Leadership Based Accountability for Facilities Management

by

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A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Approved July 2011 by the
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ARIZONA STATE UNIVERSITY

August 2011

ABSTRACT

Facility managers have an important job in today's competitive business world by caring for the backbone of the corporation's capital. Maintaining assets and the support efforts cause facility managers to fight an uphill battle to prove the worth of their organizations. This thesis will discuss the important and flexible use of measurement and leadership reports and the benefits of justifying the work required to maintain or upgrade a facility. The task is streamlined by invoking accountability to subject experts. The facility manager must trust in the ability of his or her work force to get the job done. However, with accountability comes increased risk. Even though accountability may not alleviate total control or cease reactionary actions, facility managers can develop key leadership based reports to reassign accountability and measure subject matter experts while simultaneously reducing reactionary actions leading to increased cost. Identifying and reassigning risk that are not controlled to subject matter experts is imperative for effective facility management leadership and allows facility managers to create an accurate and solid facility management plan, supports the organization's succession plan, and allows the organization to focus on key competencies.

DEDICATION

This thesis is dedicated to my wife Jennifer and my sons Erik and Tyler for

allowing me to complete this feat while staying grounded in family functions and

affairs. Without family, I would cease to strive for new concepts and ideas and I

thank you for being there for me.

ACKNOWLEDGMENTS

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INTRODUCTION

Research Objective

Understanding and synthesizing the environment is critical for managing

any facility. It should be the intent of any information system tool to help reduce

the time taken to find a given solution. This given solution is what helps drive

corporations to different levels of performance to be the first to market with their

perspective products. It is noted that the speed of business has changed over the

years. As Malhotra and Peterson point out, the speed of business has increased

due to the diffusion of computers, digital technologies, and telecommunication

devices. Such advances have enabled firms to be more responsive to customers

through flexible manufacturing, and reduced cycle times in channel operations

(2001). Furthermore, instant communication has become a prerequisite to

developing a viable market. Technologies such as data warehousing enable data

mining by capturing and managing tremendous amounts of data. Server-based

computers and inexpensive data storage have allowed businesses to capture more

and more information about their transactions (Malhotra and Peterson 2001).

As the role of the Facility manager evolved over the years, continual

improvement has increased the level of competency for the position itself. A

continuum of changes has forced the facility manager to do more work with fewer

resources. Compounded by a faltering global economy of recent years, the work

of a facility manager almost always includes a bout of constantly fending off

challenges from corporate to downsize or be outsourced. Foster and Dye support

this by stating "Because of the recent recession, companies must do more with fewer resources, meaning that business continuity planning efforts are a collateral duty that requires an executive mandate for accountability" (2005). With the reduced amount of resources available, today's facility manager has to be creative in the use of existing processes by considering streamlining and finding more efficient ways to get work done.

The corporate bottom line has become the driver in today's business world. Bottom lines for sustainability can be the evolution of more sustainable companies better situated to respond to both risk and opportunity in the volatile and fast-changing global marketplace (Boerner 2010). No longer is it acceptable to accept status quo or to make a mistake and not participate in some sort of corrective action event. Businesses have become more competitive and wages have become less isolated regionally. With the introduction of NAFTA, the free trade agreement has opened the border for increased production and in the same stroke of the pen, has put every corporate cost under the microscope.

Communication is an important part of the facility manager's work. Utilizing reports or key performance indicators is a vital tool to provide the health of the organization. Too many times, the facility manger is reactive. That is, a service call comes in and a worker goes out to remedy with little or no knowledge of the existing conditions. How can the facility manager be more proactive in the use of his reports? Thinking differently can be the key to being a successful facility manager. The question is how to generate a proactive report that tracks items that cannot be controlled and allows work towards solving problems that

support issues directly and assigns tasks and the risks to a subject matter expert who can dispatch the problem in an efficient manner. Furthermore, even though accountability may not alleviate total control and cease reactionary actions that may increase risk, facilities managers can develop a leadership based report to reassign accountability to task owners while simultaneously reducing reactionary actions. Identifying and reassigning risk that cannot be controlled is imperative for effective facility management leadership and allows facility managers to create an accurate and solid facility plan. The next few paragraphs will explore the various methods that will help reduce the risk of the issues added by the theory behind the problem statement throughout this thesis.

Hypothesis

Understanding how to address course corrections in an organization involves reviewing and analyzing different data sources in order to make informed choices to ensure that the actions are in line with the corporate bottom line. As a facilities manager, one may not have the expertise in each aspect of the organization. To compound the issue, a facility manager may have come up the ranks of the organization as an electrician or other trades person without any experience in an engineering aspect. Conversely, the facility manager may have business background and have no understanding in any of the organization's subject areas. In either case, the facility manager must maintain a vigilant watch on the pulse of his or her organization. It is this very fact that drives the need and understanding that subject experts must be consulted and utilized to help the facility manager maintain the main capital asset in support of the organization.

The goal of the hypothesis is to prove without doubt the three following reductions and the measured methods:

1. Implementation of self-accountability and its affect on decreasing overall organizational effort.

2. The use of leadership-based reports and the correlation in the reduction of control.

3. How the use of leadership reports reduces risk and effort by use of measuring what has not been measured in the past.

The previous three points of the hypothesis emphasize the practice of relying on subject matter experts and becomes imperative that the facility manager must relinquish total control in order for this methodology to be successful. Micro management cannot be successful and will be resisted, especially by high performing members of the team. Each expert is accountable for his or her subject area. In addition, the use of management reports can be developed and maintained by the subject experts proving to be a valuable resource in support of leadership functions. This critical aspect will bring the leadership role into play and allow other to self-report their progress. Minor course corrections can be made simpler to support the team with reduced effort.

The development of this hypothesis also involves certain risks. Once a facility manager can realize he or she cannot control risk, only identify and plan, it becomes easier to reassign the risk to a subject matter expert who is better equipped in dealing with them.

As support to this fact, the review of different management aspects on data collection can provide the best value to an organization and their future efficiency. The two aspects that can be compared are operations and maintenance and project management. Each aspect of the facilities operations has its own center of excellence and benefit for measuring data as it relates to productivity and efficiency.

From an operations and maintenance perspective, the use of a leadership reports allows the facility manager review the health of the facility but still may require a decision method that keeps the risk in the facility manager's arena. In some cases, the findings may actually increase the risk to the facility manager's organization. The strength of a leadership report is demonstrated by the ability to gather data showing that the assets are functioning as intended and that no costs are being accumulated that are outside the various controls set in place by departmental goals. In this case, the use of the report does not support releasing all control. The facilities manager may provide further guidance on what variable is impacting performance. Looking at Figure 1 as an example below, the facility manager can look at the preventive maintenance performance against a number of different variables. This particular chart shows how the preventive maintenance activities compare against the industry in the form of benchmarks. The chart includes a planned number and an actual number to compare overall performance of specific preventive maintenance activities. Upon review, the facility manager can quickly assess the organizational performance and decide whether a specific course correction may be required. In addition, a decision may be made to even

possibly decrease the scheduled preventive maintenance, which could increase the

risk of further equipment failure or prevent compliance in some other area or

regulatory field.
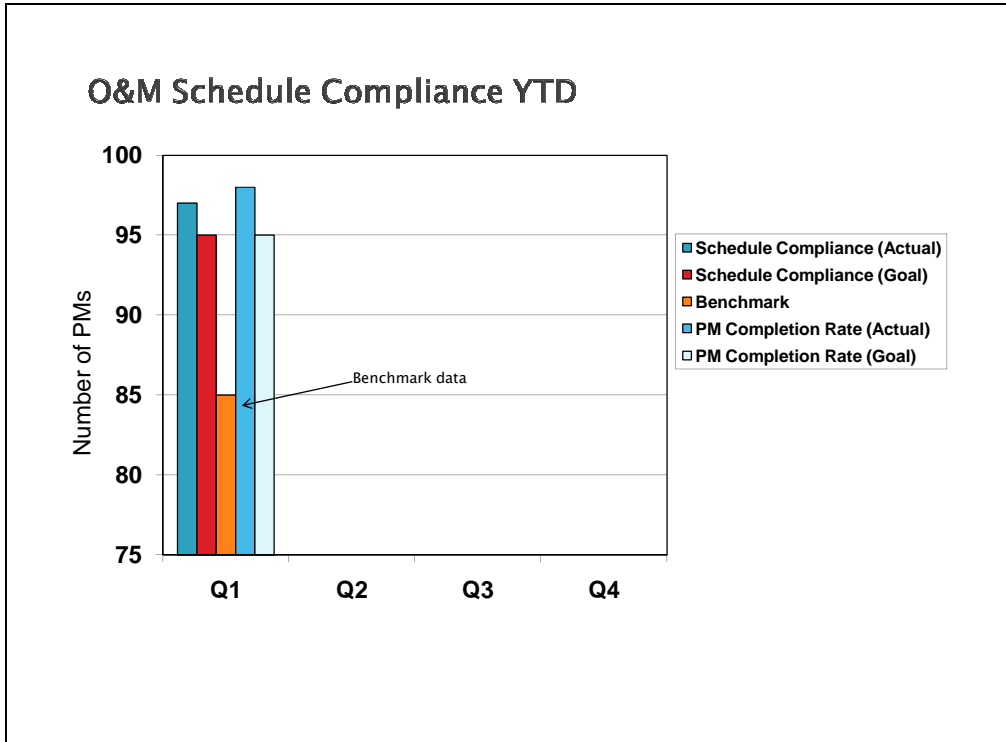
Figure 1- O and M Schedule Compliance Chart Example

To further support transferring of risk with the relation to the hypothesis,

Figure 2 goes on to show critical equipment down time and it's affect against its

particular goal. The facility manager can exploit this to illustrate the effect of poor

planning on the part of the maintenance group. The goal becomes a target at

which all members are measured against. As shown in the Figure, a root cause

analysis can be done to find out what types of failures are occurring and if the

failure is tied to quality or possibly a defect. All of the data presented can support

the use of self-accountability through performance measures.

