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Abstract

Benchmarking is traditionally used to change and improve an organization or small group of organizations by identifying and adopting best practices from excellent organizations. This paper discusses a case in which the US commercial nuclear industry benchmarked its IT practices/processes in an attempt to improve the industry's competitive and strategic position with respect to its competitors, other forms of energy production. The benchmark identified and distributed best practices of its members for incorporation into member business processes with the expectation of improving overall industry performance. This is an unusual use of the benchmarking process as its focus is more on knowledge management than on a comparative analysis. The process followed is discussed and compared to traditional benchmarking processes. It was found that with one exception, the process followed is an effective process for benchmarking and improving industry performance. The one exception is that organizations outside the US nuclear industry were not looked at. The concern is that the process may result in the industry finding and promoting good practices instead of best practices as members may be good but not great.

Keywords: Benchmarking, best practices, knowledge management, organizational change

Introduction

Benchmarking is a management tool that has been used to change and improve organizations for several years. Traditional benchmarking projects look at improving a specific organization or small group of organizations. This paper discusses how the United States, US, commercial nuclear industry benchmarked itself with the express purpose of changing and improving the whole industry. The goal was to make each nuclear utility better able to compete with respect to the cost of electrical production by identifying key knowledge and practices and distributing them to the industry. This was done as it was determined that nuclear utilities are not in competition with each other, rather they are competing with other forms of energy production. This was also a strategic activity as the industry was attempting to change the competitive position between themselves and their intra-industry rivals. The paper focuses on the benchmark project done with respect to nuclear Information Technology, IT, management.

Background

Spendolini, Friedel, and Workman (1999) define benchmarking as being a continuous, systematic process for evaluating the products, services, and work processes of organizations that are recognized as representing best practices for the purpose of promoting organizational improvement. This definition was developed in 1992 by examining the organizational definitions of more than 50 companies actively using the process. Since then the purpose and definition of benchmarking has changed little.

Benchmarking Process

McLemore (1999) outlines the benchmarking process and distinguishes between traditional and accelerated benchmarking. The basic process uses the following steps:

- Document own processes identifying your strengths and weaknesses, Leahy (1995) considers this essential prior to undertaking any benchmarking project.
- Capture the needs and wants of clients/customers and determine valued measures of performance.
- Develop benchmarks of performance by determining the processes, methods, and practices necessary to deliver a desired level of performance from the study of other organizations. There are various levels of benchmarking that will be discussed later.
- Identify best practices from the study of other organizations
- Apply statistical tools to process measurements to remove variance.
- Compare processes and measurements and determine any changes for improving the organization's processes.
- Implement changes in the organization's processes and measure results.

This is a complete process that utilizes benchmarking as the process for identifying areas for change in the organization. Depending upon the importance of the process and the time available for performing benchmarking, an organization may vary the depth of the benchmarking effort. Spendolini, Friedel, and Workman (1999) define benchmarking depth as follows:

- Level 1 closely resembles traditional competitive or comparative analysis. This level has participants contributing information on a set of quantitative indicators. These numbers are compiled into a matrix and given back to the participants to use as they see fit. The advantages of this level are that the data can be collected and disseminated quickly, upper management is familiar with the type of data being collected and is not threatened by it, and third parties can be used to collect and disseminate the data. The disadvantages of this level are that it doesn't add any new elements to the analysis, the quantitative indicators need to be precisely defined to avoid comparing apples to oranges, and the focus is on outcomes and not the processes used to generate the results. This level is the one most commonly used, approximately 85% of benchmarking activities are at this level.

- Level 2 is at the best practice level. Participants tend to be linked according to specific performance criteria. Data collection is focused on process information and quantitative data showing the effects of process changes on quantitative indicators. There is more direct communication between participants including semi-structured interviews. The advantage of this level is that it focuses on real issues regarding process improvement. The disadvantages of this level are that it takes time and participants may not trust each other. One other requirement that may be an advantage or disadvantage depending upon the perspective of the reader is the need for out of the box thinking. Only about 10% of benchmarking activities are at this level.

