INVESTIGATING THE OPTIMAL MANAGEMENT STRATEGY FOR A HEALTHCARE FACILITY MAINTENANCE PROGRAM

THESIS

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Abstract

Reacting to the need to transform and the increasing pressure to outsource all non-core activities, Air Force Material Command Surgeon General discontinued its previous use of full service contracts with original equipment manufacturers and adopted a relatively new maintenance outsourcing strategy: strategic partnering with an equipment management firm. The objective of this study is to create a decision-model for selecting the optimal management strategy for a healthcare organization's facility maintenance program. This study used personal interviews with facility management personnel from MAJCOMs to collect and analyze data.

This study offers a re-conceptualized framework for viewing and understanding the various maintenance programs and their interrelationships. Additionally, the study evaluates the strategic fit between maintenance programs and strategic objectives and finally examines the strength of the strategic fit and how it relates to overall customer satisfaction of the maintenance program. The data from the interviews tested the interviewee's relative satisfaction with their programs and analyzed each management program and determined which strategic objectives resulted in satisfaction.

This research found that facilities should determine their particular level of risk. Facilities that prefer "term vs. whole" insurance may be more satisfied with a program that hedges its risk by utilizing multiple OEMs or 3rd party providers. Facilities that desire stable pricing and cost structures and consolidated management would do well to investigate single OEMs or single comprehensive providers.

Acknowledgements

I would like to express my sincere appreciation to my faculty advisor, Lt Col Timothy Reed, my reader Major Bryan Hudgens, and my sponsor, Lt Col Dawn Rowe from the Air Force Material Command Surgeon General for their guidance and support throughout the course of this thesis effort. Their insight and experience were certainly appreciated as well as their patience with the never-ending thesis revisions. I would also like to thank my husband and daughter for their unwavering support and strength during this entire endeavor.

Additionally, I would like to thank my research partner, Lt Elizabeth Waggoner with whom I collaborated extensively on the data collection and analysis of Chapter three and the presentation of the interview results in Chapter four. Given the identical targeted populations for study, our research committee allowed this specific aspect of the work to be performed together during the effort to better leverage available resources. All other aspects of the research remained separate, individual efforts.

Daria J. Gaillard

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INVESTIGATING THE OPTIMAL MANAGEMENT STRATEGY FOR A HEALTHCARE FACILITY MAINTENANCE PROGRAM

I. Introduction

Background

Facility Maintenance.

The primary objective of maintenance is to ensure equipment components, systems, and support items are in good working condition, are serviceable, and are safe to operate. The maintenance process consists of: servicing, inspecting and repairing. Servicing includes equipment lubrication, cleaning and adjusting or readjusting as required. Inspections include measuring actual wear with instruments and comparing these measurements with documented or historical maximum allowable wear limits.

The final maintenance process, repair, is accomplished when current wear limits exceed maximum tolerable limits. (Raouf, 1994) Facility maintenance is a necessary service resulting from the normal wear and tear of facilities and equipment, deterioration due to age and exposure and abnormal wear and tear due to abuse or neglect. Parts of the facility infrastructure most likely to require and benefit from maintenance include: frequently used parts, portions exposed to the elements, and portions most likely to be overused or abused. (Marshall, 2000)

Astute management decisions regarding maintenance strategies have become increasingly complex and necessary (Walls and Thomas, 1999). Facilities are becoming

more technologically advanced, comprised of more intricate, automated systems and equipment. And, with environments becoming more demanding, breakdowns and erratic processes create difficulties in delivering goods and/or services in timely manners. Therefore, in order to optimize an organization's maintenance assets, it must install the correct equipment and facilities while effectively using its maintenance manpower to perform needed maintenance activities (Tsang, 2002). Additionally, the reliability and failure rates of highly sophisticated equipment and components cannot be determined with absolute certainty, leaving decision makers with hypothetical models and historical actuary data to base critical decisions (Walls and Thomas, 1999).

Problem Area.

Congress has long been concerned with the Department of Defense's (DoD) management of its maintenance programs. In particular, the absence of accurate data has made it difficult to make reliable funding decisions. As a result in 1999, the General Accounting Office (GAO) surveyed 571 military bases and major commands worldwide and determined DoD lacked a comprehensive or standardized strategy for maintaining its infrastructure. Each service differed in its prioritization of repairs, allocation of resources and analysis of property conditions. In addition, the GAO found many bases did not request sufficient funding to cover their real property needs, requesting only up to one fifth of the funding necessary to cover real property maintenance and reported receiving only about one-sixth. (Chan, 1999)

In response to the general under-funding of facility and infrastructure maintenance, Air Force senior leadership put particular focus on its health facilities and medical equipment maintenance programs. Senior leadership increased the Air Force

Medical Service's (AFMS) maintenance budget for its Sustainment, Restoration and Modernization (SRM) program. With funding in hand, but unreliable historical data, the US Air Force Material Command (AFMC) sought to accurately determine the condition of its health care facilities. Researchers assessed the infrastructure of seven bases from AFMC and identified and prioritized many deficiencies. The deficiencies were categorized as: health hazards/life safety, code compliance, energy conservation, service life/reliability and functionality/capacity. (AFMC/SG Case Study)

These deficiencies highlighted an unfortunate and alarming need for the Air Force to pay better attention to the condition of its medical facilities and to transform how it maintains its medical equipment and facilities. Reacting to the need to transform and the increasing pressure to outsource all non-core activities (Luz, 1996), the office of the AFMC Surgeon General (AFMC/SG) discontinued its previous use of full service contracts with original equipment manufacturers and adopted a relatively new maintenance outsourcing strategy: strategic partnering with a capital equipment management firm. Specifically, AFMC/SG's strategy of managed maintenance uses a system of third-party equipment service contracts with warranties to manage its facilities maintenance programs. Although senior leadership has embraced the concept and implemented the program command-wide, the overall management and execution of the program is still in its infancy.

Outsourcing: The Make or Buy Decision.

For the purposes of this thesis, facility maintenance outsourcing will be defined as the use of other than in-house Civil Engineering/Civil Service or over-hire staff. Likewise, facility maintenance insourcing is defined as the use of a dedicated in-house Civil Engineering/Civil Service or over-hire staff. Regardless of whether repair and maintenance and/or management of facilities are the primary responsibilities of in-house departments or outsourced organizations, the focus should be always on a quality outcome (Hertz et al, 2002).