Critical Equipment Downtime

Measured in hours
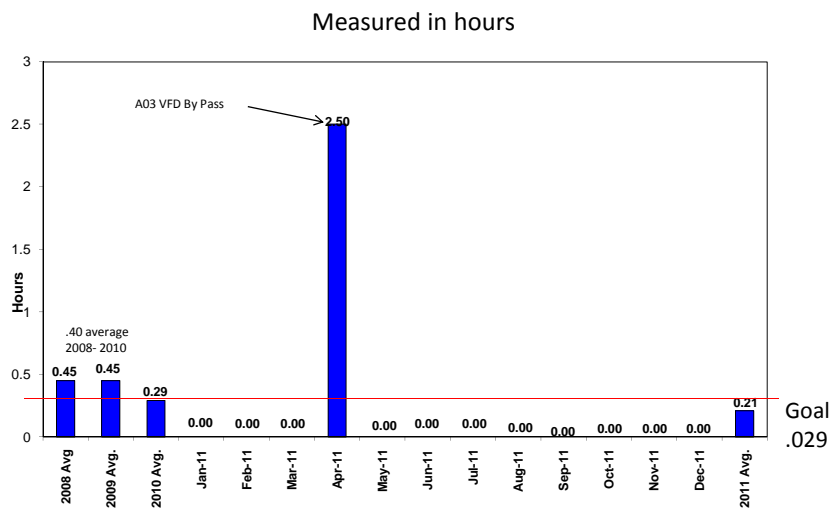
Figure 2- Critical Equipment Downtime Chart

Summary of Research Methodology

As can be seen from the two examples and Figures above, accountability

may not alleviate total control or cease reactionary actions which can lead to

additional risk, in fact in some cases it may actually increase risk. The

transference of the risk is necessary to allow entities that are knowledgeable in the subject areas to make informed decisions when addressing work performance.

In addition to transference of risk, facility managers can develop leadership-based reports to reassign accountability to task owners while simultaneously reducing reactionary actions. The goal of the leadership-based report is to reduce the amount of overall effort required to keep the business process going. It is that reduced effort that will be one of the focus points that will be addressed in this thesis. The use of a cost overview sheet in project management allows the facility manager to review both the performance of the project managers and the health of the budget. The simplicity of the report is paramount when in development. Deciding what to track and how to track it will be an important factor to support successful implementation and usage of the report.

The relevant fact to consider on all the leadership reports this thesis will discuss is how the report can be used as a powerful tool to help reduce the effort required for both the facility manager and the accountable employee. The facility manager should take the role of commander of the ship and his job is to make sure the boat is heading in the right direction. The incremental changes required to get the ship back on course needs to be addressed the moment it goes off course can be considerably less than the distance after the ship has been sailing for days. If we keep this in mind when deciding what information to measure, the more relevant and succinct the report can be. The importance of the leadership reports and what factors should be tracked will be discussed in detail over the next few

chapters. Additionally, this thesis will show how the proposed theory is tested using data from the subject company. Utilizing two variables or departments within the same organization, will demonstrate show that the hypothesis is true by validating the same results in different parts of the organization strengthening the support.

Research Scope and Limitations

The scope of the research includes data from a facilities organization within the defense industry. The first test includes the project management organization and specifically the newly initiated use of a cost tracking measurement system. The use of the tracking form was researched in conjunction with the three hypothesis concerns which included increasing accountability through measurement, decreasing the amount of control required through measurement systems, and the reduction of risk and its association to measurements and reporting.

The second test included the operations and maintenance department at the same host organization. The study revolved around the use of a critical equipment downtime measurement system that tracks individual performance back to critical equipment performance. Again, it is the goal of the hypothesis to align the three focal points of increasing accountability, reducing control, and reducing risk to the corporation into a measurement system.

The focus will be in the areas listed and will not expand any further than what has been outlined. The purpose of this is to establish a very fine point of view and a structured data set while reducing interference from other variables.

Summary of Thesis

  The structure of the thesis is important to guide the reader in the specific direction the researcher has travelled. In this case, the introduction has just been concluded. In the introduction, a discussion of research goals and objectives was completed followed by the summary of research methodology. The research scope and limitations were disclosed by discussing the parameters guiding the thesis. Chapter 2 will visit the literature review where a comprehensive evaluation of what literature was reviewed and how it is relevant to the thesis. Chapter 3 will discuss what the methodology was behind the research and how it was to be collected. Chapter 4 will analyze the results generated by the methodology and will give the first look at the data and its performance. Here various Tables and Figures will be available for viewing. Chapter 5 will summarize the findings by adding a conclusion. Additionally, there is a section on possible future research opportunities to aid in the implementation of said measurement systems.

Chapter 2

LITERATURE REVIEW

Facilities management can benefit from reviewing and addressing several different variables that affect performance. Understanding how each variable affects the performance of the entire organization is the key to becoming successful as a facility manager as well as competitive in the current business environment. This thesis and the associated literature review address the impact of three main areas related to the problem statement and ultimately the hypothesis. The research was broken down into three main topics and sub divided into supporting topics as required. It is important to understand how each topic was researched and how the data resulted. The three main topics are listed below.

- Through self-accountability, the amount of effort required to lead the organization will be reduced.

- The use of leadership based reports reduces the amount of control used in facilities management organizations

- Assigning accountability and utilizing leadership based reports will reduce overall risk for facilities managers

This study can support further research as required at any level of the hypothesis. However, prior to this thesis presentation, leadership reports were used solely to check course and make corrections as necessary. As will be shown later in this literature review, the reduction of effort theory has never been wholly considered when looking at accountability, leadership, and the reduction of control. In a future scenario, the ability to use this data to provide a launching

point and provide a roadmap to efficiency can lead to a reduction of wasted steps. This direct link from managing the process to a self-managed efficient process is the driver of this literature review.

Table 1- Search Term Matrix

Main topics		Results	Good	Reviewed	Final
1. Accountability may not alleviate total control and cease reactionary actions leading to additional risk		43235	11	250	0.03%
2. assigning accountability without control		1771	13	320	0.73%
3. identifying and reassigning risk we do not control is imperative for project management leadership		72	0	72	0.00%
4. why project managers need to create an accurate and solid project risk plan		325	3	100	0.92%
	Sub Total 1	45403	27	742	0.06%
Sub Topics					
5. Accountability and control		34	0	34	0.00%
6. Project manager and risk plan benefits		2083	3	200	0.14%
7. Accountability and total control and reactionary and additional risk		82	0	82	0.00%
8. task and risk management for project managers		549	8	208	1.46%
9. Accountability and no control		689	6	180	0.87%
10. Reassign risk and project management		226	0	50	0.00%
11. Risk list and project management		20	6	20	30.00%
12. Transferring risk and project management		18	5	18	27.78%
13. Managing project risk		39	7	39	17.95%
	Sub Total 2	3740	35	831	0.94%
	Total	49143	62	1573	0.13%

Literature Review Methodology

Among the variables affecting the outcome, specific research on the hypothesis was conducted and findings presented below. The research as demonstrated above shows that there is normally an inadequate amount of specific information related to any one topic. Based on the findings, additional research steps had to be added to include the combination of key terms. The data was then divided into sub topic areas to take individual aspects of the hypothesis into the research phase yielding a more variety of responses.

As initial indication, the review of topics was completed and findings suggest that there is a specific quantity of data available to support risk mitigation and control. As shown in the table above, the topic of risk had the highest percentage of returns. Additionally, the accountability and control search yielded very low results. Use of leadership reports rounded out the research with a high

return in each area yet not directly related as a combined topic result. The results

returned mostly on the fact of report and not directly tied to leadership. As Table

1 above indicates, the percentage of the research topics and the acceptable

returned responses fell into the respectable range. To enhance the return, the

research method divided the search into two distinct areas of main topics and sub

topics. The main topics focus on four specific areas that directly addressed the

hypothesis statement. Interesting to note, the results of the main topic research

yielded more pure results than the sub topics, however, main topics only

accounted for .06 percent of usable data returned could be represented in the

literature review. The largest return of data for a main topic occurred with the

first research statement that addressed accountability, control, risk, and reaction.

The sub topics researched tended to focus on the specific variables of the main

topic line items. For example, the first topic main theme was how accountability

may not alleviate total control or cease reactionary actions leading to additional

risk. This main topic concentrated on a very broad measure of the problem

statement. In order to capture an increased number of results, the topic was

simplified down to accountability with no control. The results of this specific

search decreased the results from 43,235 down to 689. The ensuing impact shows

an increase in usable references of 0.87 percent up from 0.03 percent. The

relevance of the data has shown that specifics or the concepts supported through

research and the hypothesis data are statistically higher individually rather than

whole. As a result, the hypothesis statistically had to rely on research primarily

contained within a subtopic. Based on the findings, the next few paragraphs will

review and summarize the research for existing data and will review what research has been completed and where additional research may be required should further data be required. Furthermore, a review of what methods were available to handle specific issues as individual problem statements presents them through this literature review.

