

Training Investigation for a Computerized  
Maintenance Management  
System Implementation

by

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**ABSTRACT**

A properly implemented and utilized Computerized Maintenance Management System (CMMS) will contribute to making informed decisions. These decisions will be supported by historical data, costs, and projections which will lead to improved organizational leadership and a more effective use of resources. The investigation of necessary training for a CMMS implementation was completed by reviewing previous research, collecting system user data, and developing recommendations from that research and data. The previous research included studies on CMMS importance, critical implementation factors, change management, and training options. A resounding theme of open communication and appropriate resource allocation (specifically time) were emphasized in the literature and recommended for XYZ. The results from the user survey indicated that users believe a CMMS is important to a maintenance operation, but that they

need additional training on system functions. In conjunction with training, the users need reports and information available to them that will link tools of the system to improving their operational efficiency. With implementation and use of the CMMS becoming standardized, the benefits of the system will contribute to the maintenance organization's vision of world class service.

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## Chapter I: Introduction

For a facility management department that services 12 facilities of mixed use (manufacturing and office space) there are countless maintenance and facility issues that need attention and valuable resources. The XYZ organization utilizes a variety of labor sources and methods to maintain the building and its equipment. The labor sources include in-house maintenance mechanics and contracted technicians. The primary methods utilized by these mechanics include preventative maintenance and predictive maintenance while mechanics also respond to emergency repairs and customer service requests. A new computerized maintenance management system (CMMS) called Mainsaver, is in the process of being implemented. The CMMS will serve as the foundation for their maintenance operation.

The CMMS attempts to provide work orders, preventative maintenance planning, equipment records, capacity planning, material procurement, and accounting/cost features just to name a few of its capabilities. Initial user training was provided on the new CMMS, instructional manuals were distributed, and the system has “gone live”. The 24 mechanics that are required to utilize the software have learned at different rates and use the software to different degrees of success. Continued education on the software is needed to reinforce the tools and techniques available and to further train the users on the CMMS functions. If the system is not integrated into the daily facility/maintenance operations, there will be continued inefficiencies in the planning and execution of work which leads to a reactive approach to maintenance. The inefficient, reactive approach results in higher maintenance costs for the organization.

The significance of successfully implementing the CMMS and determining what continuing education is needed is that it will allow XYZ to identify specifically where to apply their training resources. Understanding where the training is needed will enable XYZ to develop training plans and schedules that will focus on those weaknesses. Improving how the CMMS is used will lead to a more proactive, cost effective approach to facility maintenance. This will have a direct effect on the bottom line of the organization.

#### *Statement of the Problem*

What continuing education/training is needed for the successful utilization of XYZ's CMMS? The CMMS is in the process of being implemented and it is being used at various levels of success by the users of the system. XYZ must determine what education/training is needed and the most efficient way to deliver it.

#### *Purpose of the Study*

The purpose of this study is to identify what additional training is needed for XYZ's mechanics, so they can fully utilize the tools available in the CMMS. In addition, the purpose is to make recommendations for continuous improvement of XYZ's CMMS. These objectives are designed to uncover what additional training is needed. The under utilization has led to poor management of labor hours, inaccurate work order and asset reporting, and a hesitancy by users of the new system to embrace the change of computerized maintenance management systems. These issues have yet to be addressed and can only be resolved through proper research and subsequent training.

#### *Research Objectives*

The research objectives for this study are:

1. Identify what the CMMS (Mainsaver) requires from an administrative and user standpoint in order for it to be beneficial to the maintenance organization.
2. Determine what the users of the system actually possess in regard to skills and knowledge that will enable them to operate the system at its highest level.
3. Identify what is missing between the system requirements and the current capabilities of the users. Identifying this information will allow the organization to fill in the knowledge gaps with the appropriate training, tools, and support needed to optimize Mainsaver.

#### *Assumptions of the Study*

The assumptions of this study are:

1. The new CMMS software will be utilized for the next four years (allowing time for changes and training to take effect).
2. The new CMMS will have the “bugs” and programming issues resolved separately from the training aspect.
3. The mechanics and employees are willing to learn and improve their processes.

#### *Definition of Terms*

*CMMS*. Computerized Maintenance Management System.

*ERP*. Enterprise Resource Planning is a company-wide set of tools that ties together all or most of your businesses functions (Wallace & Kremzar, 2001).

*PM.* Any planned maintenance activity that is designed to improve equipment life and avoid any unplanned maintenance activity (Marchetti & Marek, 1999).

*In-house staff.* Full time employees of the owner/occupant organization (i.e. XYZ organization).

*Contractors.* Employees not of the owner/occupant organization who are hired to perform service/maintenance work at the expense of the owner/occupant.

#### *Limitations of the Study*

The limitations of this study are:

1. The CMMS implementation research of the XYZ organization will include XYZ Facility mechanics and employees only, other departments will not be included.
2. The recommendations of this study will apply to the XYZ organization in particular and may not be suitable for other organizations.

#### *Methodology*

The following sections of this paper will discuss a literature review on the topic of CMMS implementation efforts and training techniques. The methodology for this project's research will be detailed along with the results that are obtained. Finally, a discussion will provide recommendations for XYZ and ideas for further research that could benefit those looking to implement a CMMS.

## Chapter II: Literature Review

### *Introduction*

When implementing any new system into an organization there is an immediate need for user training so they can understand; how the system operates, the implications of the system, and the procedural changes that are necessary. Regardless of the employees' reaction to the changes, they are most likely required to learn the new system and are processed through training. The research will be focused on identifying what additional training (after initial implementation) is necessary for a new CMMS to be successful.

This additional training is often overlooked, but is critical for a new process/system to really take hold in the organization. There is no question; additional training will be required after an ERP (or CMMS) implementation to address the various unanticipated problems that arise (Vosburg & Kumar, 2001). If these problems are not addressed, they will lead to inefficiencies within the system, frustration by the users, and unrealized benefits. The review of literature will explain the importance of a CMMS, critical implementation factors, change management strategies, and training options.

### *CMMS Importance*

While maintenance work is typically not thought of as a critical business function, it directly impacts the safety, reliability, and production goals of the organization. The principle of maintenance management is the effective use of information and resources to; preserve equipment, ensure its availability, and balance the work (Nikolopoulos, Metaxiotis, Lexatis, & Assimakopoulos, 2003). One way to improve the maintenance management function is to utilize a CMMS; its implementation will assist in managing

all of the maintenance operations (Buys & Nkado, 2006). The CMMS attempts to provide work orders, preventative maintenance planning, equipment records, capacity planning, material procurement, and accounting/cost features in order to meet the goals of maintenance management. Expanding on the tasks listed, a CMMS should be utilized in the decision making process for maintenance operations and could be integrated into the enterprise resource planning system (Zhu, Gelders, & Pintelon, 2002). Extracting the data that is within the CMMS and using it to make informed decisions is one of the greatest advantages that the system offers. Informed decision making that can be supported by historical data, costs, and projections will lead to improved decisions and a more effective use of resources.

The following CMMS benefits will also improve resource use: improved equipment availability, labor productivity, inventory control, product quality, and environmental controls. Other benefits of the CMMS include tangible benefits such as reductions in overtime, contractor work, work order backlogs, and costs, as well as improved morale, service, reduced paperwork, and a clearer source of work order status' (Bagadia, 2006). It is important to understand maintenance management's supportive role in the overall organization and that a well implemented CMMS is a building block of maintenance management. The numerous benefits listed justify the expense of the system which will ultimately lead to informed and responsible decision making.

#### *Critical Implementation Factors*

When determining what additional training is needed for users of a new CMMS, it is important to understand how the original implementation was structured. Comparing that structure to known or documented critical success factors will provide insight into

additional training that is needed. The literature available on implementation factors for Enterprise Resource Planning (ERP) is vast and well documented. The similarities of ERP and CMMS implementations allow for a carryover of information that is applicable to both processes. Subsequently, the review of literature contains studies and information from CMMS implementations and ERP implementations. The review of implementation factors will contain success factors, factors that lead to failure, and CMMS implementation statistics.

There are numerous variables that affect the success of a project, particularly CMMS type implementations. It is critical to set goals for the implementation because it determines the general direction of the project and can influence the project outcome (Soja, 2008). In addition, these goals should be defined so that they can be measured in some way. If they are measurable, the people involved in the process can rate their progress during the project and determine how the final result compares to their initial desired outcome. Examples of measurable goals include inventory reduction, job time reduction, and equipment downtime reduction (Soja, 2008). Along with project goal definition, linking corporate strategy with the implementation project is another factor that is vital to the success of the project. Identifying how the project satisfies desired outcomes of the organization creates a link for actual users of the system to see how their work directly impacts the success of the entire organization.

Aside from goal setting, other critical success factors include: change management, a communication plan, and training (Finney & Corbett, 2007). A key task of change management is to gain user acceptance and a positive attitude toward the project. This can be developed through a solid project plan that is based on common

goals of the organization. Communication is vital so that shop floor employees have input into how the system is designed and operates. Lastly, training of users, the project team, and developing their computer skills is cited as being critical to the implementation.