Traditionally, maintenance activities were performed internally. External suppliers were primarily used in the following instances: insufficient internal capacity, volume of maintenance work was too small with specialty skills too varied to justify a dedicated specialist and inadequate expertise (Tsang, 2002). Today, companies are offered a variety of choices on what, if any, portion of their facilities and equipment maintenance to outsource. Companies have begun to learn and focus on "core competencies" or skills and technologies, which enable a company to provide goods and services to customers. These competencies offer qualitative distinctions, which can be used as a source of competitive advantage. (Prahalad and Hamel, 1990) Thus, companies must align their maintenance strategies with their overall business strategies and should answer three questions prior to outsourcing their maintenance activities as a strategic option:

1. What should not be outsourced?
2. What type of relationship will be needed with the external vendor?
3. How should we manage the outsourcing risks? (Tsang, 2002)

Many times the make or buy decision is viewed too narrowly as an accounting or financial decision, when in fact it is far more strategic than tactical in nature (Quinn and Hilmer, 1994). Outsourcing has become more than a costing exercise, but a management strategy, which organizations must recognize as they determine the optimum size and focus of their firm relative to its new environment (Fill and Visser, 2000). The basic premise of outsourcing is that an outside organization can specialize and perform certain services more efficiently than another organization's internal resources. The use of advanced technology, management skills, or economies of scale all contribute to this view (Roberts, 2001).

The success of an outsourcing company is largely determined by the effectiveness of the sourcing organization's management. Within the medical community, hospital size, financial status, management team and available vendors are a few of the variables affecting a management team's decision to outsource. And, although there is no boilerplate for outsourcing, there exist some helpful decision frameworks.

Using a composite outsourcing decision framework developed by researchers Fill and Visser (2000), decision-makers can more thoroughly and visually determine the current factors driving and influencing a firm or organizations' decision to outsource. From their research, three key aspects emerged:

1. The contextual factors represented by an organization's particular internal and external conditions.

2. The strategic and structural aspects associated with an organization's decision to reconfigure.

3. The costs associated with the process or activity under review.

In order to operationalize these focus areas, the researchers constructed the following composite outsourcing decision framework (CODF)

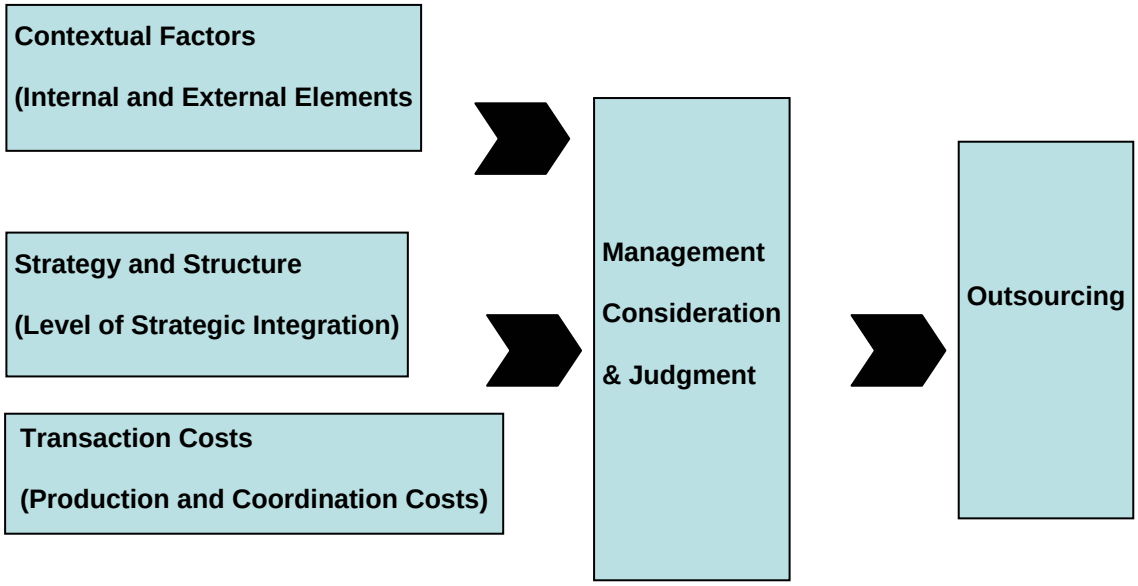

Figure 1. A Composite Outsourcing Decision Framework

Managing strategic outsourcing in the healthcare industry can increase an organization's productivity and efficiency if senior management has a firm understanding of the outsourcing strategy and the benefits and risks of outsourcing.

And, with healthcare outsourcing increasing each year, strategic outsourcing will be a viable strategy for controlling costs and sustaining quality programs. (Roberts, 2001)

Maintenance Management Programs.

The management strategy as defined in this research consists of the strategic decision to utilize total insourcing of maintenance, total outsourcing of maintenance, or the various hybrid strategies within the spectrum. The literature offers the following general hybrid programs, which will be examined and discussed in greater detail: a strategic partnership via an asset management provider or insurance risk provider; a tactical partnership via an asset management provider or insurance risk provider; a full service contract using either original equipment manufacturers or third party service providers; or a service response center. Using these general strategies as a foundation, this thesis will offer a new framework for viewing and understanding the strategies and how they interrelate.

Strategic Objectives

Strategic is a term borrowed from the military term where it means having an impact outside your own military unit, region or battle (Sullivan, 2003). In a dynamic and uncertain environment, healthcare organizations must have a clear sense of their objectives and strategies (Griffith, 1989). Nearly every business function uses the term "strategic" to describe its plans, programs and initiatives. Strategic objectives vary dramatically from tactical objectives. Whereas tactical objectives primarily impact departmental or functional goals, strategic objectives significantly contribute toward

helping the entire organization meet its long-term goals and objectives. Examples of strategic business objectives include improving customer service, reducing costs, increasing market share or employee productivity. (Sullivan, 2003)

Strategic Fit

The concept of "fit" is fundamental to much of the contemporary organizational literature. According to Toulan, Birkinshaw and Arnold (2001), strategic fit suggests that a given set of environmental characteristics necessitates a specific reaction from an organization to be effective. Furthermore, strategic fit is a central component of competitive advantage and the sustainability of that advantage as well. (Toulan, Birkinshaw and Arnold, 2001). Greater strategic fit means that poor performance in one activity (or relationship) will damage the performance in others thus exposing weaknesses. Likewise strategic fit among activities creates internal pressure and incentives to improve an organization's operational effectiveness. (Porter, 1996)

Research Objectives

The objective of this study is to investigate how Air Force MAJCOMs are selecting and optimizing their own management programs for their healthcare organizations' facility maintenance programs. This study will use interviews from MAJCOM facilities maintenance representatives to produce a top-level, descriptive analysis of the challenges each MAJCOM faces in developing and implementing their maintenance programs. This analysis will support and aid Air Force maintenance

managers in selecting and developing optimal management programs for their medical facility programs.

Research Questions

The primary research question is: How do Air Force MAJCOMs determine what management strategy represents the optimal choice for their healthcare organization's facility maintenance program?

Investigative Questions

Based on the discussion, several investigative questions were developed to support the primary research question:

1. What are the current general maintenance programs available to healthcare facilities?
2. How do organizations assess the effectiveness of their maintenance management programs?
3. What is the relative effectiveness of each maintenance management strategy?

Scope

This study specifically addresses management strategies Air Force healthcare organizations may select for their facility maintenance programs. The study does not include research into civilian facilities or other DoD entities.