- Level 3 is cross industry and potentially global. Participants are those who can provide useful process-related information, regardless of industry or country. Collected data is highly focused on process data and is prescriptive rather than descriptive. Detailed communications take place including extensive site visits. Strategies for implementing best practices are discussed and partners gain much greater understanding of how each does business. The advantage is the participants get rich, detailed information that can result in strategic and/or significant process improvement. The disadvantage is that it can take several months to perform this level of benchmarking. Very few benchmarking efforts are done at this level, approximately 5%.

The key element in benchmarking appears to be time. Management wants answers quickly. The distribution of benchmarking activities within the three levels shows that the vast majority of benchmarking activities are done at Level 1. McLemore (1999) discusses accelerated benchmarking. Organizations that implement accelerated benchmarking focus the effort on incremental improvement rather than larger issues. Benchmarking processes are streamlined and reduced to data collection methods that can be done quickly. This has been incorporated into the definition of Level 1 Benchmarking.

IT Benchmarking

IT benchmarking has two forms. The first form is as a series of standard measures for system performance. The second form is for benchmarking IT processes. Both forms provide IT management with information for assessing performance of IT. The first form is a Level 1 approach while the second form is a Level 2 approach.

IT Benchmarking Form 1
Butler (1998) defines the first form of IT benchmarking as running a set of standard tests on a system to compare its performance with that of others. Several benchmarks have been created for measuring basic hardware and software speeds. Some of these benchmarks are:

- Overall system performance for a specific task with specified data
- Performance of specific subsystems or applications for a specific task with specified data
- Capacity of a system

Good first form benchmarks use a well-defined testing methodology based on real world use of a computer system. They consist of three basic components: a specification, control logic, and implementation. The specification provides the details on how the benchmark will be performed including data points, tasks, and a execution plan. The control logic specifies the sequence of activities and is essential for ensuring the benchmark is repeatable. The implementation provides an audit trail so that the benchmark can be shown to meet the requirements of the specification.

Level 1 standard benchmarks are provided for Central Processing Units, CPUs, peripherals, system software, and applications. Standard benchmarking tools are available. Gibbs (1998) discusses one such tool for web applications, WebChallenger. This tool measures web site performance, response performance, load balancing, and other activities. While not an outstanding example of a benchmarking tool, it does illustrate the point on tools.

IT Benchmarking Form 2
IT Process benchmarking, or IT Benchmarking form 2, is concerned with identifying best practices and comparing how organizations manage IT assets. The goal of this benchmarking form is to improve organizational performance. Rubin (1999) considers continuous process benchmarking one of the keys to successfully managing IT as a valuable asset and for providing guidance for rapid change in the management of IT assets. Kakola and Kalle (1999) consider process benchmarking as a key activity for improving computer supported work processes. They propose using benchmarking as a key service in their Dual Information Systems architecture. The goal of the service is to support benchmarking that:

- Identifies best in class organizations for specific processes
- Captures knowledge of how the organization implements the process
- Determines the gap between the benchmarking organization and the best in class organization
- Determines a plan of change for the benchmarking organization

Processes that are commonly benchmarked include software development, software maintenance, project management, customer service/request, supplier management, security, infrastructure management, change/innovation management, and personnel management. Additionally, this form of benchmarking can be used for strategic purposes. Automatic I.D. News (1999) discusses using benchmarking to align supply-chain management systems with strategic initiatives and Dutta, Van Wassenhove, and Kulandaiswamy (1998) discuss drivers and differences between European countries adoption of strategic software practices.

Nuclear Industry Benchmarking, Origins and Background

As a result of the Three Mile Island 2 Nuclear accident in 1979, the US commercial nuclear industry suffered a tremendous increase in costs due to upgrades and retrofits required by the Nuclear Regulatory Commission, NRC. The effect of these costs was to raise the price of nuclear generated electricity to where it was not competitive with other sources of electricity. Additionally, the trend towards deregulation of the utility industry is forcing nuclear utilities to compete on a cost basis with lower cost electricity sources. To help nuclear plants and organizations survive in the market, the Nuclear Energy Institute, NEI, proposed that industry wide benchmarking be done. The purpose of the benchmarking was to identify best practices and processes within the nuclear industry so that NEI members could implement changes that lower Operations and Maintenance, O&M, costs and improve plant performance, Gilbert (1998). This is a unique approach in that the nuclear industry as a whole was benchmarking itself so that all nuclear utilities could improve their performance. In this case, nuclear utilities were not competing, instead, the industry considers itself competing with other forms of electrical generation.