In addition to a project not possessing the success factor qualities, a project that lacks ownership and a transfer of knowledge will have negative outcomes (Al-Mashari & Al-Mudimigh, 2003). Again, a lack of communication with no formal plan to communicate ideas and change rationales to employees will lead to failure due to confusion and the absence of a clear goal. A re-occurring theme of performance measurement and a lack of it will contribute to deficiencies in performance which will not meet the desired business outcomes.

To meet desired outcomes of a CMMS implementation, employees must: enter work orders, enter their time, close work orders, order materials/parts, and generate necessary reports (Weiss, 1998). Unfortunately, a CMMS often does not get used to its potential because the organization does not understand the ongoing human time commitments that are necessary. There are other issues within a CMMS package that limits the success and realized benefits. The CMMS implementation's success depends on corporate strategic planning and the maintenance vision of the organization (Mostafa, 2004). The implementation of a "new" process that creates a change in an employee's routine can be one of the most difficult tasks a project manager or any leader has to face. Problems with the implementation can stem from employees being reluctant to try something new, the fear of failure, or the belief that the old way was working just fine. When these attitudes are present, the new CMMS may not be given the proper attention or effort and may be set up to fail. In addition, the new system will most likely require the

people using the software to increase their accuracy and accountability in their day to day tasks. A survey done by the Plant Maintenance Resource Center on CMMS implementation provided these results: 90% of the respondents are currently using a CMMS, but between 20-40% could not report any of its benefits. In addition, 20% rated their CMMS implementation as being “poor” (Mostafa, 2004). These statistics tell that there is great room for improvement and much of it through proper implementation.

Upon review of ERP and CMMS implementations (due to their similarities), the critical success factors include setting measurable goals, handling change management effectively, communicating early and often, and on-going training. Factors identified as potentially leading to failure include a poor transfer of knowledge from management to employees, lack of time spent using the system, and simply not possessing or executing the critical success factors mentioned above. Lastly, it is important to understand that users often lack the understanding of what benefits can be obtained from their CMMS, communication and training will help to resolve this.

#### *Change Management*

Implementing a new system, no matter what type it is, is a change for the organization and its people. How this change is managed impacts the successfulness of the project at the beginning stages and determines what is needed moving forward. Current literature on change management focuses on the reasons of failure, elements of successful change, and strategies for CMMS projects.

Understanding the reasons of failure is a key element in properly planning a change initiative. Even with good intentions, some common reasons for failure are: lack of readiness, insufficient planning, poor leadership, ineffective communication, and

insufficient follow through (Smith, 2006). Perhaps the most overlooked reason is due to not adequately attending to the human factors of change. Specifically related to the human factors are the fear of the unknown, lack of information, threats to status, and lack of perceived benefits (Proctor & Doukakis, 2003). Ultimately, people do not want to change, they do not believe in it, and the initiative leaves them feeling demoralized which will not produce results (Stanleigh, 2008). The literature represents a connection between leadership's planning for the human factors and how it makes the employees feel. These feelings appear to be the determining factor in their engagement (ultimately the success) with the change initiative.

Elements of successful change management are numerous, but characteristics commonly cited include the following: a readiness for change must be created, those affected need to be involved in the planning, adequate support (staffing, money, and time), training and development programs, effective communication, and a continuous follow through in the effort (Smith, 2006). For a controlled change effort, the project must move forward step by step, with a clear vision that has been communicated to all (Stanleigh, 2008). Following and integrating these processes/steps into the change management plan will cause the new process to become the "new standard" for the organization. The change process is a journey and should be planned for accordingly.

For CMMS projects to be successful, there are specific strategies that can be utilized similar to other change initiatives, but with their own emphasis. An ERP (similarly CMMS) implementation could follow a three phase strategy as proposed by Adel M. Aladwani:

1. Knowledge Formulation-determine the needs of the users and where the resistance to change lies.
2. Strategy Implementation-Use the knowledge from step 1 to develop strategies that will overcome the obstacles.
3. Status Evaluation-Develop a performance measurement system to monitor the progress of the change efforts. Accordingly, management must take action to strengthen or correct change effort issues (Aladwani, 2001).

Communicating the benefits of the CMMS, the inputs and outputs, and in general how the system will work will address many of the areas that become identified in Aladwani's first step (Aladwani, 2001). In a CMMS implementation, effective communication is continuously cited as critical to successfulness. Employees are more likely to commit to the change when they have the information on why the change is being made (Smith, 2006). The communication coming from leaders should be frequent, honest, clear, and easy to understand. Part of this communication involves listening; the interaction will lead to insight on potential issues early on. Furthermore, communication is vital to ensuring that successful change can take place because it clears up ambiguities and uncertainty along with empowering those who are the subject of change (Proctor & Doukakis, 2003). The ability by everyone involved to understand and express their thoughts is the foundation in which an implementation process should be built.

Being able to build this process is no easy task, but adhering to the basic principles discussed in this section will improve the implementation process. The main point to remember in regard to implementation failures is that leaders often do not attend to the human factors of change; they must foster employees' engagement for the change

initiative. Elements of successful change center on creating a readiness for change and providing proper planning as described above which will cause the new process to become the new standard for the organization. Finally, straightforward strategies as proposed by Aladwani provide a framework which can be adopted for an individual change management initiative.

### *Training Options*

There are many reasons for training to take place. Inevitable change that occurs within and outside of each organization creates a need for training along with an organization's desire to stay ahead of the competition (Read & Kleiner, 1996). Specifically, training creates increased productivity, quality, and a competitive edge that will positively impact the bottom line. For an ERP/CMMS implementation, training often receives little attention, but giving it little regard and few resources is a main reason why delays, confusion, and financial ruin can result from an ERP/CMMS implementation (Gargeya & Brady, 2005). Of all the types of training available, some are the most widely used and likely beneficial.

Training methods widely used include videos, lectures, one-on-one instruction, role playing, simulation, computer based training, and a few others (Read & Kleiner, 1996). An additional type of training applicable to CMMS implementations are training manuals. The manual that is utilized will only be as effective as the perceived usability of it (Scott, 2005). The usability depends upon four factors: navigation, presentation, learnability, and task support. Whichever type of training is chosen for CMMS implementation and follow-up work, it is critical that the trainer not only be skilled at the task, but also skilled at instruction. Often, the task of training is given to the highest

performer, but they are not trained as a trainer. Ideally, a training method is chosen that involves the trainee and a measurement system is in place so that the outcomes of the training can be evaluated. The evaluation is of importance for both parties involved.

Understanding the possible training methods is only part of the necessary requirements to implement the CMMS. Having a clear idea on what is critical to the success of the training effort and exactly how to give training is a determining factor in the results. For ERP/CMMS employee training, basic computer skills are a must, without these operating the system is difficult and inefficient (Dowlatshahi, 2005). In addition, education beyond just procedural training is important. Education on new processes, performance goals, and organizational/cultural change issues were key components of successful training examples that were studied by Robey, Ross, and Boudreau (2002). The training must be shown to be valued which can be accomplished by allocating appropriate resources and ensuring that the trainee's learn what they really need to know to perform their tasks.

CMMS training is typically done in two phases. The initial training to get the system up and running and then advanced training after implementation (Bagadia, 2006). After initial implementation, employees will need refresher training and additional instruction on topics that they do not use on a regular basis or topics that they did not learn the first time around. This additional training can come from a few sources; one is from the CMMS vendor. This type of training may appear expensive up-front, but it can prove to be beneficial in the long run and for the duration of the system (Bagadia, 2006).

The second option for additional CMMS training could come in the form of training manuals that were discussed previously as a training option. The manuals present

the opportunity for the user to possess documents on how to perform the necessary tasks. It is something that they can carry out of the training session with them and utilize later on. For ongoing training, there are characteristics of the manuals that affect the usability of it. The manual size, process and table of contents clarity, ability to update the manuals, and screen shot illustrations were critical factors in the employee's usability of the manual (Scott, 2005).

Continual training is important for the CMMS to take hold in the organization and for employees to fully understand the capabilities of the system. This training requires the proper method with a skilled trainer who understands what the trainee really needs to know and one who can educate the trainee on the process. A lack of training during a CMMS implementation will cause delays, confusion, and financial loss. Once the capabilities are understood and practiced, true utilization and benefits will arise.

#### *Summary*

Any change that attempts to be implemented in an organization will either be accepted or rejected based on the effort put into the implementation, change management, and training. With an understanding of the CMMS importance, the critical implementation factors, and change management strategies, a thorough, comprehensive plan can be put into action in order to evaluate the CMMS implementation. Points of emphasis for the implementation should be on communication, planning for the human factor, and continuous training. The users of the system should be given time to accept the changes in order to minimize the impact on the organizational culture (Vosburg & Kumar, 2001). Being able to minimize any negative impact on the culture will promote the successfulness of the CMMS implementation and training effort.