Comparability

The results may provide key insight to the effectiveness of the AFMCs current managed maintenance program. In addition, results may serve as a useful model for other DoD organizations to evaluate their respective maintenance management programs.

Methodology

In order to analyze the various maintenance management programs, interviews will be conducted with subject matter experts from the MAJCOMs to compare findings of key issues. Data will be analyzed with pattern matching and grounded theory.

Research Contributions

This research offers a re-conceptualized framework for viewing and understanding the various maintenance programs and their interrelationships. The research then investigates the strategic fit between maintenance programs and strategic objectives. Finally, it investigates the strategic fit and how it relates to overall customer satisfaction of the maintenance program.

Summary

This chapter offered a brief discussion of the historical context of the research problem, and outlined the research and investigative questions. It provided an overview of the scope and comparability of the research. The remainder of this thesis is structured as follows: Chapter two will review of the extant literature as related to medical equipment and facility maintenance management strategies, underlying strategic

objectives for assessing program effectiveness for Air Force facilities, importance and relevancy of strategic fit and use of customer satisfaction as a validation tool for strategic objectives. Chapter three will discuss the methodology and analysis employed in conducting this research effort. Chapter four will provide data analysis and results and Chapter five will focus on conclusions and recommendations for further research.

II. Literature review

Introduction

The literature review will consist of four primary sections. The first section will focus on general maintenance programs and offer a framework for viewing these programs and their interrelationships. The second section will concentrate on the relevant strategic objectives DoD and civilian healthcare facilities use to assess the effectiveness of their maintenance programs. The third section will examine and discuss the concept of strategic fit and how it impacts program effectiveness. The fourth section will discuss the concept of customer satisfaction and how it may be used to validate the strategic fit framework and the reliability and relevance of the underlying strategic objectives.

Maintenance Management Programs

Current Management Frameworks.

In recent years, facilities management has undergone significant re-examination (Tarricone, 1999; Blumberg, 1997). Many firms no longer acknowledge facilities management as an inherently core activity and choose to outsource this function. This section will examine the prevailing maintenance programs as they relate to how they are managed.

Full Service Contracts.

Orig*inal Equipment Manufacturer-Single Vendor*

Although hospitals and medical treatment facilities have more management strategy alternatives, the majority of these organizations continue to use full service contracts with their original equipment manufacturers (OEMs) or with third party service providers. Using full service contracts with the OEMs remains an attractive option for healthcare organizations for a number of reasons. First, full service contracts with OEMs have inherent budget stability. The OEMs provide round the clock coverage and have set prices for their routine corrective and preventive repairs, which make repair costs more predictable for the FM. (Blumberg, 1997; Lafrenaye, 1992)

In addition to budget stability, OEM contracts offer increased reliability. Healthcare organizations receive priority status for their critical equipment with guaranteed response times and no pre-set limit to the amount of service call. Although, not unique to OEMs, and generalizable to any outsourced agency, OEM contracts provide FMs with a cheaper alternative than maintaining and sustaining current training programs for their in-house technicians. (Lafrenaye, 1992)

Using any management strategy involves tradeoffs, and despite their advantages full service contracts also have their drawbacks. Many OEMs restrict and even prohibit the use of outside service companies repairing or servicing their equipment (Blumberg, 1997). While under an OEM contract, healthcare facilities risk voiding their equipment warranties if they should choose to solicit or work with third party service companies. Although detractors exist, single sourcing offers many appealing benefits including less

administration, volume discounts, fewer hassles and hopefully a proven track record. (Tarricone, 1999)

Original Equipment Manufacturer-Multiple Vendors

Within the last ten years, outsourcing has slowly shifted from single source suppliers to a more balanced approach of out-tasking, or bundling like or complementary services. The impetus for the single source solution had been drastic reduction of overhead and administrative costs. Firms trying to eliminate staff quickly, put little time into their outsourcing arrangements and implementation plans. (Tarricone, 1999)

For their part, the one-stop suppliers entered into ad hoc strategic alliances with other suppliers or used extensive subcontracting in order to deliver the myriad services they promised. With little or no institutional knowledge of the client's corporate culture and no developed trust between the firms, the results proved dreadful. There was an overall lack of direction, poor quality, and poor service. As such, many firms today are still skeptical of using single source suppliers for their facilities management needs. (Tarricone, 1999)

Given these firms' reticence, they have opted to use two suppliers to better hedge their risk. The advantages of using two suppliers are many. First, it can provide healthy competition, often spawning "co-opetition", which is described as a cooperative arrangement between competitors whereby each supplier works side by side and occasionally works together. Second, dual suppliers offer some firms the needed flexibility by delineating areas of responsibility. (Tarricone, 1999)

Partnering with Equipment Management Firms.

Tactical Partnering

Organizations may choose not to eliminate their in-house maintenance support staff entirely. Rather, their goal is to augment the existing staff during peak periods or for specific projects. Tactical, or "episodic" relationships, as they are referred to by the maintenance community, may start with a single project or additional support, but many times it develops into a more long-term relationship with a greater scope and increased areas of responsibility. (Tarricone, 1999)

Strategic Partnering

Depending on whom you ask, strategic partnerships might be the wave of the future. Whereas facilities managers seem to prefer separate contracts for their outsourcing needs, Chief Financial Officers and corporate real estate directors look to leverage resources and bundle all of their services into one contract. One survey found 67% of polled firms used separate service contracts while only 3% used one all-inclusive contract. (Tarricone, 1999) Servicing healthcare facilities has become onerous, difficult and expensive. With repair prices already high and continually rising, the healthcare industry needed a new process to professionally manage, consolidate and reduce its costs. (Tudor and Gemill, 1994)

In an effort to reduce maintenance, repair and reorder costs associated with capital asset management, many healthcare facilities have begun using third-party capital equipment management companies (Tudor and Gemmill, 1994). This new concept in managing maintenance borrows its style from HMOs in hospitals. Hospitals or health care facilities pay companies a set amount to assume responsibility for the management

and maintenance of their facilities and/or equipment. The "third party" contracts on behalf of the sourcing agency and attempts to negotiate cost-effective maintenance contracts with vendors. (Tieman, 2002)

Third party maintainers help reduce costs by providing previously lacking technical expertise that helps reduce response times and creates more efficient preventive maintenance programs (Tudor and Gemmill, 1994). In this scenario, hospitals rely on a third party to manage their vendor contracts, using economies of scale to secure optimal equipment prices for parts and services while ensuring vendor payment. In essence, this is managed care for maintenance (Tieman, 2002).

