for continuous improvement?
- Will you insure that you benchmark for the right reasons?

If your answer to these questions is yes, then you will be increasing your company's competitive position and insuring its future.