Accountability

After reviewing the literature collected based on a search on accountability and the effect on effort, it became obvious that there was a requirement to divide findings amongst topics (main idea) and sub topics (specific ideas). Research began with the first topic to be substantiated and supported using self-accountability. Additionally, the research helped show how the amount of effort required to lead the organization can be reduced by employing accountability. To help reinforce the research, efforts uncovered references that define how measurement and accountability is valued. The American Society for Public Administration (1992) found that the "use of performance measurement is still the exception rather than the norm in American government organizations ... [T]here is great potential to improve performance, accountability, and reporting, and by integrating systemic performance measurement, monitoring, and reporting, and by integrating performance information into regular policy and management processes"(Straight, 2000). Moreover, the use of reports and metrics can lead to information being skewed or left open for interpretation. It is important to insure that the correct data and collected and distributed to insure the proper values are selected to measure (Straight, 2000). Straight continues to prove his theory by

creating a list of pitfalls to avoid during development as shown below (Straight, 2000).

1. Selecting metrics not matching the goals

2. Selecting or imposing metrics without regard to developing commitment by the team that will have to achieve them

3. Selecting metrics that are counterproductive

What Straight does not discuss in his article is the ability of a report to support leadership based directives or reduction of effort generated by the outputs of the subject reports. As with most of the references reviewed, the subject matter dealt with performance or providing a measurement to receive a desired result not necessarily measured to the reduction of time (Straight, 2000).

Additional research showed the individual characteristic of accountability and its ability to increase performance. This can be correlated to a number of different sources that discussed the benefits of accountability. Whereas, who should be accountable and why. In an article written by Gary Horsfal, he discusses his theory behind personal accountability (1996). Horsfal states, "Attaining a high level of personal accountability requires a certain level of breakthrough thinking. It is not possible in an environment where the people feel that they have little or no control over their own destiny. The truth is that they have complete control and choice over what their particular situation is and that whatever level or lack of control that they experience is only relative to what they have given over to someone or some organization" (1996). This particular reference illustrates that personal accountability is not a natural occurrence in the

workplace attesting that accountability will require sponsor ship at all levels of the organization (Horsfal, 1996). This further proves the importance of assigning tasks and making people accountable for the success or failures of their tasks. To complicate the task of trying to generate a cohesive work environment that supports accountability, it is important to understand that people thrive and strive for comfort. Change is by its very nature discomforting and thus not particularly attractive to most people (Horsfal, 1996). This important fact can help leaders to look inward and discover organizational potential only if the leader can support it. Research revealed that there are problems with assigning accountability. One such problem addresses what happens after accountability is assigned and management controls lifted (Kamery 2004). In his article, *Motivation Techniques for Positive Reinforcement*, Kamery expresses, "Good managers empower employees by helping them to realize that after many years of getting each step approved and working within limited boundaries, employees are free to pursue their needs" (2004). The basis of this empowerment is to delegate responsibility and duty while reducing the amount of control by management. If managers assign tasks to employees without assigning accountability along with it, they have not truly delegated. Employees must accept responsibility and decide for themselves a course of action. Many employees are not accustomed to a style of management that uses empowerment (Kamery 2004). Most research reviewed discussed accountability as related to personal accountability. Research was limited as to showing how accountability can be used to decrease overall effort in any fashion. However, a small excerpt found could correlate that the theory has been touched

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briefly, yet not in the manner expected and further research should be warranted. In the passage, Asare, Trompeter, and Wright state, "previous studies have generally shown that accountability increases effort and improves performance (2000). The idea behind this declaration contends that being responsible for a specific task will increase the effort it takes to complete the task correctly (Asare, Trompeter, and Wright 2000). The article could be interpreted as saying that those who are not accountable do work quicker with less effort because they have nothing to lose and are not going to go back and check the work that they have done (Asare, Trompeter, and Wright 2000).

In conclusion, of this sub section, the data research shows that there has been ample research done in the sub topics as they stand-alone. However, when the sub topics were combined into a hypothesis main topic, the data became very succinct and more defined. The accountability section dealt mostly with how accountability affects performance and other variables. When the hypothesis was researched on how accountability affected effort, the results dwindled to seven. Out of the seven results, only one had any reference to an effect on effort. The passage on effort only discussed how the author believed that accountability increased the effort and the performance together (Asare, Trompeter, and Wright 2000). In the future, more research should be done into how accountability can actually reduce overall effort for both management and workers. This literature review and associated thesis aim to begin this further research.

Reduction of Control

The second hypothesis topic addresses the value and the use of leadership based reports to drive accountability and reduce the control required to sustain the facility and its staff. In certain cases, increased control may be a result of a faulty mechanism within the structure. As Senior states, "Management should be a subtle mix of team coach and team captain. If "command and control" is needed, either the organizational arrangements are wrong or some people don't fit. Maybe both need changing urgently" (2004). The reduction in control is directly correlated to management as a function and can be successful as long as expectations are clear. (Senior 2004). A majority of the research on the reduction control identifies that there are theories to support the solution and researchers know something must be done, but no data grants how the solution may come to be. The reality proves that again we can show a reduction in effort for both management and employee and is instrumental in relation to the hypothesis. One valuable aspect in this section of the research is finding items that lead to the reduction of control. This is supported by theory presented by Arizona State University's Performance Information Procurement System (PIPS) (Kashiwagi and Byfield 2002). One position of the paper's topic discusses how alleviate control by allowing the party with risk to make the decisions. This removes the piece of control from the party that has no risk thus, removing control from something you cannot control (Kashiwagi and Byfield 2002). As an example Kashiwagi and Byfield go on to say that contractors should agree on the criteria and pick their own references to differentiate and show their capability. To take

risk is to take responsibility (2002). This information directly shows the

correlation to hypothesis statement with respect to minimizing control.

Additionally, the PIPS process utilizes various reports to capture and analyze data

while supporting a reduction in control (Kashiwagi and Byfield 2002). This data

is a valuable tool for keeping management informed and is directly related to the

main theories supporting this thesis (Kashiwagi and Byfield 2002). Kashiwagi

and Byfield further illustrate the relationship as they describe the process: "PIPS

uses an AI(Artificial Intelligence) to generate information. The AI decision--

making model makes the selection decision, minimizing need for the owner to

make decisions and minimizes the liability of the owner and the owner's

representative" (2002). Supporting the valued use of reports, Senior also discusses

a theory of relation to leadership reports, "Effective managers must have the right

information. Separate information requirements into two clear sets: (1) optimum

internal data, information, systems, and processes; and (2) minimum but effective

external reporting. Don't confuse the two. Processes also must be focused on the

exact needs of the users. Several focused and integrated processes and systems are

likely to be much more cost-effective than a few monolithic systems" (2004).

Senior's approach is a long-range forecast of what needs to be done to help the

evolution of business management (Senior 2004). Supplementary research

uncovered an additional example of how leadership reports help reduce efforts.

Rawabdeh discusses the use of a waste relationship matrix to identify the

relationship of the seven deadly wastes (2005). The benefit Rawabdeh offers is

that the matrix can reduce overall effort (2005). The waste relationship matrix

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clarifies the relationships among the different types of wastes. It provides an insight, in terms of weighing the contributions to the existence of certain types of waste. The importance of the matrix derives from the fact that it ranks the relationship quantitatively and classifies whether a certain type of waste affects or is affected by other types of waste (Rawabdeh 2005). As evidence to this fact, Rawabdeh offers up the statement: "This has the advantage of providing a focus for managers, reducing effort and time and bringing about improved performance, in addition to quantifying the potential savings based on waste elimination" (2005).

In conclusion, there is specific research data that support the individual sub topic areas for leadership reports and the reduction of control. The data pertaining to the main topic areas are available but limited and deal mostly with the manufacturing sector concerning waste during process steps. One of the authors researched states "Further research should be done in order to investigate the level of reduction in effort and time as a result of implementing the method" (Rawabdeh 2005). In agreement, a leadership approach to the time reduction effects of the report is valuable and supplies the fuel to support the finding that more research is needed in this area.

Reducing Risk

The third topic associated to the hypothesis researched was associated with the ability to reduce risk using leadership reports. The methodology for the research was finding data in support of the reduction of risk as a primary result and explains where reports can be used in conjunction with other methods to

alleviate risk. The research yielded 39 percent of the articles selected. The results were most generous with either risk or risk mitigation. Zhou, Vasconcelos, and Nunes point out that the use of reports actually helps stimulate the thought process and assists creating risk management plans (2008). Zhou, Vasconcelos, and Nunes go on to document that a high-level checklist should evolve over time and not remain stagnant (2008). The new findings will drive change, as it is in use and new aspects discovered (Zhou, Vasconcelos, and Nunes 2008). Understanding that risk is always associated with time or money, the use of leadership reports will help show the value of risk associated for either variable. Zhao mentions the reality that risk supports this and change may cause confusion among project managers as to which risk would take priority in their busy schedules (2005). Zhao continues about the use of reports to help ease the decision process when necessary (2005). The amount and the quality of the resource references available will be a valuable asset in the research results. By utilizing the leadership reports, the findings will show value by reducing the amount of effort for both the facility manager and his or her subordinates. An additional example on the reduction of risk that cites the benefit of accountability comes again from Arizona State University's Performance Based Studies Research Group (PBSRG). In the article, PBSRG discusses advanced procurement theories. PBSRG stated there is an advantage by minimization of risk that contractors do not control. This in turn creates an environment of accountability and creates the competitive advantage for high performers (Kashiwagi, Sullivan, Kashiwagi 2009). The theory continues by discussing a

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visionary approach to the high performers. It was noted that high performers or experts see the project from beginning to end, before they compete for a project, and know the risk that they do not control before they accept the project (Sullivan, Kashiwagi, Kashiwagi 2010).

In conclusion, the final topic and sub topics researched had a significant amount of data returns for individual sub topics. Once the sub topics were combined as "accountability's effect on the reduction of risk", the amount of returned responses dropped significantly. The body of knowledge gained through the PBSRG research had the largest amount of returns to show the link between accountability and the reduction of risk (Sullivan, K., Kashiwagi, J., and Kashiwagi, D. 2010 and Kashiwagi, J., Sullivan, K., and Kashiwagi, D. T. 2009). Researching on how accountability increases risk came up with no responses leading to a thought that accountability and risk had not been researched to the extent required to yield a suitable amount of returns. A further more detailed search into the basis is recommended.