Using historical maintenance data, third party maintainers may choose one of two business philosophies. Some third party maintainers may choose to assume 100% responsibility for all capital equipment. However, more companies choose a more profitable alternative and prefer maintaining the raw 20% of hospital equipment, which typically account for 80% of the maintenance dollars. (Tieman, 2002)

The multi-billion dollar managed maintenance industry has not been immune to the corporate scandals of the beginning of the decade. One prominent company's illegal accounting and business practices has focused more attention on the facilities management and forced decision-makers to behave more cautiously before outsourcing to a third party. Outsourcing facilities management is a delicate process, requiring a solid balance between maximizing revenue for corporate profit and maximizing the quality of client service. If this trust is broken, the outsourcing facility is left with broken vendor relationships and unpaid bills leading to chaotic facilities management and delinquent facilities maintenance. (Tieman, 2002)

Working on behalf of a syndicate of 23 hospital trusts throughout the United Kingdom, researchers sampled 50 hospital trusts in a facilities management survey. Their findings indicated few of the trusts felt facilities management was a mature enough market for outsourcing "total" facilities management. The report detailed of the few total facilities management contracts issued; each one was a unique model and completely groundbreaking. Even so, the report confirmed enormous potential for the total facilities management market. There are numerous suppliers in a largely un-tapped market (Tarricone, 1999). Key criteria in supplier bid evaluation included: financial stability, technical expertise, measures for ensuring quality, flexible approach and price. ("Trusts" 1996)

Although capital equipment management companies may structure or tailor their organizations differently, research (Tudor and Gemmill, 1994) shows all attempt to offer healthcare organizations the following benefits:

Technical Expertise- Capital equipment management organizations provide technical expertise superior to that offered by the original equipment manufacturers and independent service organizations since they supplement additional, more extensive training (Tudor and Gemmill, 1994).

Responsiveness- Many capital equipment management companies have on-site technicians with average response times of 30 minutes or less

(Tudor and Gemmill, 1994).Motivated Employees- Since integration within corporate culture is a key criterion for capital equipment management companies, many of these companies put additional emphasis on recruiting the right technicians. In fact,

many compensate their technicians based on quality improvement (Tudor and Gemmill, 1994).

Preventive Maintenance Programs- Capital equipment management follows the precept that one formal, over-arching, organization-wide preventive maintenance program is most effective for maximizing equipment life cycles (Tudor and Gemmill, 1994).

Risk Protection- Capital equipment management companies assume the risk for equipment malfunction and/or failure by relying on their employees' expertise and thoroughness (Tudor and Gemmill, 1994).

Documentation- As discussed previously, healthcare facilities are trying to become more patient-oriented and therefore gladly offload the chore of documenting and monitoring daily usage patterns for equipment to the capital management companies (Tudor and Gemmill, 1994).

Cost-Savings-Through the collective combination of expertise, increased response times, motivated employees, preventive maintenance programs, risk protection and documentation, many healthcare facilities have achieved upwards of 30% cost savings with improved service (Tudor and Gemmill, 1994).

Not all partnerships are strategic and strategic partnerships rarely begin that way. The relationship is progressive and can be visually explained using the Supplier Relationship Model (Rogers, 1999).

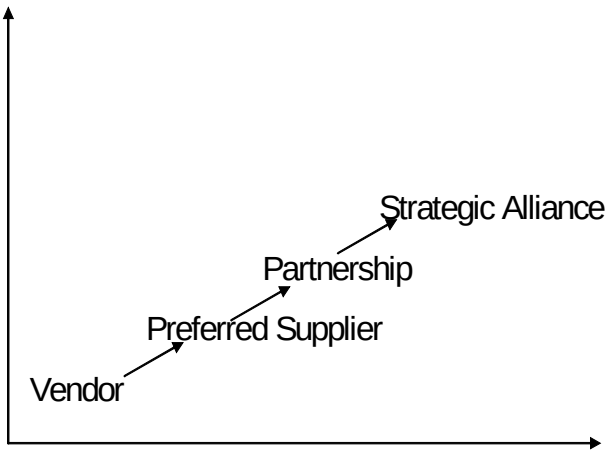

Figure 2. Supplier Relationship Spectrum (Rogers, 1999)

Partnering with Insurance Risk Providers.

Insurance risk providers offer a unique service in which a third party underwrites facility repair costs. The insurance provider charges a fixed price or "premium" for its repair coverage of the equipment. Premiums are based on the age, model number and amount of usage. The insurance provider hedges its risk through a diversified portfolio of very high cost items and very low cost items. (Lafrenaye, 1992)

As opposed to a full service contract, the insurance risk provider utilizes a time and materials contract. The equipment vendors handle all needed repair for items covered under the program. Under a time and materials contract, the vendor generates an invoice for the actual repair costs to include travel time, parts and labor and applicable extraneous charges. The healthcare facility then pays the invoice and submits the claim to the insurance risk provider for reimbursement. (Lafrenaye, 1992)

This particular management strategy allows a healthcare facility to limit its payments to only those repairs requested and accomplished. Although there is no limit to the amount of claims to be submitted, insurance premiums are directly related to the actual repair cost history of equipment and are subject to annual readjustment as such. (Lafrenaye, 1992)

Similar to the asset management programs, insurance providers may also provide on-site management to assist with program oversight and implementation. The company typically develops a database for equipment tracking, actual repairs, and claims. Additionally, they provide expertise in recommendations for second source pricing for equipment repair. (Lafrenaye, 1992)

Service Response Center.

Reporting and servicing maintenance orders can be both cumbersome and time-consuming. Multiple calls placed and phone line logjams are not unheard of situations in health facilities (Burmahl, 2001). In response to the need for more efficiency in facilities maintenance, hospitals began outsourcing their facilities maintenance using an external Service Response Center.

The Service Response Center is a consolidated management system created to increase the efficiency between in-house staff and outsourcing firms. Employees place non-clinical service requests via phone to the service response center. The center is manned by service coordinators, who log the requests, prioritize the orders, dispatch field workers to the scenes and confirm the completed service. Hospitals using a service response center have shown accelerated service times—due to the streamlined process

and improved customer satisfaction as shown by in-house hospital surveys. (Burmahl, 2001)

Using the management strategies found in the literature, this research proposes a new framework for conceptualizing the relationships between the hybrid outsourcing maintenance programs (see table 1). For simplicity, table 1 is broken into two categories: insurance based programs and non-insurance based programs. With these two broad categories, the majority of maintenance programs have been captured.

Table 1. Proposed Management Program Framework

Insurance Program: A service provider who underwrites facility repair costs and charges the organization fixed prices to provide repair coverage.	**Non-Insurance Program:** A service provider who uses methods other than underwriting facility repair costs to provide repair coverage.
Number of Insurers • Single insurer • Multiple insurers	Number of Vendors • Single vendor • Multiple vendors
Insurer • Original Equipment Manufacturer(s) insures facility parts • A third party service provider(s) insures facility • A combination of Original Equipment Manufacturer(s) and third party service provider(s) insures equipment/facility	Program • Episodic Program: Facility preventative maintenance and/or repair is covered on an "as needed" basis. • Comprehensive Program: facility's preventive maintenance and/or repair is covered under one pre-negotiated program.
Coverage • Comprehensive Program: All or most of facility's PM and/or CM is covered under one insurance provider. • Item Specific Program: All or most of the facility's preventative maintenance and/or CM is covered by different insurers based on the item.	Management • Vendor provides in-house management. • Vendor provides in-house management and on-site technicians. • Vendor provides on-site technicians. • Vendor provides an on-call service.
Management • Insurer(s) manages facility CM and/or PM with internal or onsite resources. • Insurer(s) manages facility CM and/or PM with subcontracted resources. • Health care facility manages facility CM and/or PM with reimbursement from insurance provider(s).	