The key to the NEI Benchmarking project was the creation of a standard benchmarking process. Gilbert (1998) outlines the process through the following basic steps:

- Creation of a Peer Review Team.
- Review of Plant data to determine list of candidate plants to benchmark
- Collection of standardized data via survey
- Collection of plant specific data via plant visits
- Determination of target costs versus performance for core activities
- Determination of best practices and processes
- Generation of Project Report
- Transfer of best practices to NEI members

This paper focuses on how nuclear utility IT organizations implemented this above process.

Nuclear Information Technology Benchmarking

The task force for conducting the nuclear industry IT benchmarking activity was formed by Davis (1999) at a meeting of invited participants on October 28, 1999. The task force was charged with performing a benchmarking activity in accordance with the NEI Industry Wide Benchmarking Project, SS001 (1998). All benchmarking activities were performed by the end of the first quarter of 2000, including writing and issuing the project report. Due to this time restraint the team changed the objective of the benchmarking to identifying good practices from sites that were good cost performers with respect to the production of electricity. These sites were chosen as the team realized that for their findings to be credible to senior management they had to look at those sites perceived to be the best, i.e. the top cost performers. The benchmarking team surveyed 35 plants and conducted detailed site visits at 6 sites. Following completion of benchmarking activities the team presented their report to the industry at an NEI and Nuclear Utility Software Management Group, NUSMG, sponsored industry meeting. Best practices were represented by the generation of the SPIDER model. This model is based on the composite of the good practices associated with improved efficiencies at reduced cost. The SPIDER exists in a web of complex business interrelationships that require support and understanding by management at all levels. The SPIDER model components are Standardization, Planning, Integration, Delivery, Experience, and Resources. Details of best practices findings are provided in the Findings section.

Methodology

This section will discuss the methodologies used to collect data for this paper and the methodology used by the benchmarking team to gather and analyze data.

Paper Data Collection

This paper uses a case study data collection methodology. Two converging data collection methods are used. The first method is a literature and document review. The authors had access to all the nuclear IT benchmarking documents as well as the benchmarking literature. The benchmarking literature is used to establish the model of how benchmarking is to be done. The benchmarking project documents are used to establish how the project was performed. Analysis is based on comparing the literature to the documents.

The second data collection method is unstructured interviews with benchmarking project personnel. Extensive interviews were conducted with project team members. Additional interviews were conducted with the NEI project manager and a senior nuclear IT manager familiar with the project. Data from the interviews was used to fill in holes in the project documentation and to provide background knowledge as to why the project team made the decisions they made and did what they did. Analysis uses this data to understand and assess what was done when the project documentation shows a deviation in process from the literature.

Selection of Team Members

The team was selected based on the interest of nuclear utilities. NEI notified each nuclear utility through their economic point of contact that the benchmarking activity was going to be performed and solicited participation of utility personnel for the benchmarking team and of utilities for participation. Participating utilities were required to commit the time of their personnel to responding to benchmarking team requests. Utility personnel volunteering to serve on the team needed the commitment of their time and costs from their utility. This selection method was chosen as it ensured team members and participating utilities were committed to the project.

Selection of Sites to Benchmark

The NEI Information Technology Benchmarking Task Force conducted site selection. The criteria developed for site selection ensured the selection of good performing plants. The initial list was developed using the 35 sites with the best operation and maintenance costs per kWh over the period 1996 - 1998. All plants on this list were surveyed for data on their IT organizations. The second step was to determine a list of 6 sites for site visits and detailed data collection. Results from the survey were used to select the sites for visits. Each survey result was scored and an overall site score generated. The top 6 site scores were chosen for site visits. The generation of the survey and the scoring system are discussed in the next section.