## Chapter III: Methodology

### *Introduction*

The XYZ Organization in an effort to standardize, improve, and develop efficiencies has implemented a new computerized maintenance management system (CMMS)-Mainsaver. The new system (Mainsaver) will provide asset and maintenance planning, tracking, and reporting for 24 mechanics that operate a combined 12 office and manufacturing facilities. After the initial training and implementation took place, the organization wanted to identify the next steps they could take to strengthen the new process and systems. The specific problem XYZ wanted to address was to determine what continuing education/training was needed for the successful utilization of XYZ's CMMS.

### *Research Design*

To meet the three research objectives that were identified by XYZ, data was required that would provide insight into the requirements of the system, current usage and capabilities of the users, and an understanding of what was missing between the requirements and their capabilities. Specifically, data on the effects of the initial training from a Mainsaver consultant and XYZ trainers was needed. Secondly, data from the users on their thoughts/feelings about their current usage of the system and what they experienced as obstacles when using Mainsaver. Lastly, data was needed that identified how the users would like to see the system utilized and a description of what they believed they needed in regard to training and education that would expand Mainsaver's use and benefits. The variables in gathering this data included the attitudes and experiences of the researched population. Their unique skills, history with the

organization, and industry experience affected the quantity, type, and quality of data that was collected.

#### *Selection of Subjects*

The primary users of the system (mechanics) directly benefit from the CMMS and are also the individuals that have the most impact on its success. To obtain the data needed for training ideas/improvements, 24 mechanics and four supervisors were surveyed for a total sample size of 28. Due to the fact that the entire population was only 28, they were all given the opportunity to respond to the survey. These 28 were chosen because of the reliance and impact they have on the system and the fact that they all work within the 12 facilities under study.

#### *Instrumentation*

The survey that was administered contained questions structured around providing answers to the three research objectives (requirements of the system, current usage/capabilities, and the knowledge of what was missing). In regard to requirements of the system and implementation efforts, the questions focused on identifying how the respondent would rate the initial training they received (Lickert scale) and what aspect(s) of the training were most and least beneficial (multiple choice). For current usage/capabilities, the questions revolved around the respondents describing their commitment to learning and the effort they have set forth by providing answers through the use of Lickert scale questions. In addition, multiple choice questions allowed the respondent to quantify their time spent using the software and to identify challenges they faced. To gain an understanding of what knowledge was missing between the requirements and their current usage, multiple choice and Lickert scale questions were

written to get the respondents view on the future of the CMMS for XYZ. In addition, there were questions designed to gauge their reaction to potential training options and several open ended questions that allowed them to describe what reports and functions they would like to utilize from the CMMS.

### *Procedures*

As described, the measurement instrument utilized to obtain the data was an online survey distributed through XYZ's Microsoft Sharepoint intranet site. The survey was administered by the researcher who posted the survey and gathered the responses over the course of two weeks. The data that was collected through the survey was valid because it was directly representative of the entire population (at least those that responded). Each member of the population had the opportunity to respond.

Two days prior to posting the survey on the intranet site, an email was sent to the entire sample group informing them of the forthcoming survey and the purpose for it. In that email (and all other communication emails), the email addresses were placed in the 'bcc' line to protect the anonymity of the subjects. When the actual survey was made available for response, another email was sent to the sample group. This notified them of the available survey, of UW-Stout's IRB approval, and ensured them that their responses were anonymous. The Sharepoint site did not collect names or any identification that could link the respondent to a set of responses. After one week had passed a reminder email was sent to the sample group. At the end of two weeks, the researcher who posted the survey collected the anonymous individual responses and cumulative results. The survey was made available 7 weeks after the implementation process began. This timeframe was chosen because it gave the system users time to gain experience, develop

a solid database of information, and to allow them time to develop questions/concerns that they could communicate to the researchers through the survey.

#### *Data Analysis*

The results that were obtained were analyzed according to the type of question/answer it was (Lickert scale, multiple choice, or open ended). Lickert scale questions were interpreted through the use of percentages, the actual quantity of particular responses, and by percentages of similarly grouped responses. Multiple choice questions were analyzed through the use of Pareto charts, the actual quantity of particular responses, and by percentages of a response (in some cases, only responses greater than a defined percentage were included in the discussion). The multiple choice analysis provided insight into the training efforts, what skills the respondents possessed, and what skills were missing. Lastly, the open ended questions were summarized and broken down to identify re-occurring themes in the responses. The recommendations that came from this analysis addressed maintenance organizational issues, the research problem, and additional initiatives needed to maximize the CMMS.

#### *Limitations*

The data indicated various weaknesses in the initial training and gave good insight into what next steps to take. The information received was limited due to the small sample size. This fact could not be avoided because the research only wanted to identify what training was needed at XYZ, not other organizations that were operating Mainsaver or another CMMS. Another limiting factor could have been the relatively short time window that the users had to actually operate the system prior to being surveyed. If they

had even more time to gain experience (greater than 7 weeks), their responses in regard to additional training may have been more appropriate and beneficial.

*Summary*

The survey that was conducted was designed to provide data that that would assist XYZ in meeting the three research objectives of this project. The data that was obtained through this survey did provide insight that would have been unattainable otherwise. The respondents were able to anonymously provide their thoughts and feelings in way that will benefit the implementation effort and ultimately the entire XYZ organization.

## Chapter IV: Results

### *Introduction*

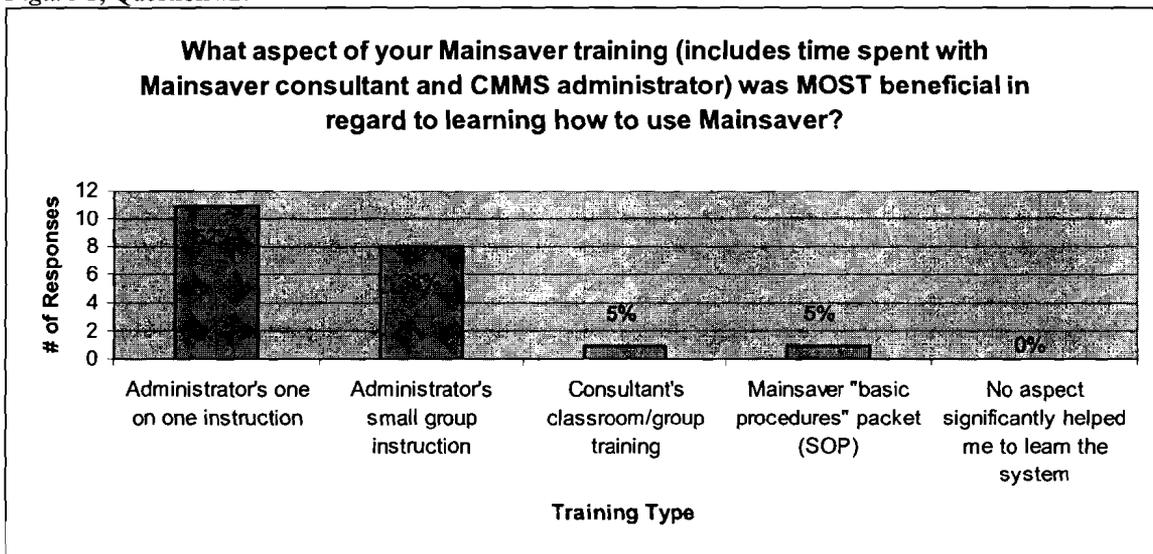
A survey was administered to XYZ's CMMS users in order to obtain data that would aid in identifying what continuing education/training was needed for the system's implementation at their 12 manufacturing and office facilities. Specifically, the survey was structured and written so that the responses would help to provide answers to the three research objectives. Understanding what was missing between the requirements of the system and the users' current capabilities will lead to effective and beneficial training. The survey questions were either Lickert scale, multiple choice, or open ended. All of questions attempted to provide data in regard to requirements of the system, current user capability, or what was missing between the requirements and the capabilities. The survey had a response rate of 75% (21 of the 28 people responded). This response rate exceeded the goal of obtaining 70% participation. The following sections report the survey results.

### *Requirements of the System*

The first question of the survey: "Rate the importance of a CMMS for facility maintenance and management from your perspective and experiences" was included in the survey to understand whether the respondent(s) feels as though a CMMS is required for a successful maintenance operation. 12 of the 21 respondents answered "very important", 7 answered "important", two answered "neutral", zero respondents answered "unimportant", and zero respondents answered "not important at all". For this Lickert scale question, 90% of the respondents feel as though a CMMS is either "important" or "very important".

The second question of the survey also falls into the category of understanding the requirements of the system (see Figure 1).