Strategic Maintenance Management Objectives

In many business areas, successful outsourcing can be measured simply by looking at the bottom line (Fill and Visser, 2000). However, healthcare facilities maintenance requires a more thorough evaluation of outsourcing performance (Hubbard, 1993). The following list details the key objectives decision makers face as they choose to outsource and the metrics used to evaluate performance. (Fill and Visser, 2000)

Timeliness.

The nature of the work involved and the criticality of the item affects response goals and thus response times. Timeliness is measured by the average time to respond for particular classes of maintenance activities. It is calculated by capturing the elapsed time between the work request and the actual time work has begun. This measurement is helps indicate how well maintenance satisfies customers' expectations of timeliness. (Hubbard, 1993)

Quality of Service.

While there has always been a focus on reducing costs, firms are becoming more sophisticated and are looking less for "labor brokers" and more frequently for value. Firms more often desire outsourcing agents who bring best practices with them as well as sophisticated procedures and technical knowledge. (Finchem, 1997) Quality of work is not as quantifiable as timeliness and therefore not as easily measured. However Table 2 illustrates metrics can be used to help gauge the level of customer satisfaction.

Table 2. Quality Metrics (Finchem, 1997)

Customer Complaints	Most visible measure of customer satisfaction.
Work Reviews	In many cases, customers must sign completed work slips acknowledging any dissatisfaction.
Repeat Work	From the customer's perception, continual facility problems indicate poor maintenance performance.
Formal Rating Systems	These programs may provide valuable feedback regarding satisfaction.
On-going Commitment	From customer's perspective, supplier shows continual improvement.

Reliability Improvement: Equipment Downtime.

As the heading indicates, this maintenance goal seeks to maximize the uptime of all parts of the facility infrastructure. Maximizing operational availability improves patient care (Hertz, Freeman, Berek and Perry, 2002).

Cost Reduction.

Historically, cost reduction has been a primary driver for outsourcing maintenance (Finchem, 1997).

Cost Stability.

Cost stability shows a continual identification of waste and abuse, new controls and cost reporting and national purchasing power (Hubbard, 1993).

Program Flexibility.

Program flexibility as a maintenance objective is the ability to expand and contract services based on demand (Hubbard, 1993).

Management Expertise.

Management expertise allows for the more efficient use and utilization of specialized skills and knowledge (Hubbard, 1993)

Repair Documentation Management.

More efficient repair documentation management allows for less obsolescence since preventative maintenance is being performed in a timely manner with the documentation being organized and managed (Hertz et.al., 2002).

Strategic Fit

Strategic fit is one of the oldest concepts in the strategy literature (Toulan, Birkenshaw and Arnold, 2001). Strategic fit rests on a widely shared and enduring assumption within the strategy formulation literature that the appropriateness of a firm's strategy can be defined in terms of its fit, match, or alliance with the environmental or organizational features or objectives facing the firm (Hofer and Schendel, 1978). Strategic fit is a core concept in strategy formulation models (Toulan and others, 2001).

A better understanding and incorporation of strategic fit into strategy is viewed as improving organizational performance (Zajac, Kraatz and Bresser, 2000). However, some authorities argue that strategic fit has been supplanted on the management agenda while managers take a less holistic organizational approach and focus singularly on core competencies, critical resources and key success factors. (Porter, 1996)

Strategic fit is a central component of competitive advantage and the sustainability of that advantage as well. Good strategic fit means that poor performance in one activity (or relationship) will damage the performance in others thus exposing

weaknesses. Likewise strategic fit among activities creates internal pressure and incentives to improve an organization's operational effectiveness. (Porter, 1996)

Customer Satisfaction

Customer satisfaction is central to competitive advantage (Boone and Kurtz, 1995, Drucker, 1954). It is defined as the ability of a good or service to meet and/or exceed a customer's needs or expectations. Customer satisfaction encompasses both the tangible and intangible traits of a firm's goods or services. (Boone and Kurtz, 1995) Not only is customer satisfaction critical to an organization's success (Drucker, 1954), but it is the true measure of the quality of a good or service (Boone and Kurtz, 1995; Gibson, Ivancevich, Donnelly and Konopaske, 2003).

Customers have product performance and service expectations, which they want met. In fact, customers have begun to demand more than simply a fair price, but added value, which results in increased worth by offering more than expected. Customer satisfaction then becomes a balancing act between what customers want and what organizations can provide. (Boone and Kurtz, 1995)

In order to optimize this relationship, companies need accurate information. With more precise information, companies can focus on the integral issues actually driving satisfaction. Directed focus often leads to cost reductions since organizations can target improvements in areas of customer concern and de-emphasize their focus in non-customer-valued adding areas. (Michel, 1999)

Theoretical Model

From the literature review, this research can best be conceptualized using the following theoretical model, which states: The fit between particular maintenance management programs and corresponding organizational strategic objectives will result in or influence the degree of customer satisfaction. Through the data collection and analysis, this thesis intends to support and validate this model or explain any deviations to the model if identified.