Survey and Scoring System Generation

The task team developed an information technology process map, figure 1, from which a 45-question survey instrument was developed. Survey questions focused on information technology program management, technology planning, solution delivery, operation and maintenance of information technology systems and services, and program evaluation. The breakdown of survey questions by area is identified in Table 1. No questions were asked on Program Guidance as this section addresses reference documents generated by organizations regulating or assisting the industry and are common to all utilities.

Table 1. Percent of Survey Question from IT Process Map Area

Process Map Focus Area Percentage		**Percentage (%)**	
Section	*Title*	*Main Section %*	*Sub-Section %*
1.0	Program Management	28%	
2.0	Program Guidance	0%	
3.0	Core IT Activities	62%	
3.1	*Technology Planning*		24%
3.2	*Solution Delivery*		24%
3.3	*Operate and Maintain Systems and Services*		52%
4.0	Program Evaluation	10%	

The survey instrument was designed as a short answer or fill in the blank series of questions that could be completed in 4 to 6 hours. The survey instrument was mailed to the NEI Economic Point of Contact for each utility represented on the site survey list. Each site had approximately 3 weeks to complete the survey and return their response to the NEI IT Benchmarking Task Force project leader.

Based on site survey responses, the task force computed overall site scores. These scores along with economic and resource survey data were then used to compute five site IT performance ranking indicators. The performance ranking indicators included the following.

- Survey Score per IT Cost/MWh (Mega Watt Hour)
- Survey Score per Site Operations and Maintenance, O&M, Costs/MWh
- Survey Score per ratio of IT Cost to Site O&M Costs
- Survey Score per IT FTE (Full Time Equivalent)
- Ratio of Customer FTE to IT FTE

The task team calculated a composite indicator for each site using the above indicators. The composite indicator was the arithmetic sum of its component parts. The task team then plotted the site composite indicator against O&M Costs/kWh. (kilowatt hour) Using the resulting scatter diagram the list of sites surveyed was reduced to eight candidates that formed the site selection "short list." The task team then used the supplemental information provided on the surveys to reduce the list to six sites for benchmarking visits. Each selected site was then contacted to verify its willingness to participate in the benchmarking effort.

Findings

The findings presented in this section are from the benchmarking project as reported in the NEI/ NUSMG Information Technology Benchmarking Report (2000) by the benchmarking team.

Process Map

The benchmarking team developed the IT benchmarking process map by identifying and grouping all related activities identified by The Standard Nuclear Performance Model - A Process Management Approach (1998). The map contains four overall process categories to meet the business need:

- Program Management, which covers program policy and procedures, organizational structure, strategic planning, resource allocation, and configuration management, and software quality assurance.
- Program Guidance, which addresses references written by nuclear industry and regulatory organizations.
- Core Activities, which represent the processes of business technology planning, delivery of information technology solutions, and the operation and maintenance of IT services and systems.
- Program Evaluations, which are designed to provide feedback mechanisms such as performance indicators, self-assessments, oversight group feedback, benchmarking, and process and program improvement.

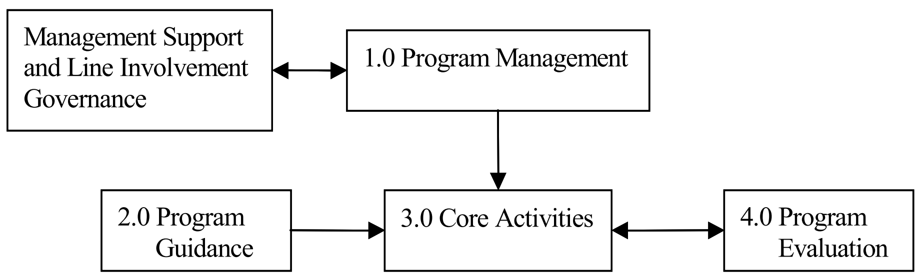

Figure 1. IT Process Map

SPIDER Model

Data was reviewed according to categories identified on the process map. Methods or practices used to accomplish activities identified on the process map found at all or most of the benchmarked plant sites were identified as "Common Contributors." These are essential elements of good information technology programs and were used to generate a critical success factors model of a nuclear IT organization, called the SPIDER Model. The SPIDER model links management elements to each other, indicating the relationships recommended for good business programs and processes. Attributes comprising the SPIDER model were defined previously and are evident in the identified good practices described below.