Summary

In summary of the research findings, the quantity of articles collected during the research phase clearly shows that the data can be researched as smaller portions. The differences in the two research methods were significant enough to affect the results. The context of how each sub topic was used almost always did not match the intent of the research results. There were significant holes in the research data for the combined topics that may lead future research efforts. To expand the research through the hypothesis statement, the main core subject areas

were heavily researched as well and included the modified search for sub topics. These areas include the following:

1. Implementation of self-accountability and its affect on decreasing overall organizational effort.

2. The use of leadership-based reports and the correlation in the reduction of control.

3. How the use of leadership reports reduces risk and effort.

Furthermore, it is important to understand the relationship of current facilities management roles and understand how they affect other parts of the organization. The success of the organization depends on removing non-value added tasks while continuing the focus on numerous items. Based on his information, the amount of exposure to a particular item can be minimized while supporting the increased speed of business today.

With reference to accountability, there is potential to improve performance, accountability by integrating performance measurement reporting (Straight, 2000, Sullivan, K., Kashiwagi, J., and Kashiwagi, D. 2010 and Kashiwagi, J., Sullivan, K., and Kashiwagi, D. T. 2009). Management support of accountability efforts showed a benefit to support self-accountability (Horsfal, 2009). Additionally, empowerment can be used to delegate responsibility and duty while reducing the amount of control by management (Kamery 2004). To the contrary, there was research data returned that supports that accountability actually increases effort (Asare, Trompeter and Wright 2000).

Research conducted on the reduction of control using leadership reports yielded better returns than other topic areas. Senior points out that control is give and take and if something doesn't work, one of the numbers in the equation is wrong (2004). The PIPS program from Arizona State University demonstrated the use of reports and the affect of minimized effort and data to support leadership function (Kashiwagi and Byfield 2002). The PIPS process utilizes various reports to capture and analyze data (Kashiwagi and Byfield 2002). The use of reports showing reduction in controlling activities was apparent in the article by Rawabdeh where a waste reduction matrix was created (2005). As evidenced above, reviewing the causal effect of leadership reports and ensuing effect on control can complete a more definitive research effort. However, supporting data was found to reinforce the thesis body of work.

Reduction in risk is an important part of managing a facility. The use of a proper risk mitigation plan helps stimulate the thought process (Zhou, Vasconcelos, and Nunes 2008). This helps the accountable people think through all the available options they control and that they might not control; as this can add effort to the project or change the established budget (Zhao 2005 and Kashiwagi, Sullivan, Kashiwagi 2009). The amount of data collected will support the thesis. Again, looking at how the research terms are put together directly affect the responses. Individually there were numerous responses to the sub topics. However, when sub topics were combined, the amount of returns dropped indicating the amount study done in the specific area of the thesis was lacking.

Chapter 3

METHODOLOGY

The methodology to test the hypothesis involved two different case studies

incorporated into a facilities management organization. The cases are two

separate parts of the organization and will be a good test of the hypothesis due to

the varied degrees of separation between the two entities. Neither area has any

overlap in duty however; there is collaboration during the normal work efforts.

The hypothesis has four main areas to be tested showing an impact on efficiency:

1. Reduction in effort

2. Reduction in managerial control

3. An increase in low level accountability

4. Reduction in overall risk

It is the goal of this test to show unequivocally that by using a leadership

report, all four variables can be reduced by a quantifiable amount. The test of the

hypothesis will validate the data as true and will address nothing more then these

facts.

Hypothesis Case Test #1: Cost-Tracking Database

Keeping the ever-changing speed of business in mind, the hypothesis

needed to focus on cycle time of projects. To support this, it was the main idea of

the hypothesis to:

1. Reduce effort by allowing financial activities to be collected real
   time.

2. Reduce managerial control by utilizing a leadership report to view high-level performance data.

3. Increase low-level accountability by pushing data collection at point of use.

4. Reduce overall risk forecasting overruns and under runs and by analysis of change orders and associated criteria.

The objective was the implementation of a system to help keep management up to date on the health of the project management organization. The system was required to:

1. Support reducing efforts involved in sustaining various financial project management tasks.

2. Increase the accountability to end-users in support of capturing and maintaining project financial data.

3. The reporting function of the system documented the proof of a reduction in managerial control.

4. Using the cost tracking system, a reduction in overall risk should occur.

Test Environment

In order to test the hypothesis, a project management organization at a top ten U.S. defense contractor was selected. The demographics for the subject organization involved included:

1. Self-performing project management office serving the facilities department.

2. Staff ranged from two years of service up to thirty-five years.

3. Project limit of 1.5 million dollars maximum.

4. Strict guidelines and processes that supported the various project management functions with limited flexibility.

Analysis

Upon review of the prior conditions, it was evident there were some key performance indicators missing and in some cases, misapplied. These indicators included:

1. No method to track cost or change orders within the existing system.

2. No formal reporting process or standard report that supported the leadership team.

3. No documentable accountability back to project parameters other than outcome.

4. Project cost were tracked at the finance level and not at the point of use adding time to the end of the project and increasing the risk to the budget.

During the review, it was found that existing project process supported the projects until the completion where budgets were tabulated to determine performance against the goal. Leaving the fund details to the end of the project created a very rigorous effort to verify invoices received and booked. Additionally, if project assumptions changed in the project, there was no way to evaluate the impact against the approved budget. Thus, change orders could not

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be fully evaluated at the time they were generated to allow for an accurate account of the change or determine impact, which added risk to the project. A few of jobs were noted as coming in under budget and there was no way to notify management for budget reallocation. Similarly, the project overruns has the same effect as well. For the projects that overran, there was exhaustive effort to recreate the wheel; how did the overrun occur and how much more budget is required? How much do we amend the funding document for?

Adjustments

The hypothesis presented the case that change was needed based on the initial conditions documented above. To help align the organization with existing project management methodologies, a process was charted by the local organization. A review of key finding provided the roadmap to support use of the leadership based reporting system.

The goal of the proposed condition was to:

1. Create a system environment where all cost could be captured real time.

2. Develop a level of accountability at lowest level for capturing and reporting project data.

3. Data needed to be updated, accessible, and reported throughout the project life cycle.

4. Data needed to be able to be queried to support decisions for work outside the agreeable scope.

One major benefit of the new system was the reduction in the amount of effort required to verify cost. At the end of the project, reconciliation of project funds was reduced to doing a simple query of the database. The reduction in cost gathering activities had a compounding effect by simultaneously reducing risk created by missing data or untimely data leading to budget shortfalls. Additionally, the system was accessible for a variety of communication reasons to a wide audience that includes all project constituents and stakeholders. To accommodate the communication aspect, this report was integrated to the web and affixed to the Computer Assisted Facilities Management (CAFM) system. The simplistic nature of the web reduced the effort required to communicate project status. To finalize the system, the creation of a director's overview page was implemented to allow users to get a quick overview of organizational performance. Additional benefits of the new system included the ability to provide real-time data on project performance with the ability to supply reports as needed. This was a two-fold solution since it also increased accountability on part of the project manager to add his project data to the system. Since the project manager knew he or she was providing data for the report being viewed by upper management, he or she was more likely to insure the data was up to date and relevant. This in-turn allowed management to reduce control because data was simply at their fingertips. No longer did management need to badger the project manager for information. That is, provided the data was accurate. In the existing condition, the data was contained in different databases making data mining very difficult. To enhance communication with executive management, the

incorporation of the director's overview page that allows a quick glance of the various projects along with the different performance indicators. This feature helped eliminate duplicate data streams throughout the project communication events.

Key benefits realized by implementing the cost-tracking database:

1. Reduction for effort required verifying cost.

2. Reducing risk created by missing data or fixing untimely data leading to budget shortfalls.

3. Reduction in managerial control and influence through proactive reporting methods.

4. Increasing accountability on part of the project manager to maintain data in the system.

5. Accessible to all project constituents and stakeholders.

6. Integrated to the web and queried the Computer Assisted Facilities Management (CAFM) system.

7. Enhancing the communication model through the leadership report.

Summary of Testing

The use of data from the cost-tracking database benefited the organization by providing real time data and historical costs by logging into one common database. Since the database could query a number of different variables, data mining took little time in comparison prior to implementation leading to a reduction in effort. The database allows instantaneous access to current project

financial data to produce instantaneous reports showing current project progress

while reducing effort required to communicate progress to stakeholders via email

or web browser. Additionally, the use of the database helps push accountability

down to the end user. The responsibility to maintain the various project data

components also falls to the project manager further providing critical support to

the value of the accountability concept. Additionally, the accountability moves the

risk to the task owner rather than the manager assuming the risk by dictating an

action towards a particular outcome. Moving the responsibility to the project

manager also helps reduce the amount of managerial control. This is achieved by

providing an in-demand access to the project data while simultaneously reducing

effort of retrieval and the minimization of control on part of the manager. The

ability to lead the project with the understanding the impact of a change order or

using the contingency is a primary benefit. The data is now pushed from the

lowest level and viewed at the convenience of the director. Having this data

derived from the lowest level reduced control on the overall process. When

compared to data being pulled at the management level, it was discovered the

activity itself actually reduced control to the process. To test the hypothesis, the

review of business administrator functions that supported the projects was

initiated. As listed above, the findings indicate that a majority of time is spent

supporting projects. Time was being consumed locating and verifying cost

information for management, project managers, and finance employees. This

resulted in an average of twenty-four hours each month researching financial

project data per project. The activity would result in a three-day delay in project

closing. Once the cost-tracking database was implemented, administration support time was cut from a twenty-four hour a month activity down to an eight-hour activity per month. This resulted in a reduction 69 percent effort in just the admin activity alone. The project-closing task was also reduced by three days. The documentation of this reduction in effort helps prove the hypothesis as true. The utilization of leadership reports helps optimize project time by reducing the effort required to support a project. This is achieved by making the project manager accountable for the data collection strategies employed. Additionally, using the leadership-based reports by analyzing budget impacts can mitigate project risk.