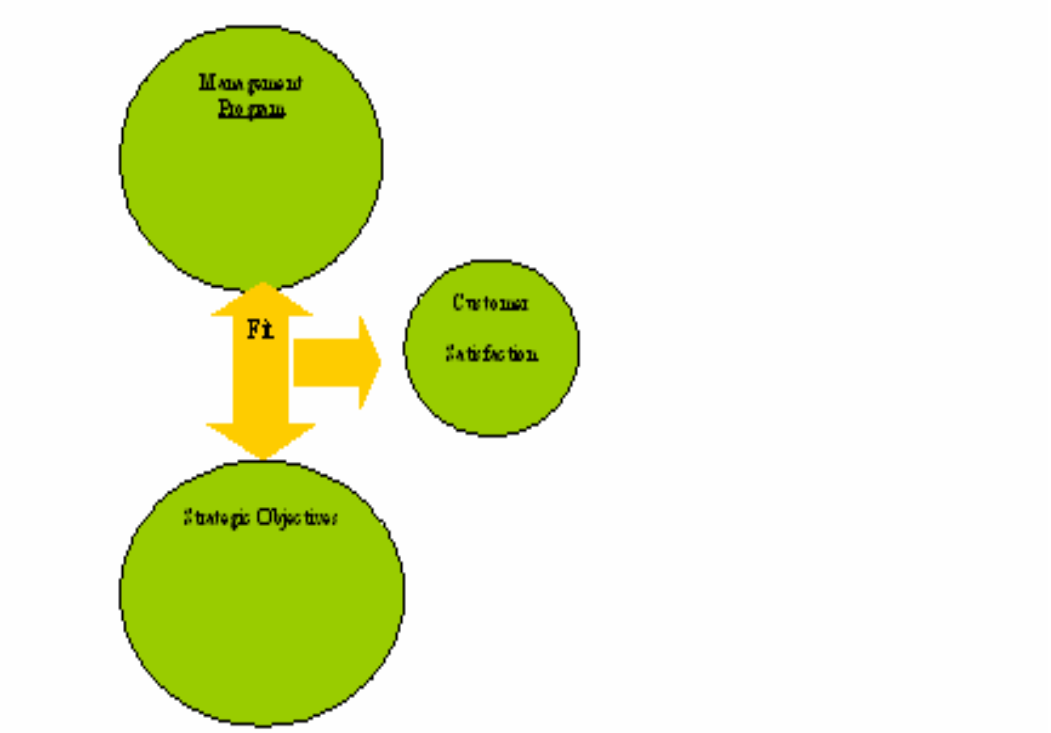

Figure 3. Theoretical Relationship Model

Summary

This chapter provided a review of the literature as related to facilities management programs, maintenance management objectives and concepts of strategic fit and customer service. The researcher merged these areas into a theoretical model and offered a re-conceptualized framework for viewing the traditional management strategies. Chapter 3 discusses the methodology and validation tools the researcher used for testing the research question.

III. Methodology

Introduction

Selecting a research methodology is a critical step when beginning a research project. The design of the project comprises the blueprint for collecting, measuring, and analyzing the data. This chapter outlines and describes the methodology used to answer the research questions posed in Chapter 1 of this research. The discussion includes the methodology used to analyze the interviews and guided interview questionnaire responses and the rationale for the chosen data collection methods. Additionally, it discusses the development of the interview and questionnaire, how experts were identified, selected and interviewed and the revising of the research question.

Research Problem

The question driving this research is: How do Air Force MAJCOMs determine what management strategy represents the optimal choice for their healthcare organization's facility maintenance program? In order to answer this question, several investigative questions were developed for support and analysis:

1. What are the current general maintenance programs available to healthcare facilities?
2. How do organizations assess the effectiveness of their maintenance management programs?
3. What is the relative effectiveness of each maintenance management strategy?

The purpose of the methodology is to create and describe a rigorous, sound roadmap for answering the investigative questions and ultimately the primary research question.

Purposeful Sampling

The research employed purposeful sampling method to select the pool of interviewees. This method is particularly appropriate for this research since it is designed to understand certain select cases in their own environment without generalizing to an entire population. Furthermore, it offers the opportunity to study in depth information rich cases, where the researcher can learn most about central issues pertinent to their study. Within purposeful sampling, there are ten variations from which to choose (Isaac and Michael, 1997):

1. Extreme or deviant case sampling
2. Maximum variation sampling
3. Homogeneous samples
4. Typical case sampling
5. Critical case sampling
6. Snowball or chain sampling
7. Criterion sampling
8. Confirmatory or disconfirming cases
9. Sampling politically important cases
10. Convenience sampling

Of these ten variations, this research used homogeneous samples. It allowed for a small sub-group to be studied in-depth and the possibility of uncovering major program issues (Isaac and Michael, 1997).

Representative Types of Qualitative Research.

Although there are various methodologies used for qualitative research, all methods have two basic tenants in common (Leedy and Ormrod, 2001). The first is they all focus on phenomena that occur in natural settings and, second they involve studying those phenomena in all their complexity (Leedy and Ormrod, 2001). According to Denzin and Lincoln (1994), qualitative research emphasizes processes and meanings that are not rigorously examined or measured in term of quantity, amount, intensity, or frequency. There are numerous research strategies available in this type of research; study design, case study, ethnography, phenomenology, ethnomethodology, grounded theory, biographical method, historical method, action and applied research, and clinical research.

In particular, Leedy and Ormrod (2001) discuss four qualitative approaches, which will be explored in the following paragraph. Leedy and Ormrod discuss several designs in each approach, allowing the researcher to determine which method may be best. As this research more closely meets the criteria expressed for qualitative research, only qualitative designs discussed by Leedy and Ormrod were extensively examined. These designs include case study, ethnography, phenomenological study, and grounded theory.

Case Study

Case studies intend to understand a situation, or small number, in greater depth. Case studies examine a phenomenon using one or a few instances in the natural setting. The case study is a research strategy focusing on understanding the dynamics present within contemporary, single settings. Moreover, the case study can be used to provide description, test theory or generate theory. (Eisenhardt, 1989)

Case studies may involve both single and/or multiple cases with various levels of analysis (Yin, 1994). Since the case study is such a dynamic, flexible design, it incorporates data from archives, interviews, questionnaires and observations. As such, the evidence collected from case study research can be qualitative, quantitative or both. (Eisenhardt, 1989)

Ethnographic Designs

Ethnographic designs were dismissed due to a focus on understanding group culture at a specific field site.

Phenomenological

Phenomenological designs study an experience from the participant's perspective. A phenomenological study is a study that attempts to understand subject's perceptions, and understandings of a particular situation. Phenomenological researchers depend almost exclusively on lengthy interviews with a carefully selected sample of participants. A typical selection size of five to twenty five is appropriate with all respondents having direct experience with the phenomenon being studied. Data analysis in phenomenological research has one central task; identify common themes in people's description of their respective experiences (Leedy and Ormrod, 2001).

Grounded Theory

While most qualitative research methodologies have a beginning theoretical framework, grounded theory research is one of the exceptions. The major purpose of grounded theory study is to begin with data and use them to develop a theory, using a prescribed set of procedures. As with other qualitative research designs, data collection is field-based, flexible and likely to change through the course of the study. Interviews typically play a major role, but other sources of data such as historical records, observations, and other documents are used. The only restriction on the data used in this methodology is that the data collected must include the perspectives of the people being studied (Leedy and Ormrod, 2001). "Of all the research designs [described] … a grounded theory study is the one that is least likely to begin from a particular theoretical framework" (Leedy and Ormrod, 2001,). In addition, the focus of a grounded theory study tends to be human interactions. After selecting a methodology, which essentially combines aspects of grounded theory, phenomenological and case study methods, the research followed a process adapted from Eisenhardt (1989):

Table 3: Process of Building Theory from Case Study Research (adapted from Eisenhardt, 1989)

Step	Activity	Reason
Getting Started	Definition of research question. Possibly a priori constructs	Focuses efforts, Provides better grounding of construct measures
Selecting Samples	Neither theory nor hypothesis. Specified population. Theoretical, not random, sampling	Retains theoretical flexibility. Constrains extraneous variation and sharpens external validity. Focuses efforts on theoretically useful cases—i.e.; those that replicate or extend theory by filling conceptual categories.
Crafting Instruments and Protocols	Multiple data collection methods. Qualitative and quantitative data combined. Multiple investigators	Strengthens grounding of theory by triangulation of evidence. Synergistic view of evidence. Fosters divergent perspectives and strengthens grounding.
Entering the Field	Overlap data collection and analysis, including field notes. Flexible and opportunistic data collection methods.	Speeds analyses and reveals helpful adjustments to data collection. Allows investigators to take advantage of emergent themes and unique case features.
Analyzing Data	Within-case analysis. Cross-case pattern search using divergent techniques.	Gains familiarity with data and preliminary theory generation. Forces investigators to look beyond initial impressions and see evidence thru multiple lenses.
Shaping Hypotheses	Iterative tabulation of evidence for each construct. Replication, not sampling, logic across cases. Search evidence for "why" behind relationships.	Sharpens construct definition, validity, and measurability. Confirms, extends, and sharpens theory. Builds internal validity.
Enfolding Literature	Comparison with conflicting literature. Comparison with similar literature.	Builds internal validity, raises theoretical level, and sharpens construct definitions. Sharpens generalizability, improves construct definition, and raises theoretical level.
Reaching Closure	Theoretical saturation when possible.	Ends process when marginal improvement becomes small.