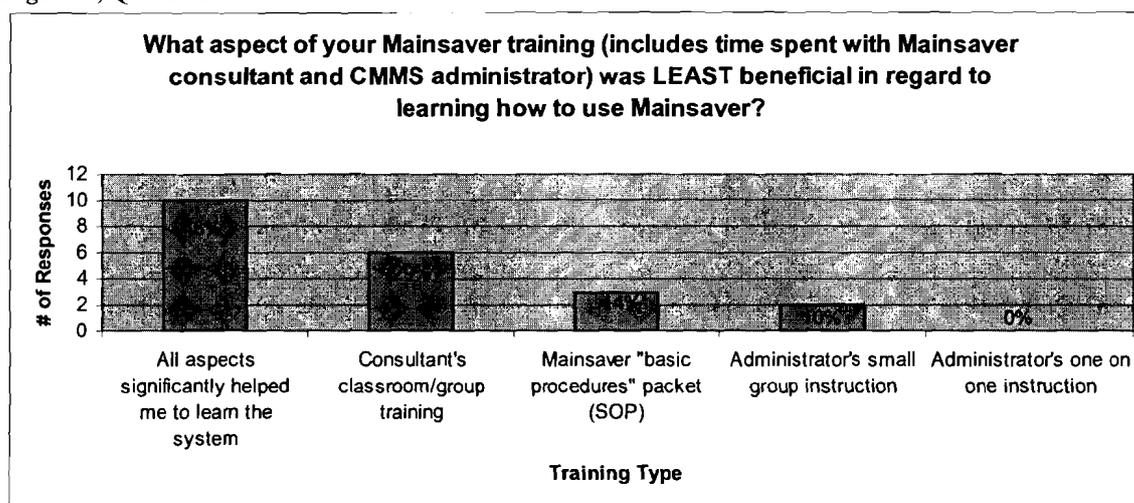
Figure 1, Question #2.



11 of the respondents answered “administrator’s one on one instruction”, 8 answered “administrator’s small group instruction, one said “consultant’s classroom/group training, one said “Mainsaver basic procedures packet – SOP”, zero respondents answered with “no aspect significantly helped me to learn the system”. Insight into the respondents training experiences provides information on the type of training that was most effective for the CMMS implementation so far and what will be required in the future.

The last question that provides information into the requirements of the system is question #3 (see Figure 2).

Figure 2, Question #3



10 respondents answered that “all aspects significantly helped me to learn the system”, 6 answered with “consultant's classroom/group training”, three responded with “Mainsaver "basic procedures" packet (SOP)”, two responded with “administrator's small group instruction”, and zero said “Administrator's one on one instruction”. Similar to question #2, understanding what type of training was least beneficial will lead to the use of the proper training type(s) in the future.

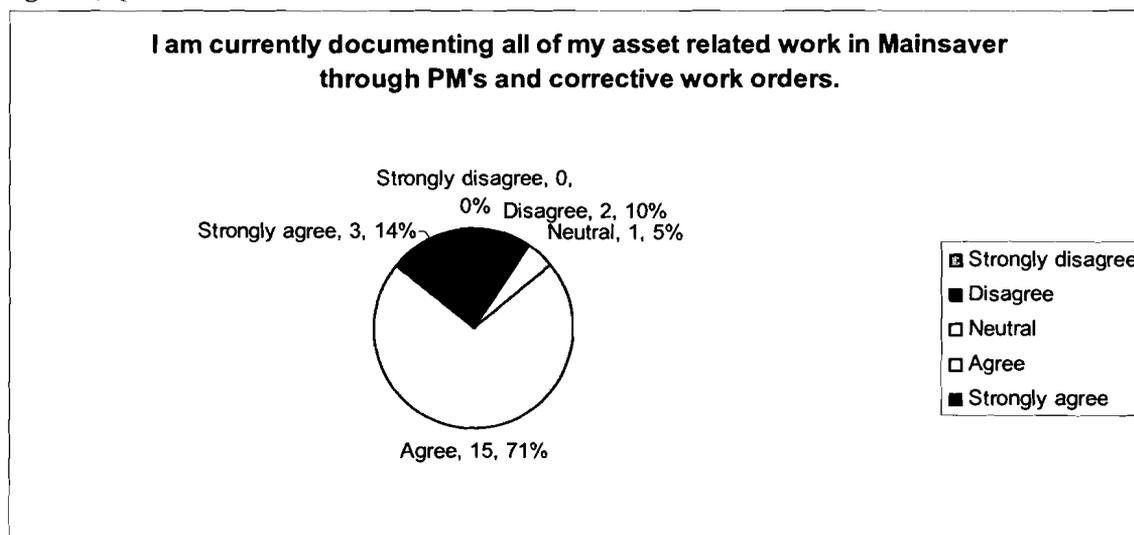
#### *Current User Capability*

Identifying what is required of the system by analyzing the users experiences and their thoughts on the criticality of a CMMS is only one part of puzzle that will answer the research problem-“What continuing education/training is needed for the successful utilization of XYZ’s CMMS”. The questions and responses in this section identify the second piece of the puzzle (second research objective) what is the current user capability? The fifth question/statement in the survey “I spend time each day using Mainsaver” received the following responses. 7 of the respondents said “strongly agree”, 11 answered with “agree”, one response was “neutral”, two said they “disagree” with the statement,

and zero respondents answered with “strongly disagree”. The results show that 85% of the respondents are reporting that they spend time each day using Mainsaver.

While the survey shows that 85% of the respondents are using Mainsaver each day (question #5), it is important to additionally understand how accurate the users are when they input data. The 6<sup>th</sup> question was included in order to gain that deeper understanding (see Figure 3).

Figure 3, Question #6



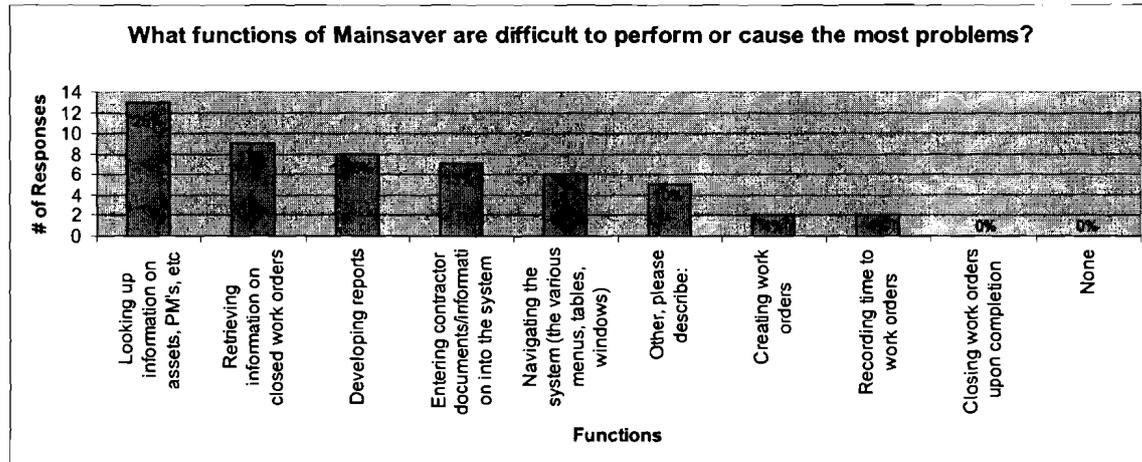
Following the response summary from question #5, question #6 shows that 85% of the respondents “agree” or “strongly agree” with the statement that they are documenting their work through PM’s and corrective work orders.

The 7<sup>th</sup> question in the survey aims to further understand the current capability of the user by inquiring about how much time per week the respondents are dedicating to using Mainsaver. The specific question was “On average, how much time do you spend each week using Mainsaver (entering time, creating work orders, looking up info, etc)”? Understanding how much time they are dedicating to use of the system will impact the interpretation of the previously discussed current user capability questions. 6 of the

respondents answered “more than 150 minutes”, two answered “120-150 minutes”, 5 responded with “90-120 minutes”, 5 with “60-90 minutes”, and three said “30-60 minutes”.

The final survey question that explained current user capability was question #8 (see Figure 4).

Figure 4, Question #8



Question #8 allowed the respondent to choose as many answers as applicable; therefore the overall quantity of responses was higher. The answers that the respondents chose 10% of the time or more include: “looking up information on assets, PM's, etc” which was chosen 13 times, they chose “retrieving information on closed work orders” 9 times, the function of “developing reports” was selected 8 times, “entering contractor documents/information into the system” was chosen 7 times, “navigating the system (the various menus, tables, windows)” was chosen 6 times, and the choice of “other, please describe” was selected 5 times (see Appendix A). The other response options were selected minimally as you can see in Figure 4.