Hypothesis Case Test #2: Critical Equipment Downtime

The goal of the hypothesis in this case test is to provide a leadership based report to understand and reduce the amount of downtime associated with critical equipment. The report will have the following features:

1. Categorizes critical equipment based on importance.

2.   Looks at types of failures.

3. Looks at the frequency of the failure.

4. Acts as a springboard for future maintenance plans based on failure frequency.

These important aspects were missing in support of facilities management effectiveness at the O and M level as most equipment utilized a run-to-fail methodology. Additionally, to test the hypothesis, the inclusion of the following features would be required:

1. Reduce effort required to generate and maintain reports and equipment.

2. Reduce managerial control by allowing the data to run frequency of maintenance efforts.

3. Increase low-level accountability by allowing the technician to own the data used to create the report and link to performance.

4. Reduce overall risk by identifying critical equipment needed to run the plant and creating a maintenance schedule tailored to the failure rate.

Test Environment

As with the first test case, the same company was utilized as the test case. However, a different part of the organization was utilized. The theory behind using a different part of the corporation was to see if the hypothesis is true between those two organizations with different goal and leadership. If the theory can be proven between two different parts of the organization, then the hypothesis must be true. The test organization met the following criteria:

1. Top ten U.S. defense contractor.

2. In-house operations and maintenance group.

3. Reactive maintenance practices.

4. No tracking of data.

5. Old school leadership (iron fist).

Analysis

At the onset of the initiative, it was important to understand how the organization operated. Key leadership traits were looked at with regards to the operational and maintenance aspects. The findings are below:

1. Leadership was not predisposed at looking at the big picture.

2. Maintenance was only done as reactive or breakdown mode.

3. Little to no proactive maintenance was done especially reviewing the critical equipment that was needed to support the business.

4. No charts or graphics were available or generated to look at trends.

5. No quality checks at the end of the task.

The disquieting issue became prevalent when critical equipment failed. This forced nearly all repairs into emergency basis and usually incurred overtime and expediting of replacement parts. Looking at the way this was handled prior to the creation of the leadership-based report is important to the insight of how the organization functioned. Maintenance was done on a frequency that bordered on a run to fail environment. No charts or graphics were available or generated to help support how a particular piece of equipment was performing or weather it was within normal operating parameters. In regards to the facilities management's perspective, the leadership team was made of employees who essentially came up the ranks in their associated trades. There was little paradigm shift when they held positions of power. To compound the situation, the quality of the periodic maintenance was not quality checked and therefore, machines went down based

on unsatisfactory work. This magnified the issue and effect of reactive maintenance.

Adjustment

A change was needed that allowed the leadership team to evaluate the performance of equipment. More importantly, identification was required to study which pieces of equipment were critical to the business and how they failed. Once identified, an initial push began with a process implemented to capture the failure rates of the selected equipment. With the inception of a critical equipment downtime report, several aspects of the organization began to change and are listed below:

1. Creation of the critical equipment downtime metric.

2. List of critical equipment required to keep business in operation.

3. Development of a proactive maintenance plan that reduced the effort associated with each piece of critical equipment.

4. Reduced managerial control of the maintenance plan.

5. Reduced the risk of unforeseen down time.

Once the plan was created, it was clear by the performance of the organization the report directly supported productivity efforts. After the downtime chart was developed and implemented, management could finally identify the cost of downtime and associate the risk. In turn, the organization could easily track and devise a plan to reduce reactive maintenance and emergency work that directly influences cost and time. In addition, the report allowed the organization to manage resources more effectively than in the past. An established baseline for

critical equipment was generated that allowed management to review the current

performance with the past performance which supported continual improvement.

Summary

The data shows that the implementation of the critical downtime report

had the following effects in addition to the benefits above:

1. Reduced effort by allowing the organization to realize which

   equipment was critical to the support of the corporation and

   creating a proactive plan to manage it.

2. Employing leadership traits and reducing decisions by individuals

   through automation of data collection methods and allowing data

   to drive efforts.

3. Allowing accountability to the technicians for their assigned

   maintenance functions and accuracy of the data.

4. Work on equipment just prior to breakdown frequency reduces the

   risk of an unforeseen failure.

One of the most pronounced features of the downtime data is the

mitigation of risk. The use of the new data addresses and mitigates the risk by

identifying the equipment's known failures and documenting the frequency of

those failures and assigns a cost. Cost now could be assigned a risk factor for

decision purposes. As mentioned above, the use of the report also addresses the

accountably aspect. The accountability aspect pushes the data-collecting task

down to the technician and provides direct accountability for the accuracy of the

data. Moreover, providing the data to a central repository and having multiple

inputs reduces effort, managerial control, and risk while increasing the

accountability at the lowest level. Addressing the reduction of control, the

leadership report allowed the leadership staff to quickly analyze the failure rate

and insure that the trends are heading in the correct direction. This was achieved

by allowing maintenance employees to do the job as indicated by the report

focused where the attention was needed reduced the control. The collected data

proves that through use of a leadership report that effort, control, and risk can be

reduced.

Table 2- Condition Index

Condition Index		
Cost Tracking Database		
Existing Condition	**New Condition**	**Outcome**
1 No method to track cost	Create and track Cost info in database	Reduction in 12 hours of effort per project
2 No method to track Change Orders	Create and track CO in database	8 hour reduction of effort researching cost & reduction in risk for $55,783 CO
3 No formal reporting process	Director level web based report	Reduced the number of steps by 8 required to provide reporting data
4 No documentable accountability	Project manager responsible for data accuracy	Over 4 years, project underruns averaged 14%
5 Project cost tracked at the finance level	Projects tracked at project manager level	Change orders accounted for .08% of budget
Critical Equipment Downtime Report		
Existing Condition	**New Condition**	**Outcome**
1 Management was blind to the big picture	Leadership reports with predictive trends	2004: realized that each piece of equipment cost the company $408 per hour when down
2 Maintenance was reactive	Proactive maintenance plan	Reduced unplanned activities from 44 down to 6 in a four year period
3 No understanding of critical equipment required	Development of critical equipment list	Develop a list with 10 type critical of equipment
4 No charts or graphics to measure performance	Development of perfomance measures	16.8 failure reduction over 9 year period
5 No checks on quality of maintenance	Tracking of performance data on task	Showed a 13% reduction in service related calls year over year

Chapter 4

DATA ANALYSIS AND RESULTS

The previous chapter discussed the methodology for data collection

behind both the cost-tracking database and the critical equipment downtime

spreadsheet. It also illustrated the steps of how data was chosen and summary of

what data was collected. The data collected using the methodology in the previous

chapter will be analyzed in this chapter to validate the hypothesis. The intention is

to show that there is sufficient evidence to imply that the use of data in the form

of a leadership-based report has the ability to reduce overall effort, increase low-

level accountability, reduce managerial control and reduce the amount of risk

associated related to projects and maintenance. The outcomes of the analysis are

listed below:

1. A reduced effort captured for project management financial activities

    by sixty-nine percent equating to 16.5 hours of reduction. This was

    substantiated by additional data showing a reduction in one hundred

    eighty-two unplanned activities over a one-year period for the

    maintenance department.

2. Increased accountability contributed to a twenty-one percent reduction

    in variance average over a four-year period. The data also showed a

    reduction of twenty overruns by the same period as well as a reduction

    in the average overrun percentage. For operations and maintenance,

    increase accountability accounted for failure reduction by five over a

    nine-year period.

3. Reduction in control is achieved by minimizing the number of steps required to run the facilities work request. The reduction was completed by rearranging the financial process and by reducing overall steps by one to achieve an efficient eight-step process. The process was essential in developing a report, which allowed management to monitor from a distance. Within the operations and maintenance field, the tracking of individual performance as opposed to managing daily events lead to a reduction in critical equipment downtime by 0.19 hours based on a three year average of 0.40 hours prior to implementation.

4. Reduction in risk was realized by tracking the number of project change orders against overall budget that led to a total drop in change orders by twenty. The development of a top-ten list of critical equipment required to sustain business operations showed a reduction of five failures over a six-year period.

Data Collection

The data collection was initiated by the need to drive decisions and accountability to the lowest level while simultaneously decreasing effort and risk. In order to keep a facility productive, it is important to focus on certain business factors that drive a reduction in bottom line budgetary commitments. The company participating in the study was a top-ten defense contractor. The study correlated two separate facets of the organization. The two areas involved included project management organization and the operations and maintenance

organization. The demographics of the project management organization and operations and maintenance were similar. Both engage self-performing tasks for ninety-five percent of all activities. The Staff experience ranged from two years up to thirty-five years with the majority belonging to the latter. The project group supported projects up to 1.5 million dollar threshold as a maximum. Both organizations utilized strict guidelines and processes that supported various pieces of the respective functions with limited flexibility outside the accepted process. Over the next few paragraphs, a review of how the data was collected will be discussed along with an analysis of the outcomes and the affect upon the hypothesis.

Effort Reduction

The reduction in effort metric data was collected by the need to be timelier in financial reporting and more efficient in the overall process activities. The existing process had the information generated after the project was completed which delayed project performance results and other financial steps such as capitalization of assets. The steps taken to collect data involving effort reduction were as follows:

1. Create a baseline to measure against the total number of hours used during project closing activities specifically reviewing before changes and after changes affects.