Research Design

Methodological Triangulation.

Denzin and Lincoln (1994) suggest because different perspectives can result from the use of different methods, often more than one method may be used within a project to gain a more holistic view of the setting. This dual view is referred to as methodological triangulation (Denzin and Lincoln, 1994).

A research design develops a logical plan for taking the proposed questions to conclusions. For the case study, Yin identified five components in the design: the study's questions, propositions, unit(s) of analysis, logic linking data to propositions, and criteria for interpreting the findings. Case studies are interpreted here in the more general sense of qualitative research. Yin proposed the following 3 conditions to facilitate researchers in selecting a particular design (1994):

1. the type of research posed;
2. the extent of control an investigator has over actual behavioral events;
3. the degree of focus on contemporary as opposed to historical events.

Using these conditions, Yin (1994) developed the following decision table, which captures and matches the conditions with which certain strategies are selected.

Table 4. Relevant Situations for Different Research Strategies (Yin, 1994)

Strategy	Form of research question	Requires control over behavioral events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Using this table as a guideline, this research has numerous elements that add to the complexity of collecting accurate and full data. For that reason, a cross-section of methodologies has been used to add to the rigor of the research as well as ensure capturing the full perspective of the targeted population.

Research Design Quality.

Readers, reviewers, and practitioners must be able to assess the worth of a proposal or research (Leedy and Ormrod, 2001). Four tests are commonly used to assess the quality of empirical studies and these four tests are also relevant to case studies (Yin, 2003b). The four tests, tactics for use, and appropriate research phase for implementation are summarized in Table 6 (Yin, 2003b).

Table 5. Case Study Tactics for Four Design Tests (Yin, 2003b)

Tests	Case Study Tactic	Phase of research in which tactic occurs
Construct validity	• Use multiple sources of evidence	• data collection
	• Establish chain of evidence	• data collection
	• Have key informants review draft case study report	
Internal validity	• Do pattern-matching	• data analysis
	• Do explanation-building	• data analysis
	• Address rival explanations	• data analysis
	• Use logic models	• data analysis
External validity	• Use theory in single-case studies	• research design
	• Use replication logic in multiple-case studies	• research design
Reliability	• Use case study protocol	• data collection
	• Develop case study database	• data collection

The trustworthiness of results involves unique criteria. Conventional research uses the standards of internal validity, external validity, reliability and objectivity. However, these standards need to be modified when dealing with research in a naturalistic setting. Since aspects of this research follow both conventional and naturalistic research lines, the following table adapted from Lincoln and Guba (1985) is included to detail the criteria for establishing trust and confidence in research results.

Table 6. Criteria for Establishing Trust and Confidence in Research Results (Lincoln and Guba, 1985)

Conventional Research	Naturalistic Research
• Internal Validity—Did variations in the independent variable produce a change in the dependent variable?	• Credibility—Will the methodology and its conduct produce findings that are believable and convincing?
• External Validity—Can the results of this investigation be generalized to other settings?	• Transferability—To what other contextually similar settings can these findings be applied?
• Reliability—Are the results consistent, repeatable, and predictable from one study to another?	• Dependability—Within reasonable limits, are the findings consistent with other similar studies?
• Objectivity—Are the events under study public and observable so as to allow agreement among investigators?	• Confirmability—Are both the process and the product of the data collection and analysis auditable by an outside party?

Internal Validity/Credibility.

Internal validity is designed to eliminate rival explanations for the findings in contrast to those presented by the researcher. Similarly creditability aims to produce findings that believable and convincing (Isaac and Michael, 1997). To achieve construct validity, an investigator must specifically define the variables of interest, relate them to the study's objectives, and demonstrate the selected measures reflect these variables (Yin, 2003b). Yin (2003b) lists three tactics to meet the test of construct validity: use multiple sources of evidence, encouraging convergent lines of inquiry; establish a chain of evidence; and have the draft study report reviewed by key informants. All three tactics were employed for this research. Details of the first two tactics are discussed in the section on data collection principles. (Yin, 2003b).

External Validity/Transferability.

External validity establishes the domain to which a study's findings can be generalized (Yin, 2003a). To determine whether research findings are generalizable beyond the immediate study, Leedy and Ormrod (2001) cite two applicable strategies for external validity: use of a real-life setting and replication in different context. A case study naturally occurs in a real-life setting. As discussed previously, the research was conducted as a multiple-case design. The multiple cases allow for replication. Furthermore, Yin (2003b) calls for analytical generalizations, where the results use a broader theory as the basis for generalization. Yin (2003b) cautions that the generalization is not automatic and insists the theoretical generalization must be tested by the same replication logic underlying experiments. This study relies primarily upon replication to create external validity by context and theory through the use of a multiple-case design.

Reliability/Dependability.

Yin (2003b) describes reliability, whose goal is to minimize the errors and biases in the study, as follows:

> The objective is to be sure that if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions (p. 37).

To accomplish this task, Yin states documentation of the procedures is the key. This chapter describing the methodology, the use of a questionnaire approval protocol, and the interview follow-ups served this purpose.

Objectivity/Confirmability.

Objectivity strives to eliminate subjective bias by assuring that the methods of obtaining information are public and observable to allow agreement across multiple observers. Confirmability attempts to ensure that both the process and the product are auditable by an outside party. Confirmability is the most demanding of the four criteria, involving a comprehensive examination of the entire sequence of the entire event. The purpose of this examination is to establish the extent sound decisions were made, but also to determine if accurate information was attained (Isaac and Michael, 1997).

In order to avoid subject and response bias, the research team alternated interviewing and recording duties. This allowed each researcher an opportunity to objectively listen and record responses and later to guide questions and listen. Additionally, each interview was later formatted into tables and coded into categories and sent to interview recipients for content and context approval. All interviewees responded that the content and "spirit" of their responses had been captured and coded accurately.

Study Development.