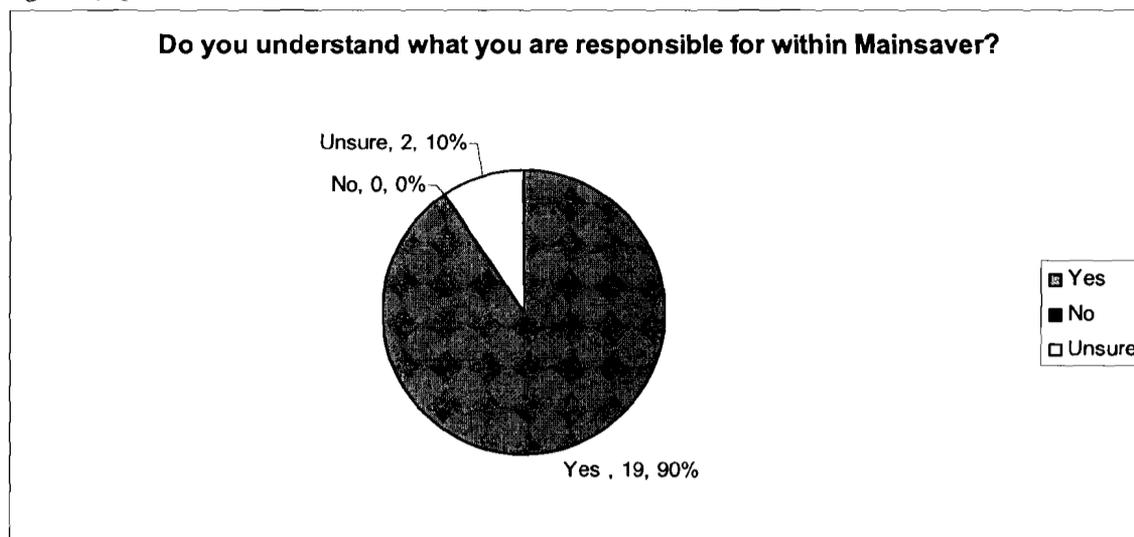
*What is missing?*

Being able to identify what is missing between the requirements of the system and the current user capabilities is the final step in attempting to answer the three research objectives and ultimately the research problem. The first question relating to the missing link was question four “I received enough training to execute my responsibilities on Mainsaver”. One respondent said they “strongly agree”, 12 chose “agree”, 5 answered with “neutral”, three with “disagree”, and zero said “strongly disagree”. Overall, 62% of the respondents said that they either “agree” or “strongly agree” that they received enough training to execute their responsibilities, this question was included so as to better understand if there is additional training needed in order for the mechanics to perform their basic responsibilities.

While looking at missing pieces of the CMMS training, it is important to identify if the users have an accurate understanding of the organizational effects of the new system. Question 9 “how do you think Mainsaver will affect the maintenance organization” was include in order to obtain data on their level of understanding. The respondents had the ability to choose as many of the multiple choice responses as applied to them, subsequently there was a total of 56 responses chosen by the 21 survey respondents. The response “it will keep track of all PM’s and assets” was chosen 17 times, “it will create accurate asset/equipment histories” was chosen 11 times, 10 times the respondents selected “it will improve the scheduling of maintenance work”, 9 selections for “provide a means to record labor hours”, “allow for improved capital spending decisions” was chosen 8 times, and one response was “no effect”.

Question 10 was a simple multiple choice question, but an important one that attempted to provide insight into whether the respondents understood their responsibilities (see Figure 5).

Figure 5, Question #10

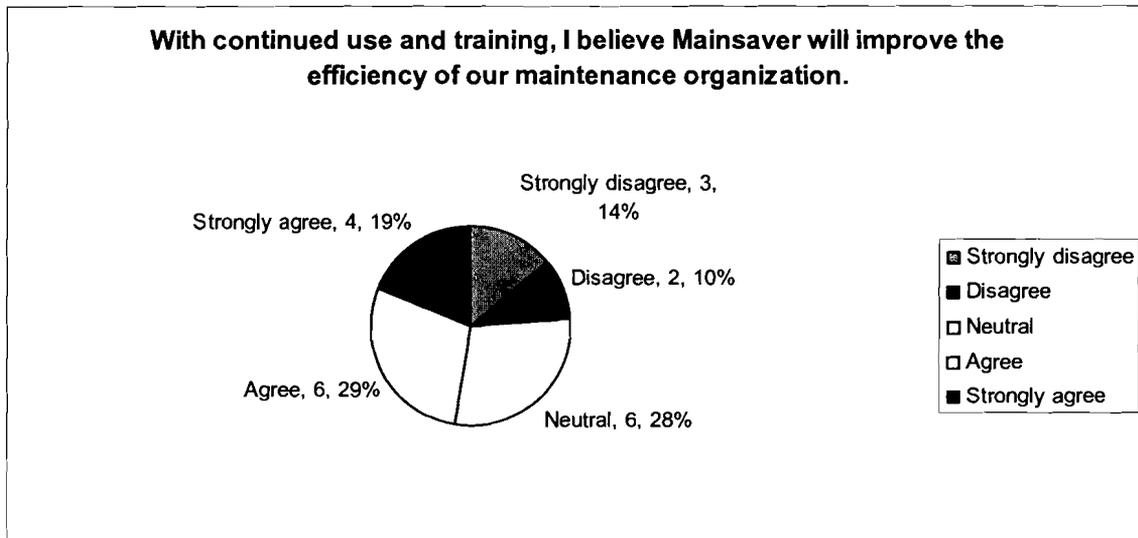


The data from the respondents indicates that 90% of them understand what they are responsible for within Mainsaver, 10% were “unsure”, while zero respondents replied “no” to the question.

While it is important to understand the functional, user level effects of the CMMS and whether the respondents understand their responsibilities, it is also critical to have a view of their outlook and belief in the system and the organization. Question 11 was included to understand what is missing between the respondents beliefs and what the true impact of the system is at a maintenance organizational level (see Figure 6).

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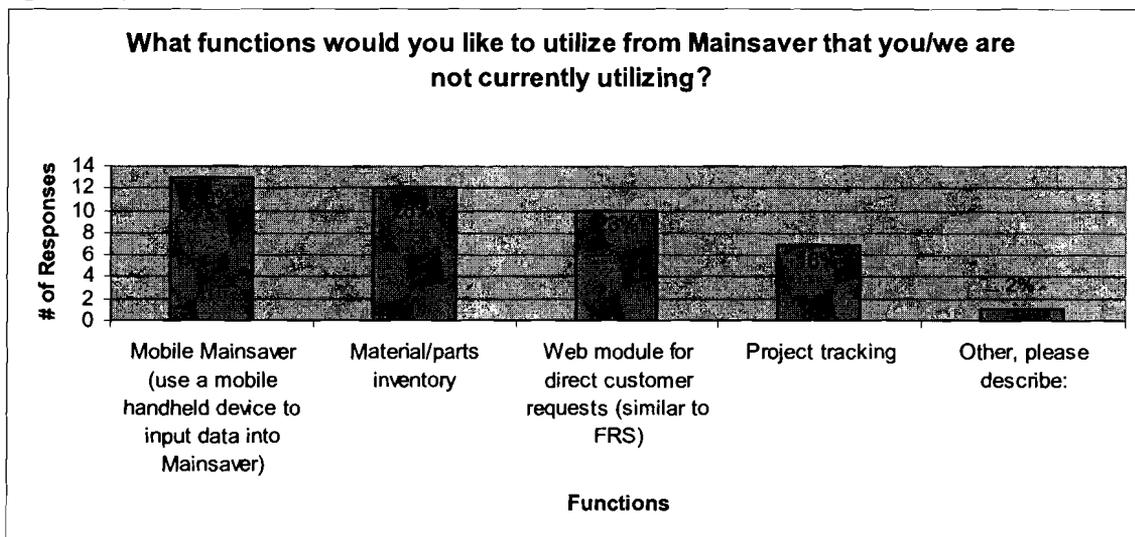
Figure 6, Question #11



The responses chosen for this question varied with no over whelming majority for any one individual choice. 48% of the respondents either “strongly agree” or “agree”, 24% of the respondents either “strongly disagree” or “disagree”, and 28% felt “neutral” in response to the ability of Mainsaver to improve the efficiency of the maintenance organization.

To identify what is missing from the CMMS itself (functions/operations) from the respondents’ perspective, question 12 was included (see Figure 7).

Figure 7, Question #12



Question #12 allowed the respondent to choose as many answers as applicable; therefore the overall quantity of responses was higher. 13 respondents chose “Mobile Mainsaver”, a “material/parts inventory” was chosen 12 times, a “web module for direct customer requests (similar to FRS)” was selected 10 times, 7 times “project tracking” was selected, and one chose “other” (see Appendix A).