2. Relocate the financial reporting sooner in the process as to provide a proactive mechanism for reporting performance to management. This is

achieved by having project manager administer as part of his or her project

tasks through accountability.

3. After the cost-tracking database is implemented, measure the amount of

time consumed by project closing activities.

The findings indicated that moving the financial reporting step to the project

execution stage and adding a process to track project expenses real time

contributed to a reduction in hours required to close the project. Prior to the

changes, the closeout activity took an average of twenty-four hours. After the said

changes in the process, the hours decreased to 7.5 for a 69 percent reduction in

effort for this task. See table below for more detailed breakdown of the outcome.

Table 3- Project Closeout Matrix

	2010 Project closeout	2011 Project closeout	Difference	Improvement
Number of projects	44	24		
total hours of closeout	1056	180	876	
Average hours	24	7.5	16.5	69%

As discussed earlier, aligning the financial data collection step to the

project manager also allows for flexibility when addressing change orders or any

other variables that may affect project funds. Because of this information, the data

collection was moved to the assigned project manager. Although, it may appear

that aligning the task to a different owner is simply moving the task and time to a

different location, it is evident that the impact to total project time is reduced by

the ability to review dominant information at the time it is the most relevant. The

ability to make adjustments in project scope and schedule requires less effort

before an approval can occur.

As a result, achieving the following steps created the new process flow:

1. Move the cost collection steps from the end of the project or the project-closing step back to the project execution stage and utilize real-time data for approvals.

2. Move the task ownership from the financial administrator to the project manager. This was logical because he or she has direct impact through various project financial instruments that affect cost and schedule.

3. Measure end state to make sure that reduction is occurring; make adjustments as required.

For the operations and maintenance organization, the implementation of the site wide service call report lead to a reduction in unplanned activities. The steps leading up to the reduction included an analysis of the number of service calls made in a given year reviewed against the prior year. The results were measured against the improvements over time. With the addition of a focused maintenance program, the output of the proposed change showed improvement over time. This improvement was achieved by:

1. Generate list of service calls by trade and track by year.

2. Track the calls over time to see which trades are subject.

3. Align maintenance functions to address a plan that would be proactive to reduce the number of failures.

4. Track the measures over time to show performance improvement.

The results of the change uncovered the fact that an unplanned effort actually takes more resources to solve. When a service call comes in, it takes effort to schedule, effort to troubleshoot the issue, effort to create a plan of action,

and effort to generate a corrective action measure to insure it does not happen again. Tracking these trends give the operations organization valuable data to plan and prepare for the failure thus reducing overall effort required to both maintain and repair the asset. The table below illustrates how the data was tracked.

Table 4- 2010 Service Call Matrix

Service Call Report 2010														
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	Improvement
HVAC-2010	68	51	65	52	54	77	128	67	43	67	95	53	820	17%
HVAC-2009	63	60	53	53	67	37	66	42	46	76	68	51	682	
Lighting- 2010	103	93	100	88	68	77	78	81	93	76	68	118	1043	-19%
Lighting- 2009	115	103	121	205	115	82	82	101	80	94	85	60	1243	
Electrical- 2010	62	15	19	19	10	10	11	13	18	14	29	13	115	-12%
Electrical- 2009	21	31	32	45	18	16	10	15	19	15	26	9	129	
Plumbing- 2010	0	0	0	0	0	0	0	0	0	0	0	0	0	-106%
Plumbing- 2009	38	68	0	0	0	0	0	0	0	0	0	0	106	
Total	470	421	390	462	304	273	354	291	262	313	316	282	4138	-30%

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The resulting data shows a reduction in traceable service calls by trade type year over year. After implementation of a targeted maintenance plan, the service call number reduced by 182 for 2010. This illustrates that measuring and planning data and activities actually reduced the effort required to manage the maintenance system and reduce time during scheduling activities answering service calls.

Increased Accountability

The data collection methodology developed to show increased accountably and its affect to project performance was generated by a need to reduce overall cost and increase the performance of the assigned project manager. Measurement is a sign of accountability especially when linked to performance evaluation. This data collection metric was used and involved both project managers and the operations and maintenance organization. For the project management organization, it was important to reduce the amount of overruns especially those driven by change orders. The collection of the data involved the following steps:

1. Collect data on project over runs and cost variance by utilizing past performance.

2. Analyze the performance periods to establish the actual performance.

3. Establish the overrun rates and variance percentages to measure against.

4. Modify existing process to include a leadership-based report supported to track individual performance.

Table 5- Overrun Analysis Table

Year	Number of Projects	Estimate	Actual	$ Variance	% Variance	Reduction		Overruns	Reduction		Percent overrun	Reduction
2007	85	$1,726,108	$1,259,821	$466,287	37%			26			31%	
2008	86	$2,621,386	$2,025,872	$595,514	29%	8%		23	3		27%	-4%
2009	46	$5,418,210	$4,632,887	$785,323	17%	12%		1	22		2%	-25%
2010	44	$4,125,588	$3,542,793	$582,795	16%	1%		6	-5		14%	11%

Total Improvement   77%

As shown in the above table, after implementation of the cost-tracking database at the end of 2008, the amount of over runs decreased by twenty supporting the accountability hypothesis. The data shows that by tracking and measuring project manager performance, the performance and effectiveness of the individual increased and drove the number lower year over year. The impact of this change was tracked over a four-year period. The results reported out positive impact as to the effectiveness of increased accountability on the budget variance.

As an additional support for utilizing increased accountability, the operations and maintenance organization look at service calls by type to determine suspected problem areas. In the early days of facilities management, planning and cost containment was never a driving factor. In fact, the focus was solely on customer service with little regard to the bottom line. As times got leaner, cost became a factor. Executive management began to track the facilities contribution to the products manufactured. This drove early cost cuts and other directives aimed at bottom line improvement. Management reviewed the cost structure and discovered that a large number of service calls from customers participating in driving a high cost to do business. To get a better understanding, the following steps were taken to begin the measuring:

1. Measure the different types of equipment failure for critical equipment and tie them back to the systems that serve them.

2. Include past performance of failures in data collection.

3. Review the data as baseline.

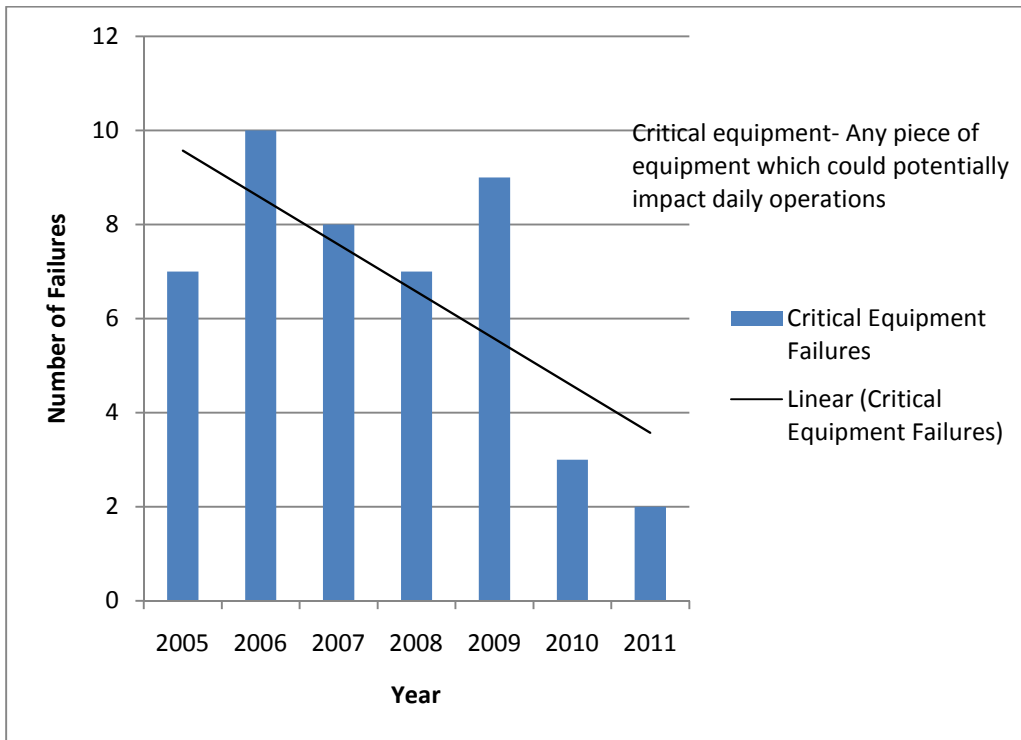4. Track equipment failures to a specific cause.

Figure 3- Critical Equipment Failure Chart

The Figure 3 above shows that over time, identifying and tracking the equipment failures allowed recognition of what failed and the possible root cause for the failure. The definition of failure is any piece of equipment that simply stops working causing downtime and a disruption to the business process. For example, the characterization of the failure provided data to the cause of the failure that may be the quality. Each failure was tracked and eventually reconciled to an individual performing the task. Part of this discovery lead to technicians not

having the correct discipline to get the task completed. Additionally, nothing was tracked in the past structure so individual performance was not addressed. Management decided to track the task to the technician and guide the accountability of the performance for that equipment to the individual's level. The accountability phase of this process helped trace the performance and the maintenance tasks for a failing piece of equipment back to the technician who serviced it. The result of the data collection provided a benefit that showed a reduction of eight failures of system equipment over a six-year period.