Standardization is critical in establishing information technology procedures, processes and tools to lower cost and improve software reliability. Sites visited had published and implemented a set of core standards that were focused on business value and had processes in place to assure compliance. The results were software applications delivered efficiently, on time, reliably and at the lowest possible cost. Examples of standardization good practices include:

- Standardized desktops
- Consolidated help desk
- Use of remote control software for help desk personnel
- Server configuration control
- Consistency of software applications among multiple site locations
- Reduction in number of software packages supported
- Use of commercially available software without customization
- Use of automation software for software distribution

Planning is an overall strategy and a clear vision provided by senior management and implemented by IT. IT develops and defines objectives to meet this strategy and vision. The nuclear facilities that stand out and are doing well in accomplishing their strategic direction assure that IT is a major component of the overall planning process and business initiative. The IT plan is based on evaluated strategic projects as business investments within a business unit. Business plan items are reviewed for cost-effectiveness and directly tied to the budget. Due to continuing industry and technology changes, plans are reviewed several times a year and flexibility is imperative to capitalize on opportunities. Key good practices include:

- Senior management commitment and support for the use of information technology to facilitate business processes and promote standardization
- Management commitment to and ownership of the planning process
- Integration of the strategic plan with business plans
- Regular reviews and updates of the information technology strategic plan
- Benchmarking of information technology usage and deployment against other utilities and industries
- Stakeholder involvement in the planning process
- Consistent implementation of the plan at the plant site and across multiple sites for multi-site utilities
- Clear line of sight goals from top tier objectives to implementing employee groups

Integration is accomplished by the active involvement of the IT staff within the nuclear generation organization. Integration promotes teamwork that produces effective solutions to increase user productivity through technology. IT staff that share in the ownership of the site's performance becomes an integral part of the success of low cost producers. Examples of good practices include:

- The strategic and tactical objectives for the IT organization and nuclear business units were aligned
- IT personnel had experience in or substantial knowledge of the "customer's" business activities and processes
- There was consistent, timely and accurate communication between organizations
- The IT organization is viewed as an integral part of the plant operating team and not simply a service organization
- Implementations of IT initiatives are driven by the nuclear business units or have the "buy in" of the stakeholders
- IT projects are implemented by teams consisting of IT professionals and representatives from the nuclear business units
- Computer system outages are planned, coordinated and communicated with nuclear business units affected by the outage
- Nuclear business units have direct access to the IT professionals supporting key software applications
- Procedure processes control the scope, approval and management of significant IT projects

Delivery of solutions includes all elements of procurement or development, deployment, and implementation. Sites that deliver software solutions effectively have standardized processes and procedures that initiate, evaluate and approve IT projects. These processes assure that the business drives IT, and that IT is an involved partner throughout the process. Applications that are developed/purchased, deployed, and implemented using structured processes are delivered within schedule and cost. Good practices include:

- Peer group or review team to select projects and obtain funding
- Use of formal project management methods
- Configuration management of computing hardware and software life cycle control
- Solution delivery that promotes consistency between computing environments and business organizations
- Development teams comprised of members from business line organizations
- Recognition that the timely implementation of the project will continue to align the strategic plan with the business plan
- Established metrics that projects are evaluated against several months after implementation to determine if the project achieved expectations

Experience is the blending of experienced nuclear plant personnel with skilled IT professionals to create organizations that are successful in delivering solutions in support of overall station business objectives. Nuclear plant experience is a major contributing factor to the overall success of nuclear IT organizations. Good practices include:

- All of the sites visited had staff in the IT organization that included personnel with nuclear experience. Roles varied, but in general, all of the IT organizations had a good understanding of the nuclear business.
- At some sites a significant portion of the IT workforce had backgrounds in nuclear business organizations outside the IT function
- IT management had incorporated experience from plant organizations outside the traditional IT departments. This provided an understanding of nuclear plant operation and knowledge of regulatory requirements. The corrective action program was generally used within the IT organization for key issues. In addition, most sites had a system for tracking traditional IT problems.
- At one utility it is a requirement that managers supporting specific nuclear functions in the IT organization have nuclear plant experience
- It was observed that site IT managers maintain open communication with other site managers resulting in successful IT support of the plant. Most attend the plant Plan of the Day meetings or other plant management meetings that ensure IT direction is consistent with plant requirements in the most cost-efficient manner.

Resources are necessary to operate an IT organization. It is essential that the senior nuclear officer of the facility have knowledge, understanding and support of the information technology process and translate these actions through allocation of appropriate resources, during the IT planning phases, to facilitate usage of proven technology and afford proper IT support in the business process. Good practices for this item involve cost data and other information considered proprietary by the nuclear industry and are included in this paper.

Analysis

The process followed is a modified Level 2 process. Detailed data resulting in the identification of Good Practices as well as quantitative data were collected. However, the process followed is not exactly as the literature outlines. The purpose of this benchmark was to improve a whole industry while traditional benchmarking usually assumes a single organization or small group of organizations seeking improvement. For this reason it is expected that this benchmark will differ from traditional benchmarks. These differences will be analyzed based on literature identified benchmarking mistakes and the effectiveness of the actual project. Sheridan (199) lists various mistakes benchmarking projects can make:

- Assigning too many people
- Failure to assign people for whom the benchmarking project is important
- Failure to tie benchmarking to strategic objectives
- Focusing on "battleship" issues (such as reducing costs) rather than narrowly focused "speedboat" objectives
- Setting unrealistic timetables
- Picking the wrong benchmarking partners (halo positive and halo negative effects)
- Failure to follow proper protocol
- Excessive data collection
- Emphasizing numbers rather than the processes behind the numbers
- Failure to identify targets for action in advance

This project can be perceived as having made some of these mistakes. How critical these mistakes are is discussed below.

Team Selection

Leahy (1995) states that team members should be open minded, patient, and have good analytical and project management skills. The team selection methodology does not guarantee team members have these qualities. This methodology relied on volunteers and did little qualification testing. It is reasonable to assume that organizations would only pay for and send personnel they expect would do a good job. However, since there was little training in benchmarking prior to team selection there is no guarantee that managers were aware of the traits needed for this team. In support of this methodology, Sheridan (199) lists as one of the mistakes in benchmarking being the assignment of personnel for whom the project is not important. Using volunteers ensures this mistake does not exist as it is reasonable to assume that organizations would only pay for and send personnel that are interested in and committed to the project. The final point to consider is that the nuclear industry is a relatively small industry. There are 102 nuclear plants. Nuclear personnel tend to know each other or to at least have heard of others. Also, this is a highly professional industry. It is reasonable to expect that a team assembled from multiple organizations on a volunteer basis will get competent personnel and would be able to ensure, through peer and professional pressure, that all team members were fit for the project. The team selection process is not considered an issue, and is a strength for this industry.

Wide Focus

The objective was the "battleship" issue of reducing operating costs. No causation was established between IT processes and the costs of producing electricity, i.e. operating costs. It is known that there are impacts on overall operating costs from the resources used in IT, but there was little understanding of how IT affects key processes and their impact on operating costs. This caused the team to spend much time deciding what data needed to be collected and who to look at. It was assumed that low cost electricity producers were the sites to look at as they were meeting the goal of "reducing operating costs." A better approach would have been to include looking at IT support of critical core processes, especially Work Management processes. It appears that this was not done due to the time constraints on the project. Mapping IT to the industry core processes would have taken several months. This is considered a weakness of this process. However, this weakness should not distract from what the benchmark achieved as the project was effective in looking at the IT management function.