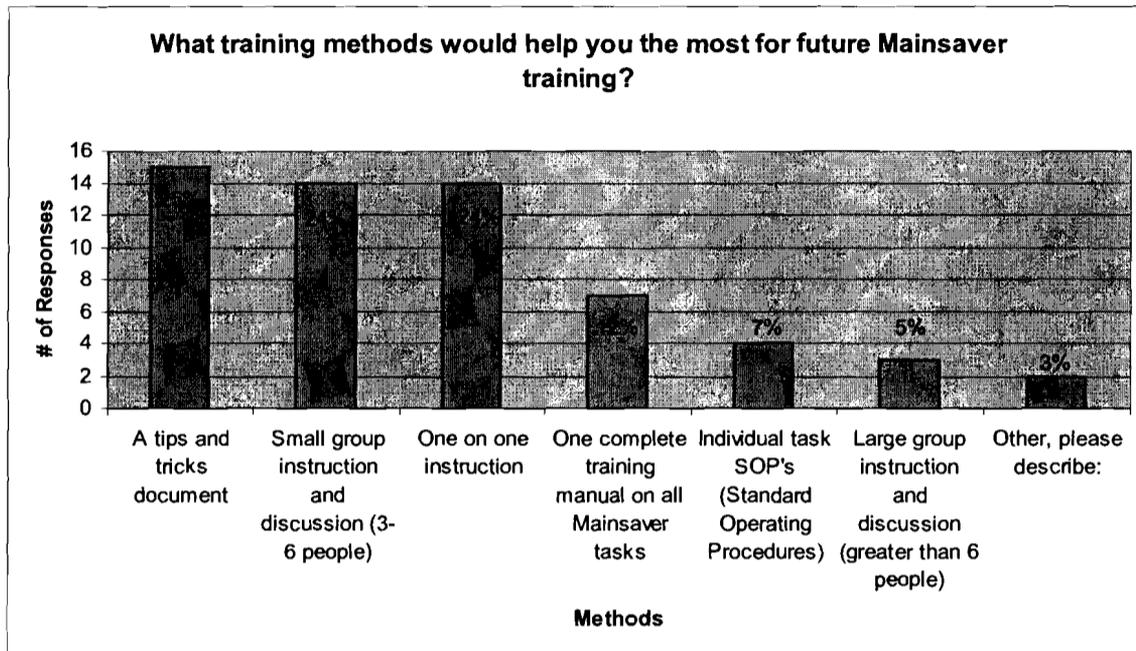
In addition to understanding what is missing from the functional and operation perspective, the system implementation will benefit from feedback on the types of reports that users of the system (respondents) would like. Question 13 “what type(s) of reports would you like to see from Mainsaver” was written and included in order to clarify this point, it was also written as an open ended question which allowed the respondent to write in any response. Due to this, the 10 responses that were received varied, but the most predominant, re-occurring theme was that users would like to be able to access reports that describe a particular asset’s history (repair and maintenance history on that asset, along with costs for that work). A secondary theme was that users did not know what report(s) they would like to see at this time, but with more use of the system, they eventually would benefit from some type of reporting capability.

Another open ended question was included to identify what other general information respondents would potentially benefit from. Question 14 “other than reports, what information/data/decisions would you like to get from Mainsaver” received a total of 9 responses. These responses also varied with two re-occurring themes. The first theme was that the respondents would like access to information on parts and materials used for asset maintenance. The second theme was similar to question 13 whereas the

users do not know what information/data/decisions they would like to see available from Mainsaver at this time, but they may after spending more time with the system.

The last question of the survey was one of the most critical because it aimed to identify what type of future training would be most beneficial. This topic gets at the heart of this project and attempts to provide answers to the research problem of “what additional training is needed for the CMMS implementation” (see Figure 8).

Figure 8, Question #15



Question #15 allowed the respondent to choose as many answers as applicable; therefore the overall quantity of responses was higher (a total of 59 responses). The answers that the respondents chose 12% of the time or more include: “a tips and tricks document” which was chosen 15 times, “small group instruction and discussion (3-6 people)” chosen 14 times, also chosen 14 times was “one on one instruction”, and “one complete training manual on all Mainsaver tasks” was selected 7 times. The other response options were selected minimally as you can see in Figure 8.

*Summary*

The survey response rate of 75% produced a sufficient amount of data for interpretation. The data provided details into the respondents view on the requirements of the system, their current capabilities, and what was missing between the two. The most encouraging data is that 90% of the respondents feel that a CMMS is important and that 85% of the respondents are making an effort to use the system each day for recording their asset related work. This encouraging and honest data will provide for better business decisions in regard to future CMMS implementation steps.

## Chapter V: Discussion

### *Introduction*

To implement a CMMS within any organization, the project leaders and individuals involved must feel passionate and be fully engaged in the process. The desire to improve the maintenance organization and have a positive impact on the business must drive the decision making and ultimately the goal(s) of the project. For XYZ to realize the benefits of the new CMMS, it was important that they review their implementation effort so far and determine the next steps to take. The problem facing XYZ as they worked through the implementation was that they needed to determine “what continuing education/training is needed for the successful utilization of their CMMS”. The approach used in this research project was to identify what the CMMS requires from a user standpoint, determine what skills the users currently possess, and understand what was missing between the requirements and the user’s current capabilities.

To explore and identify what a CMMS requires, the researcher performed a literature review focused on CMMS implementations. Specifically, literature that discussed the importance of a CMMS was reviewed in order to accurately describe the potential benefits of such a system. Literature based on critical implementation factors was also reviewed and summarized in an effort to provide a measuring stick for XYZ’s evaluation. Another area of literature that was important to review was change management strategies. Being able to takeaway valuable “best practices” from change management experts gave the research project information that will benefit XYZ. Lastly, literature on various types/methods of training was researched so that options for XYZ could be identified and ultimately added into the recommendations that were produced

from this research project. Along with performing a literature review to identify the requirements of the system, a survey was administered in which a portion of the questions were aimed at identifying requirements of the CMMS.

In addition to the survey containing questions structured around requirements, it contained questions regarding the users' current capabilities within the system. The survey administered to the users of the system (mechanics and supervisors) was the primary tool utilized to determine what skills they possessed. To obtain an accurate assessment of their capability, the survey was made available to them 7 weeks after the initial implementation took place. They were given the opportunity to respond and subsequently shape the future direction of the system and the maintenance organization.

Determining what was missing between the requirements and the current capabilities required data gathering and an analysis of that information gathered throughout the project. The data gathering took place through use of the survey. Questions within the survey focused on obtaining information that would describe what the respondents were missing in regard to training, communication, or system functions, there were also questions on future training options in order to understand what was most desired. By identifying the missing pieces, the research project attempted to conclude and make useful recommendations. The remaining sections of this final chapter describe the limitations of this project, conclusions in regard to the three research objectives, recommendations for XYZ, and lastly, future research possibilities.

### *Limitations*

When working on a project that includes a change for an organization and its people (a CMMS implementation), there are limitations and obstacles which affect the objectives, research, and results.

The limitations of this study were:

1. The CMMS implementation research of the XYZ organization included XYZ Facility mechanics and employees only, other departments were not included.
2. The recommendations of this study apply to the XYZ organization in particular and may not be suitable for other organizations.

The three objectives of this research project (user requirements, current capabilities, and what is missing) were formed based upon limitation #1. The decision that only XYZ Facility mechanics and employees were going to be included narrowed the scope and ultimately the procedures necessary to meet the objectives. The research itself was also affected by limitation #1 because the population for the survey could only include the described group of individuals. The population size affected the quantity of responses and the strength of the data analysis. Lastly, the results and recommendations that were developed lead to limitation #2. Due to that limitation, broad industry-wide applicability of the results is not as likely as it would have been if other individuals outside of the organization were studied. In addition to the limitations set forth at the beginning of the project, there arose other limitations throughout the duration of the project.

The ability to overcome those limitations and obstacles during the research project, (similarly an implementation) was the result of proper planning, execution, and change management. Two limitations encountered were time/experience constraints and

scheduling issues. The amount of time the CMMS users had to learn and use the system prior to the survey being administered was approximately 7 weeks. While the 7 weeks was adequate for them to understand the system, allowing them more time with the system would have likely generated additional and more detailed responses to open ended questions within the survey. The second limitation encountered was a result of the scheduling and release date of the survey. The survey was released to respondents on June 20<sup>th</sup> and was open for responses for 14 days. Due to the fact that many employees take vacation(s) around the 4<sup>th</sup> of July holiday, response totals may have been lower due to individuals' vacations and busy personal lives at that time of year. This limitation could have been avoided if the survey was administered after the holiday, but that would have delayed the completion and recommendations of the project. Regardless of the fact that there were limitations identified at the beginning of the project and others originated later, the research identified relevant literature and obtained data that led to the following conclusions.

### *Conclusions*

There are specific strategies that can be applied to CMMS projects in order for them to be successful. As proposed by Adel M. Aladwani (and discussed in Chapter 2), a three phase strategy could be used for an ERP (similarly CMMS) implementation. The three phases are: knowledge formulation, strategy implementation, and status evaluation. This research project and ultimately XYZ, is following this strategy in many ways. Knowledge formulation is being determined through the literature review, identifying the requirements of the CMMS, and in understanding the users' current capability. Aladwani's strategy implementation steps are being followed by utilizing the knowledge

learned in step one and by identifying “what is missing” through the survey to develop strategies in order overcome these obstacles. Finally, the third step of status evaluation is incorporated into this project through the recommendations (later in this chapter) and the performance measurement that is being formulated by XYZ in the form of management reports containing CMMS data.

For XYZ to continue their implementation project and realize the benefits that a properly implemented CMMS can provide, it is critical that the conclusions of this project are understood. These conclusions come from the high points of the review of literature and significant data that was gathered through the survey. This conclusion section will describe relationships between previously written literature and XYZ’s data in regard to the three research objectives: requirements of the system, current user capability, and what is missing.