Reduced Control

When looking at measures required for reducing control, the project management organization looked to the internal process to run a construction project. The goal was to look for opportunities to put the financial process step in a position where control is reduced simultaneously looking for ways to reduce the number of steps. The steps required to collect the data were:

1. Map the existing process.

2. Review existing process steps for proper alignment.

3. Remove steps not required or combine steps.

4. Relocate strategic process steps to support reduction in control.

The review of the data collected found that the financial process would be better suited in the interest of reducing control at the beginning of the project management process where data could be collected real time. The current process had cost collection at the very end of the project. The two Figures below show the entire process from start to finish. The processes in red show the change as related

to the cost tracking and its realignment. The reduced control reduced effort by

management reviewing performance data as opposed to telling an employee what
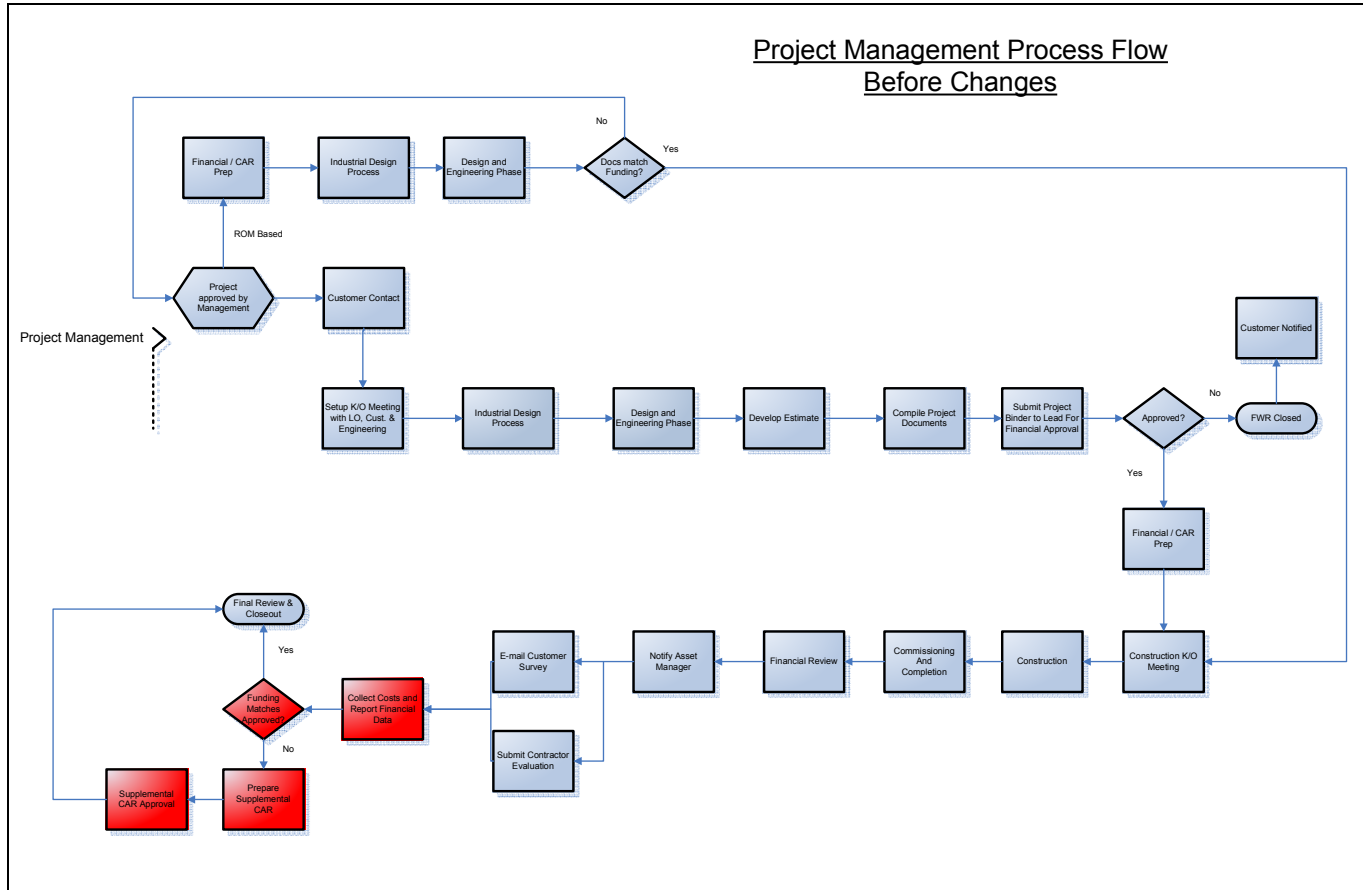
to do at each step of the process.

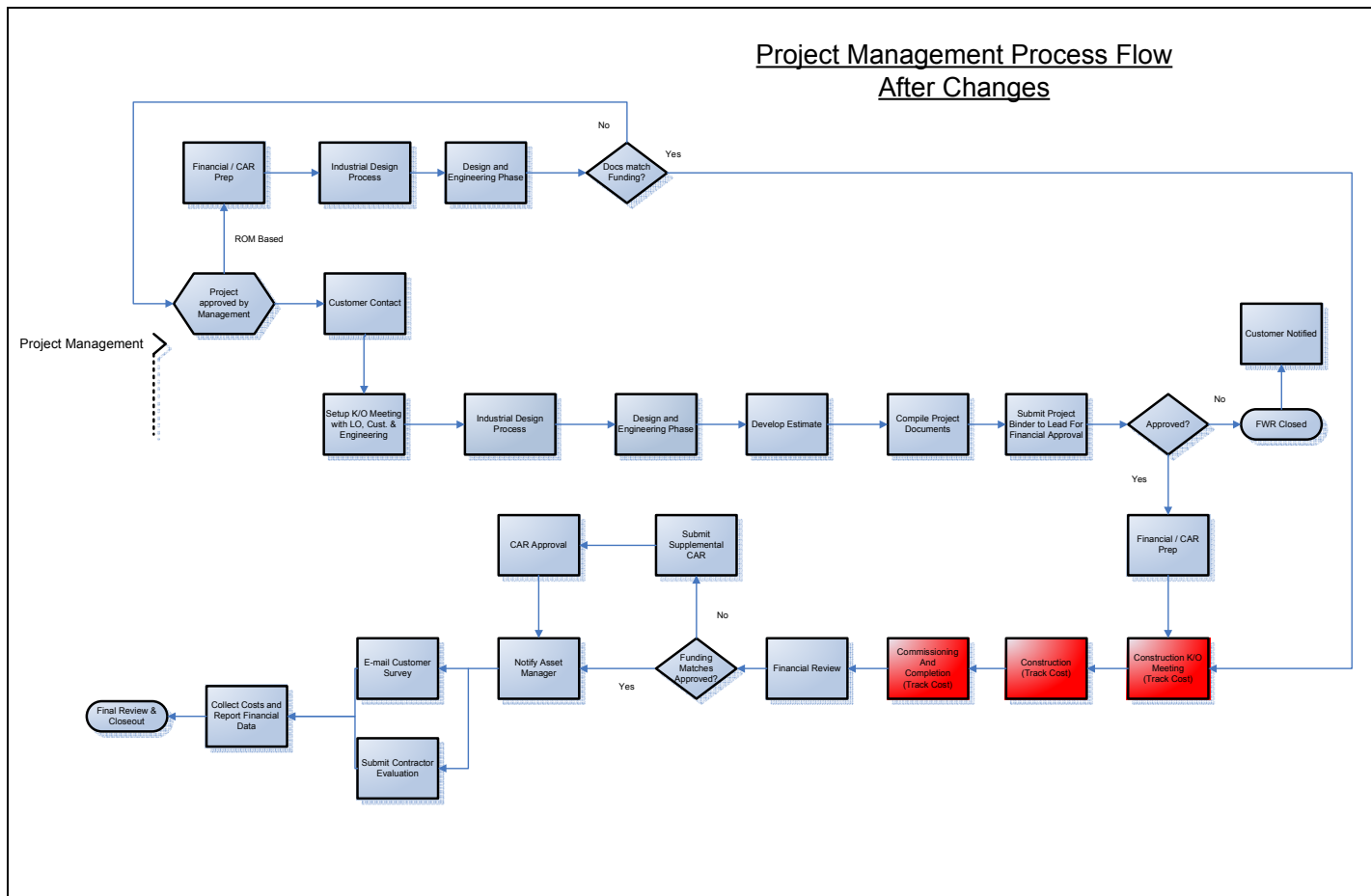Figure 4- PM Process Flow Prior to Change

Figure 5- PM Process Flow After Change

The data and standard project management processes showed that it was timelier to capture costs as in the project execution stage. Upon further review of the process, it was determined that the removal of one-step improved overall throughput and decreased cycle time. The elimination of the capital appropriation supplemental step at the end of the project eliminated the 16 hours from the process. The steps to achieve the reduction are listed below:

1. Reduce the amount of control implied by management by supplying a report that provides a glance a project performance and health.

2. Reduction of 16.5 hours per project required to collect and analyze the financials (shown in the effort section).

3. Align the process to support quicker project closeout process leading to efficient capitalization.

With the new improvements in the process flow, the finance admin had time to close out the projects in a timelier fashion.

From an operations and maintenance perspective, the reduction in control is achieved by the following method with respect to critical equipment:

1. Tracking the individual service calls generated and tying them back to individual performance.

2. Review of data against historical performance of downtime.

3. Take corrective action to reduce the amount of time equipment is not running.

4. Increase the ability to observe the raw data and provide insight to the
   effect of failure.

The failure could be either man or machine and that data becomes very powerful once identified in a measured environment especially when aligned with a monetarily.