Time Constraint

An unrealistic timetable was assigned. This resulted in the team modifying the process to fit the timetable. Modification included looking for Good Practices rather than Best Practices since the team could not look at all organizations. Also, to conserve time only the top 35 plants were surveyed instead of all 102. This reduces the overall validity of identifying Best Practices. However, the team recognized this and ensured that the published report of findings was clear in stating that "Good" Practices had been identified. Given the rapid transformation towards deregulation the tight time constraint is understandable and is not considered a weakness of the process since the findings need to be relevant more than complete.

Benchmarking Partners

The wrong benchmarking partners may have been chosen. By choosing partners that were low cost electricity producers a halo positive effect may be present. No direct tie was established that said low cost electricity producers were good IT users. Conversely, no effort was made to see if high cost electricity producers had good IT practices. This was a point of considerable debate for the team. Use of low cost electricity producers was justified from the standpoint that they were recognized as industry leaders and thus findings from these organizations would be credible to senior management. Politically this was the correct approach to take but it does lower the validity of the findings. A possible alternative approach was to select subject organizations based on external rankings. One such ranking that could have been used is the ComputerWorld rankings. Using this ranking would have changed two of the sites selected for visits. However, of the two sites that would have been changed, one of them was requested to participate but refused. This suggests that the method used by the team while flawed, yielded acceptable results. This was further validated in the interviews when it was revealed that the team did consider industry rankings from the NRC and the Institute of Nuclear Power Operations, INPO, prior to making the final selection for site visits. The only real concern is that best practices from high cost producers were not identified. The team also recognized this possibility and changed the goal from identifying best practices to identifying good practices. The distinction between best and good is meant to reflect that the team could not guarantee that the best practices had been identified.

The other aspect of this issue is more significant. The benchmark only looked at nuclear partners. No non-nuclear sites were considered. IT is not a nuclear unique process. It would be expected that many Best Practices could be found looking at how the lower cost electricity producers as well as other, non utility organizations managed IT. While this is an industry benchmark, there should be no requirement that only industry members be benchmarked. Spendolini warned of this danger in his benchmarking training by referring to this practice as producing the "tallest midget." This is the greatest threat to this process as a model for industry benchmarking. It is recommended that future industry benchmarks also consider non-industry organizations.

Conclusions

The overall conclusion is that the process used for this industry benchmark is recommended with the one exception of including non-industry organizations for the identification of best practices. The benchmark found several good practices that are consistent with accepted IT management practices and which have had beneficial effects when implemented by organizations. Two examples of organizational improvement are presented and as reported through the interviews. One utility reported savings of $2 million in 2000 alone by changing the way they procured hardware. Several other utilities reported support savings by reducing application inventories. Both changes were a result of good practices identified in the benchmark. While these two changes are not sufficient by themselves to say this was a good process, a look at how one utility is implementing change as a result of the benchmark shows that the benchmark results are resulting in change.

During the interview with a benchmark team member it was asked how his organization was implementing the results of the benchmark. This team member's organization was not visited nor surveyed for the benchmark and is considered a poor cost performer with respect to cost per kWh. The team member stated that his IT organization had reviewed the benchmark findings and were incorporating those good practices they considered applicable in their IT strategic plan. There were four practices they wanted to implement. These are:

- Quarterly releases on applications instead of whenever one is ready - pilot in progress
- Organization - reorganizing next quarter, moving to functional instead of Area of Responsibility, AOR, alignment
- Creating a Central Review Committee, CRC, to improve client involvement in prioritization and decision making

- Verifying alignment between Nuclear strategic planning and IT strategic planning (complete)

Each of these initiatives should improve performance of the IT organization with respect to cost and integration.

Finally, from the standpoint of knowledge management this benchmarking process should be considered somewhat successful. Knowledge in the form of good practices was identified, documented, captured, disseminated, and used to change the way the participants did business. It would have been more successful had a full search for good practices been performed by looking at all members of the industry. As a knowledge management technique/tool, benchmarking is acceptable, however, it needs to include all members of the target group.

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