*Requirements of the system.* The requirement of the CMMS for XYZ is that it is capable of assisting them in managing the maintenance operation. To effectively manage maintenance, XYZ must productively use the information and resources that are available through the CMMS. Informed decision making that can be supported by historical data, costs, and projections will lead to improved decision making and an effective use of resources. This information (historical data, costs, projections) is precisely what a properly utilized CMMS will provide, but importantly, not the only information it will provide. These justifications for a CMMS from the literature review support the importance, criticality, and ultimately the requirement that the system be utilized. Comparing the literature to the survey data finds that XYZ’s users of the system are in agreement on the importance of a CMMS. When asked to “rate the importance of a

CMMS for facility maintenance and management”, 90% of the respondents felt as though a CMMS is either “important” or “very important”. It can be concluded that a CMMS is required of maintenance employees; they must understand and know how to use the system. XYZ’s employees understand that it is required and it will help them to be successful individually and as an organization.

An additional key finding from the literature review on requirements of the system is that often a CMMS does not get used to its potential because the organization does not understand the ongoing human time commitments that are necessary. The time commitments start during the project planning phase and last well beyond the initial implementation. Management must be the driving force in allocating the proper time for project leaders, users, and support personnel. This is best done through the reallocation of resources and simply supporting the initiative by allowing the individuals’ time to get their CMMS related work completed. Another key requirement is that the new CMMS will likely require people using the software to increase their accuracy and accountability in their day to day tasks. Users of the system will be hesitant to accept a new process when it requires them to improve their accountability. Project leaders must foster open communication about this fact so that users of the system can have their questions, concerns, and fears answered. As discussed in the literature review, effective communication is continuously cited as critical to successfulness. The ability for everyone to understand and express their thoughts should form the foundation of the project. XYZ has taken many steps to incorporate communication into their organization and specifically this project by seeking input from its inception all the way through the

implementation itself. Useful communication tools that they have used include many project meetings, surveys, training sessions, and direct one on one discussion.

A key finding from literature suggests that for any type of training chosen for a CMMS implementation, it is required that the trainer not only be skilled at the task, but also skilled at instruction. To understand how XYZ performed in their training efforts and identify what type of training would be required for future sessions; two questions were included in the survey. Question #2 asked “what aspect of your training was most beneficial in regard to learning how to use Mainsaver”. The results indicate that 19 of 21 (90%) respondents felt as though training they received from the administrator (either one on one or small group training) was most beneficial. This supports the literature cited necessity of having skilled instructors. Reasoning for the responses can be attributed to the fact that the administrator likely had a good understanding of what specific tasks the users would be responsible for. Having this knowledge allows for simplified and applicable training sessions that educates the users on what they need to know. Question #3 asked “what aspect of your training was least beneficial in regard to learning how to use Mainsaver”. The results show that 10 respondents believe that all training aspects helped them to learn the system and there were a mixed, low quantity of responses on other training types that were least beneficial. All of these results from question #2 and #3 clearly show that XYZ has successfully executed various training techniques in order to implement the system and none that were utilized failed in the eyes of the survey respondents. For future training sessions, it is evident that both one on one instruction and small group instruction will be beneficial to Mainsaver users. In addition to

understanding the requirements of the system, an assessment must be made on current user capability topics.

*Current user capability.* When evaluating the key findings on the users' capability, it is helpful to look at the change management section of the literature review. There is a strong connection between leadership's planning for the human factors and how it makes the employees feel. Their feelings appear to be the determining factor in their engagement and the success of the change initiative. XYZ should continue to communicate (as discussed earlier) and receive feedback from the employees. With various changes and new initiatives being brought forth in the maintenance organization, the current feelings and level of engagement of the employees may fluctuate. Proper encouragement and steadfastness with the CMMS implementation will improve the users' capabilities and level of engagement. Other aspects of the change management strategy should include: those affected need to be involved in the planning, provide adequate support (staffing, money, and time), training programs, and continuous follow through. XYZ needs to continue their efforts in these areas, by doing so they will cause the new process to become the "new standard" for the organization.

For the CMMS to become the "new standard" it is important to compare aspects of the literature review to XYZ's data (obtained from the survey) so that an assessment can be made of the users' current capabilities. A survey done by the Plant Maintenance Resource Center on CMMS implementations provided these results: 90% of the respondents are currently using a CMMS, but between 20-40% could not report any of its benefits. This data can be compared to the responses received from question #5 of this research project's survey. The question asked "I spend time each day using Mainsaver",

the results indicated that 85% of the respondents are reporting that they spend time each day using Mainsaver. These results from XYZ's survey closely align with the results cited in the literature review that 90% are currently using a CMMS. More importantly, the literature review statistic that 20-40% could not report any benefits must be eliminated (if present) from XYZ's CMMS. The users need to understand and see results from the effort they put into the system. This should come in the form of reports useful to the XYZ employees, asset data that is beneficial for them, and lastly a more accurate individual performance history that will assist performance management.

To obtain an accurate picture of the users current capabilities, results from question #8 of the survey must be interpreted. The question posed to the respondents was "what functions of Mainsaver are difficult to perform or cause the most problems". The three responses that were chose most often were "looking up information on assets, PM's, etc", "retrieving information on closed work orders", and "developing reports". These functions named are beyond the basic responsibilities of the users, so it can be concluded that they are currently capable and confident in their ability to perform the basic, required tasks. They are at the stage in their development where they are just beyond the initial learning phase. The users are beginning to understand what information they could obtain from the system and they are looking for instruction on how to obtain that information. The progress and results discussed in these last two survey questions should be re-assuring for XYZ. They are beginning to pass the initial learning phase where the users learn what is expected of them, how to operate the system, and begin changing their documentation habits. This is a critical milestone to reach because it will enable XYZ to incorporate additional features of the CMMS into their daily work. It is

with this work that greater benefits of the system can be obtained. The next section on “what is missing” will discuss main points from the literature review and also identify exactly what is missing through an examination of the survey results.

*What is missing.* With an understanding of the requirements of the system and the users’ current capabilities, the literature review and survey results allow us to formulate what is missing between the two and ultimately XYZ’s implementation. As cited several times throughout the literature review, training often receives little attention, but giving it little regard and few resources results in delays, confusion, and financial loss. The training must be shown to be valued which can be done by allocating proper resources and ensuring that the trainee’s learn what they really need to know. The significance of training cannot be overstated. To compare XYZ’s training efforts and understand what is missing, a comparison will be made between the literature (described above) and data from question #4 of the survey which asked “I received enough training to execute my responsibilities on Mainsaver”. The results show 62% said that they either “agree” or “strongly agree” with the statement, 24% answered that they were “neutral”, and 14% “disagreed” with the statement. It can be concluded that the majority of respondents feel as though they have received enough training to date, but at only 62% for the agree/strongly agree category, there are many others who feel that they need more training. XYZ needs to continue emphasizing training and allocating resources to the development of the employees’ Mainsaver skills. In particular, they need to identify the employees who are struggling with the system and provide assistance to them.

In addition to training, it is crucial to set measurable goals for the implementation. If the goals are measurable, the people involved can rate their progress during the project

which will positively influence the project outcome. To determine if XYZ's employees are missing what the goals and their responsibilities are for this project, we can look to the results of question #10. The question asked "do you understand what you are responsible for within Mainsaver". 90% of the respondents answered "yes", while only 10% answered "no". Although the answer choices were simple (yes/no/unsure), the results provide good insight into whether or not they feel as though they have clear goals and responsibilities in regard to Mainsaver. These statistics are positive results for XYZ, they need to focus on setting goals for additional CMMS events (training sessions, meetings, and individual performance objectives) and holding individuals accountable to meet those goals.

To determine if there are missing links between the organization's strategy and the project goals, it is useful to refer to the literature. The review recommends identifying how the project satisfies desired outcomes of the organization. Creating a link for the users of the system to see how their work directly impacts the success of the organization will motivate and inspire the users. To identify what the respondents believe the impact of the CMMS will be, we can refer to the responses of question #11. The question asked "with continued use and training, I believe Mainsaver will improve the efficiency of our maintenance organization". The responses varied, 48% of the respondents said they either "strongly agree" or "agree", 24% of the respondents chose either "strongly disagree" or "disagree", and 28% chose "neutral". The range of responses indicates that the users are not able to clearly link Mainsaver's goals with becoming more efficient as a maintenance organization. The project leaders need to be clear about how Mainsaver will improve their operations. One way that this can be done is by utilizing workload and scheduling

reports to better allocate labor resources. Going through this process and sharing that information with the system users will help to link the users' efforts with improving efficiency and the overall maintenance organization.