Referring to the Figure 2 in chapter 1; the graphic shows the effects of measurement over time and the use of meaningful metrics that reduce control. Based on two billion dollars in sales, lost time could be tracked in revenue opportunities missed. In the example above, each piece of equipment down equates to a $103,000 loss sales per hour. The total uptime opportunity hours for all critical equipment are 525,408. The use of the data allows the management team to review results without direct contact. Corrective actions can be implemented as soon as a course correction is identified to meet corporate goals. In this case, the reduced control and the use of the report accounted for a 0.19-hour reduction in critical equipment downtime when compared against the average of 0.40 hours over the four-year performance-measuring period.

Reduction in Risk

In the project management domain, project risk can be a very detrimental feature of the overall project plan. In the evaluation of the single most detrimental risk, the change order has the most impact to both schedule and budget. In most project plans, change orders are inevitable. To better minimize the risk to the organization, it was crucial to whatever cost tracking method was employed, should include a change order module. The module needed to be forward looking

and able to work with what-if scenarios to support the minimization of decision-making. In addition, to be successful reducing risk, different aspects would need to be measured. The information would be utilized in the approval process to help decide whether to accept the proposed changes. To collect the data involving change orders, the following process was used:

1. Collect the past performance of projects in the form of change orders generated.

2. Identify the value of the change orders prior to the implementation of the cost tracking database

3. Establish the benchmark to measure against.

4. Show the reduced change order amounts as a reduction in project risk.

All change orders are logged and generated in the tracking database. This would allow a review of the impact to budget while reducing the unknown risk associated with the change. Figure 6 below shows the director's overview page of the cost-tracking database. The page allows a quick view of project health will increasing accountability, and decreasing control and risk through measurement methodology.

Figure 6- Cost-Tracking Director's Overview Page

The process also provides a method for generating improved financial performance by determining the impact of the proposed change prior to implementation. The chart below shows the improvement over a four-year period.

Table 6- Change Order Reduction Table

Year	Projects	Budget	Change Orders	Reduction (yr/yr)		Percent	Cost	Reduction(yr/yr)
2007	85	$1,726,108	26			30.59%	$206,961	
2008	89	$2,621,386	22	4		24.72%	$159,106	$47,855
2009	46	$5,418,210	0	22		0.00%	$0	$159,106
2010	44	$3,465,155	6	-6		13.64%	-$71,232	$71,232
			Total Drop==>	-77%			Total Drop==>	$278,193
						-66%	Decrease in risk to budget	

The decision to employ a change order module was driven by analysis of the performance of the 2007 through 2010 project budget. The reduction in change orders took a total drop of 77 percent over the four-year performance period. That correlated the changes orders reduction in risk to budget of $278,193 or 66% decrease. Additionally, for the year 2010, there were only six projects had change orders approved equating to 13 percent of total jobs. The goal was to

drive this down further using the cost tracking report. The report became fundamental in supporting the budget and schedule within the project management process.

On the operations and maintenance side, the report was used to generate a top-ten list of critical equipment. As with any critical piece of equipment, unscheduled downtime can cost the company revenue and place risk on meeting the top management operating goals. The creation of the top-ten critical equipment downtime report allowed management to both identify and measure the most critical equipment performance while simultaneously reducing the risk to the corporation. The effort began with the following steps:

1. Begin data collection of all the different pieces of equipment.

2. Divide the list into critical and non-critical when reviewed against business needs.

3. Create a list of the top-ten most critical pieces of equipment.

4. Develop a plan to maintain the list and track performance for the top-ten list.

5. Benchmark the equipment and generate plan to maintain the equipment.

Table 7- Critical Failure Table

Top Ten Failures	Electrical unit subs and feeders	Chillers	Pumps	Cooling towers	Air compressors	Air handlers	Emergency generators	Electrical panels	Electrical transformers	Potable water system		Total	Reduction
2008	0	2	0	0	0	3	1	0	0	1		7	
2009	0	1	1	0	1	4	1	0	0	1		9	29%
2010	0	0	0	0	0	2	0	1	0	0		3	-67%
2011	0	0	0	0	0	1	0	1	0	0		2	-33%
Total	0	3	1	0	1	10	2	2	0	2		21	-24%
							Total Average Reduction=	-24%					

As shown above in Table 7, the table tracked how many times each chosen

piece of equipment failed. Once the data was gathered, it was analyzed for the

cause of failure by month. This provided the operations and maintenance team

with data to develop maintenance plans to help drive the failure number down 24

percent through predictive measures. The chart below shows the performance of

the organizations efforts. The chart reflects a downward trend over time. A

reduction of downtime was realized based on the organizations stance for

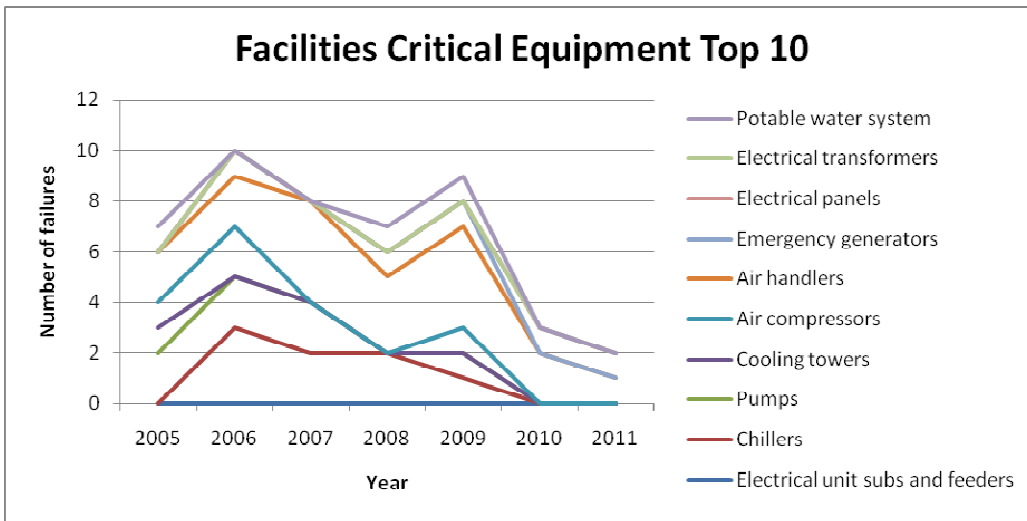maintaining operations and minimizing business disruptions.

Figure 7- Top-ten Failure Chart

Summary

The results of the data analysis validate the hypothesis that leadership-

based reports have the capability to enhance the performance of the facilities

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management organization by a series of measurable factors. These significant factors are identified by the following benefit areas in both a project management subject area and the operations and maintenance subject area.

- Use of a leadership-based report reduces effort through the reduction of time taken to collect and track project financial data.

- In operations and maintenance, the reduction in effort was achieved by the ability to track the number of unplanned activities and create a proactive plan to reduce the number of failures.

- The report contributed to increased accountability of the project manager's to a point where projects budgets began to reduce. Additionally, the incidence of over runs diminished.

- The accountability aspects of the leadership-based report also help operations and maintenance organization reduce failures over time by measuring the individual performance of equipment and employing predictive practices.

- The leadership-based report helps reduce the amount of direct control by guiding the rearrangement of existing processes and removed steps required to run the process. Reduction in control is achieved by minimizing the number of steps required to run the facilities work request thereby reducing the amount of managerial control.

- Within the operations and maintenance field, the reduction of control was achieved by tracking individual performance, which led to a service call reduction.

- Reduction in risk was realized by utilizing a version of a leadership-based report that looks at total change orders in comparison to the operating budget. The report can be referenced when approving change orders.

- For operations and maintenance, the top ten list of critical equipment reduced the risk associated with downtime and its impact to business operations.

The results have shown a significant improvement for both organizations in the areas in listed above. Additionally, the impacts of the improvements helped keep budgets in line with corporate guidelines, reduce business impacts, and increase quality assurance activities as related to preventive maintenance performance. The efficiency of the organization has increased and most of the activities have been pushed down to their lowest level reducing the amount of managerial control required to meet corporate objectives. The leadership-based report provides a quick indicator to the staff and allows minute course corrections required to meet organizational requirements. The facts that the information is now available real-time removes direction and helps the organization grow supporting a leadership environment.

Chapter 5

CONCLUSIONS AND FUTURE RESEARCH OPPORTUNITIES

Conclusion

In conclusion, with the data presented, it has been proven that the use of leadership- based reports provide incremental performance increases throughout organizations. The performance increases have been confirmed by comparing two separate organizational entities at a top defense contractor. The methodology for collecting data from two different resources supports the validation the hypothesis and can be obtained with two variables within the same corporation. Additionally, the theory behind a leadership-based report was to show how accountability may not alleviate total control or cease reactionary actions but it is instrumental when coupled together with other aspects aimed at increasing overall efficiency. Facility managers can develop leadership-based reports to reassign accountability to task owners while simultaneously reducing reactionary actions that lead to risk. It is the identifying and reassigning of the risk that we do not control that is imperative for effective facility leadership and allows facility managers to create an accurate and solid facility management plan. In fact, all of the data collected and analyzed showed an increase in performance while simultaneously driving down negative factors that impact the company's bottom line.

Future Research Opportunities

One of the most important factors discovered through the current research was the fact that assigning and measuring work performance increased effectiveness. The fact that not all organizations employ some of the most basic structure uncovered in this research is mystifying. With increased control and lack of measurements and

performance criteria, the leadership team actually accepts more risk. The future research opportunity lies with the ability to look into the underlying psychology of why leadership teams decide to work in this environment and do not seek out change. Is it that the leaders are unaware of the benefits, not trained, or are simply not interested? If corporate business could understand the revenue impact of such decisions, they may be receptive to the data presented in this thesis and by future studies in the area of leadership and performance.

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