For additional features that the system is "missing", data from the survey can be analyzed and concluded upon. Question #12 asked "what functions would you like to utilize from Mainsaver that you/we are not currently utilizing". The results from the most commonly chosen responses are: 30% would like to utilize "mobile Mainsaver", 28% a "material/parts inventory", and 23% a "web module" for direct customer requests. The mobile Mainsaver aspect has potential for future benefits, but it is necessary to focus on optimizing the traditional Mainsaver system before it is taken mobile. The second most chosen response of a "material/parts inventory" is a desired function by both management and the users. There are various benefits that could be obtained when this is implemented. The benefits include: simple economy of scale, reduced inventory, reduced transaction time, and standardization of maintenance processes. These advantages clearly indicate that this effort must be pursued. The inclusion of material data into the CMMS is a labor intensive process and should be planned for accordingly. XYZ should start by identifying realistic goals for this function, utilize best practices of other XYZ sites/industry as a whole, and potentially a lean sigma approach. The best practices may include just in time inventory procedures, a material storeroom, vendor agreements, and training methods. The function of adding a "web module" is possible, but XYZ is currently utilizing different customer interface software so there is little need to duplicate this effort.

An excellent feature of Mainsaver is the variety of reports it can provide. To identify what reports XYZ was missing (or not providing) question #13 "what type(s) of

reports would you like to see from Mainsaver” was included in the survey. The open ended question produced a variety of responses, but the most predominant, re-occurring theme was that users would like to be able to access reports that describe a particular asset’s history (repair and maintenance history on that asset, along with costs for that work). These asset reports described should be developed and instruction given on how to access those reports. Providing useful features (such as these reports) will allow the users to see how their effort impacts the organization and decisions that are made. A description of how XYZ should provide the discussed training follows.

In order to utilize additional functions or reports as described in the previous two paragraphs, it is necessary to continue training the users of the system. In fact, identifying what continuing education/training is needed for the successful utilization of XYZ’s CMMS is the goal of this entire project. As described in the literature review, the implementation is typically done in two phases: the initial training to get the system up and running and then advanced training after implementation. To understand how the advanced training should be structured, question #15 “what training methods would help you the most for future Mainsaver training” was included in the survey. The responses most chosen were a “tips and tricks document”, small group instruction, and one on one instruction. From these results, it can be concluded that future training need not be elaborate, extensive, large group meetings with complicated agendas. What appears to have the greatest impact on the users is small group and one on one meetings where they can get the information they need to perform their tasks. These small meetings should have clear and concise agendas that are an efficient use of time. In partnership with the meetings, it is evident that a document describing “tips and tricks” would be beneficial.

The results are surprising; a “tips and tricks” document would be preferred over a step by step standard operating procedure. This contrasts the literature review that described detailed manuals that would be critical to a CMMS implementation. A “tips and tricks” document is something that is relatively simple to create, but would provide substantial benefits to the system users. The conclusions from the literature review and survey described above compare two chapters of this report. The following section on recommendations will provide specific steps for XYZ to take and also provide suggestions for additional research.

### *Recommendations*

For the effort of this research project to be beneficial, useful recommendations will be described based on the researcher’s experiences, literature review, and survey results. The following recommendations will address maintenance organizational issues, the research problem: “what continuing education/training is needed for the successful utilization of XYZ’s CMMS”, and other initiatives needed to maximize the CMMS.

An issue facing the maintenance organization that presents a roadblock to its success and the success of the CMMS implementation is that there is no clear, standardized definition of the maintenance mechanic’s responsibilities. At each of the sites, mechanics operate differently in regard to what issues they respond to, how they are notified of issues/requests, and their resulting action. One reason for this could be the geographic spread of these sites. They are all within 30 miles of each other, but the different uses of the buildings results in inconsistent work methods. As described in the results of the survey, 90% of the respondents said they understand what their responsibilities are within Mainsaver, but those definitive responsibilities do not carry

over into their other work. The result of this is that various mechanics do not have a clear understanding of their responsibilities which leads to an unstructured, reactive form of maintenance. Ultimately, these work habits and inconsistencies affect what information is entered into Mainsaver and how the system itself gets used. In order for XYZ to improve their work and realize the benefits of Mainsaver, a clear definition of the mechanics responsibilities needs to be created. The document should outline their “scope of work” by listing the type of work they are responsible for performing in standardized definitions, applicable to all sites. The development of this document must be completed without soliciting an abundance of ideas defining the responsibilities. One or a few individuals must define the contents of the scope of work and ensure that the supervisors follow it at each site. In order for the defined responsibilities and Mainsaver initiatives to be successful, there must be an increased supervisory presence at the sites with multiple mechanics. The supervisors must be in frequent contact with the mechanics, drive the work efficiency, and reinforce the initiatives.

The goal of this project was to identify what continuing education/training is needed for the CMMS project. The recommendation for the training method is that two specific types be utilized. First, one on one training should be done in order to instruct users of the system on procedures and answer operational questions that they have. Secondly, small group instruction should be utilized when general Mainsaver operations and issues need to be discussed. When the same message or operation needs to be demonstrated to the user, utilizing a small group is a more efficient use of time and it also allows the users to hear questions, ideas, and tips that their peers have. These methods should be implemented in order to train the users on advanced and follow up Mainsaver

skills. As is evident from the research and survey data, the users are capable of the basic procedures; advanced training should incrementally, yet progressively be completed so that benefits and reporting features can be generated.

In conjunction with the advanced training, it is clear that a “tips and tricks” document should be developed and given to the users of the system. The document should be simple to use and formatted so that it can be referenced quickly. It should likely contain screenshots and descriptions of the tips/tricks. As stated previously, it is relatively easy to create and it is an alternative “training” method that would create some additional user acceptance and efficiency with the system. It is important to note that even though one on one, small group, and a tips and tricks document will be utilized there still is a requirement to develop standard operating procedures (SOP’s) for Mainsaver. The SOP’s will provide detailed instructions on the important Mainsaver operations and it will also allow management to hold system users accountable for their performance. The SOP’s should be posted and maintained on an accessible intranet site. Being open, clear, and honest about expectations will improve the accountability of XYZ’s training efforts and maintenance organization.

An additional initiative for XYZ should involve creating a link for the users of the system to see how Mainsaver’s goals impact the goals of the maintenance organization. After a substantial amount of data has been input into the system, the reports and the decisions that have been made based off of them should be summarized and communicated to the users. One way to communicate the information is to create a short, informative presentation that describes “what we have done with Mainsaver data so far”. This could be a PowerPoint presentation that display the reports, outlines the decisions

that have been made, and the impact of those decisions. Demonstrating a real life Mainsaver success story will help to build credibility for the system and encourage its use.

Promoting the use of Mainsaver can also be done by including the parts and materials module of the system into the day to day activities. Response from the users of the system is clear that it is needed and its effect would help to streamline operations. The recommendation for XYZ is that the implementation of the parts and materials module be as a sub-project of the entire CMMS project. As a sub-project it needs a separate project plan with measurable goals based on a realistic timeline. This project plan should be developed after reviewing best practices from other XYZ sites and across the industry. The plan needs to involve key XYZ users of the system so the best practices can be adapted to fit XYZ's operation. With all the changes taking place in the maintenance organization, it is important this sub-project be taken step by step and only implemented after use of the system is consistent at all sites and meets the objectives set for the users. This may take several more months to get the CMMS use at this level, but project planning can begin prior to that with actual implementation completed once use is at the desired skill level.

Expanding beyond parts and material reports, recommendations for other reports include asset history reports, preventive maintenance work order load for future weeks/months, and individual performance reports. One type of asset history report could describe the "top 5" assets requiring resources over a given time period at a particular site. This would provide a quick view of assets which are most costly to maintain. For preventive maintenance load reports, future schedules could be displayed to allow for

work load balancing and also to aid in allocating labor resources appropriately. The individual performance reports should be used to provide data supporting the measurable objectives identified for each user of the system. Those reports would describe their work order completion success rate, the amount of time allocated to asset maintenance, and compare preventive, predictive, and corrective maintenance amounts. The reports should be developed as soon as the data allows so that users have an understanding of what is being measured and how their work affects that data.

Opportunities for additional research are based on two topics. The first involves researching what efforts an organization can take prior to implementing a new CMMS. Identifying the steps needed to prepare the users for the changes coming their way would help to make the efforts described in this project more successful. The second recommendation for research is based on the opposite end of the project. For continuous improvement and sustainable impacts of the CMMS, it would be beneficial to understand what type of advanced training is needed one, two, or three years post implementation. Technology along with business objectives will continue to change so having an understanding of how the CMMS can evolve will help to keep the CMMS an integral part of the maintenance organization. The recommendations in this section are included in an effort to provide insight into how XYZ can overcome obstacles facing the maintenance organization, answer the research problem, and identify initiatives that could be developed from the CMMS implementation. If the recommendations are understood and acted upon, XYZ will be moving towards operating with world class service.

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## Appendix A

*Survey responses to the "other" (write-in) answer choice for the following questions:*

Question 8: What functions of Mainsaver are difficult to perform or cause the most problems?

- Seeing others work orders so I can put time against them.
- Need to allow for at least 1 day for changes after wo is closed. If closed and wrong date is recorded we can't change to correct date.
- Transferring work orders to other mechanics.
- Scheduling work when you can't see all the information on the front side of the work order, due dates, etc.
- There are many aspects to the system that I have not been exposed to. I am certain that over time these things will become easier.

Question 12: What functions would you like to utilize from Mainsaver that you/we are not currently utilizing?

- Customer generated work requests.