This research sought to extract expert opinion regarding the selection and optimization of maintenance management models; however, research has shown that the original research questions may shift during the research process. Interviews were selected as the primary and most appropriate data collection methodology for this research. The interview technique was deemed the most flexible and adaptable method for gaining insight into contemporary research questions, which may evolve. The interaction between the interviewer and interviewee provides the distinct opportunity to

seek further clarification and/or explanation regarding answers or insights. (Eisenhardt, 1989)

Interview Development Process.

In order to focus the primary type of data collection (interviews) and add a secondary type of data collection and analysis, a guided interview questionnaire instrument was developed. The questionnaire went through multiple review and pre-testing procedures. The questionnaire reviews came in two different forms. The first was the Air Force Personnel Center (AFPC) approval process and the second was the Human Subject Review Board (HSRB) approval process. Finally, the questionnaire was pilot tested on MAJCOM representatives attending an Air Force medical facility maintenance conference.

AFPC Review

The AFPC approval process is an integral step for a guided interview questionnaire or survey administered to Air Force personnel. With few exceptions, AFPC is the focal point for all questionnaires administered within the USAF. The Headquarters AFPC/DPSAS survey approval program is designed to protect individual responses and ensure confidentiality to preclude any possible negative action or reprisal (AFI 36-2601).

Human Subjects Review Board

The second review process accomplished during this research effort was the Human Subjects Review Board (HSRB). The purpose of the HSRB is similar to that of the HQ AFPC/DPSAS review process, yet the focus is strictly on the protection of subjects being tested or interviewed. The HSRB, a review committee created from AFI 40-402, was created solely for the “Protection of Human Subjects”. The HSRB is

responsible for the examination and review of each study, experiment or research project performed in the USAF that deals with human participants.

Subject Matter Expert Review

The last method of review was conducted at a conference for Air Force medical facility maintenance personnel. This group was selected primarily due to their knowledge of the subject matter, their MAJCOM perspective and their availability as a whole. The purpose of the pilot test was to test the guided interview questionnaire, identify discrepancies, redundancies and highlight areas of improvement. In addition, it was intended to allow the researcher to gather data for testing and comparison. Feedback indicated the questionnaire was too lengthy and certain sections of the survey were not applicable to their respective job specialty. Adjustments were made to the interview guide based on this feedback.

Subject Matter Expert Interviews.

Using the pre-tested guided interview questionnaire, subject matter experts were interviewed. The purpose of these interviews was to gather information and expert opinion on the current maintenance programs being used in Air Force healthcare facilities today. As mentioned, the interview questions were adapted from the pre-tested guided interview questionnaire previously developed by the research team. The guided interview questionnaire is attached to this document in Appendix A. During the interviews, the questionnaire was used to capture demographic information and lead the discussion until the interviewees were comfortable in speaking free form of their maintenance programs.

Sample Interview Questions.

1. What is your current maintenance management program?
2. Are you satisfied with this program? How is it working?
3. Are there any unique challenges or tradeoffs to using this program?
4. How do you see the role of the facility manager?
5. Do you have any method in place for determining the best management program?

Sample Selection.

In order to discover the collective viewpoints of Air Force health facilities experts, the interviews were conducted during a conference of the Air Force Health Facilities Division. Participating personnel represented the Air Force MAJCOMs, with additional members from the host organization, Brooks City Base. A total of 8 interviews were conducted from the following MAJCOMs: USAFA, AFSOC, AFSPC, ACC, AMC, AFMC and AFMSA. Experience ranged from 2 years to 25 years. Due to time constraints, the researchers were unable to obtain interviews from every MAJCOM.

Using representatives from the conference limited the number of potential subjects who could be interviewed, however the experience and knowledge of these particular "subject matter experts" offered the exact knowledge and information the interviews sought to extract, thus mitigating the threat to the validity of the research.

Data Collection

Data Collection Principles.

In an effort to enhance the creative potential and confidence in the interview process, the research utilized two investigators instead of one. Not only do team members have complementary insights, which add richness to the data, but they offer converging observations and a higher likelihood of discovering unique findings. (Eisenhardt, 1989) The two-person research team divided the interviewing responsibilities between them. While one researcher conducted the interviews, the other researcher taped the sessions and recorded notes and observations.

All interviews were conducted in accordance with AFI-36-2601, Personnel: Air Force Personnel Survey Program and local Air Force Institute of Technology (AFIT) procedures. Participants were all informed their identities would not be disclosed and their responses would not be used in such a way as to trace their identities.

Secondary Sources.

Industry reports and literary sources were examined if available. Informal observations were made, and data were collected on personality and leadership styles, MAJCOM demographics, and prior experience with various healthcare facility maintenance strategies. (Eisenhardt, 1989).

Key Informant Review.

As mentioned earlier in the chapter, tabular interview transcripts were made available to subjects for final approval and release before the data was analyzed. The transcripts were returned to the participants for approval. Coded interview transcripts were used in the composition of this study. Once the report was completed, key

informants were asked to review the report for accuracy. Key informant evaluation of the results of the study increased the validity and reliability of the research.

Data Analysis

Overview.

The analysis procedure was adapted from the grounded theory approach first formulated by Glaser and Strauss (1967) and more recently employed by Isabella (1990). The approach requires that data and theory be constantly compared and contrasted throughout the collection and analysis process. Through this set of procedures, it is possible to develop "grounded theory" about what is observed in the field (Strauss and Corbin, 1990). The fluidity of this approach often results in a re-conceptualization, which should account for and include all nuances of the data. (Isabella, 1990)

Once the interviews were completed, they were each transcribed and summarized by the team. The analysis process began with preparing separate summary tables for each interviewee. The tables were divided to represent the alternate views between the subjects' present management programs and the "desired" or "in process" management programs. Additionally, the tables captured the shifting perceptions of the effectiveness and/or efficiency of the strategic objectives as they related to the present and desired management programs.

The data was initially pre-arranged in the tables through recorded notes and observations. The team collaborated to fill in any gaps, clarify interpretations and discuss inconsistencies. Next, the team listened to the recorded interviews and adapted the data tables as needed. As a final independent review, the summarized interviews were

electronically sent to the interviewees for validation. This allowed the subjects to preserve any language they wished and helped ensure the accuracy of the results. The interview results provided a basis to establish the limitations of the original research question and the opportunity to gain insights into the research question and assess the current environment surrounding healthcare facility maintenance within the Air Force.

Content Analysis Design.

Content analysis provides a framework for data analysis within the case study design of this research necessary to answer the research questions. Therefore, content analysis must also be explored. The following paragraphs detail the use of content analysis in general as well as the specific ranking scheme used for this research and its reliability. Although a complete methodology in itself, content analysis was used here to help guide the researcher to valid and reliable conclusions and ensure the repeatability of the study. The rigor of the study lies primarily in the case analysis design.

Use of Content Analysis

Content analysis takes many words from a document and classifies them into much fewer content categories, "reducing [the document] to more relevant, manageable bits of data" (Weber, 1990). For a proper analysis, a coding scheme must be created a priori. The scheme should ensure reliability of coding as well (Weber, 1990). Generation of the coding scheme and its reliability will be discussed in the following sections.

The Coding Scheme

Weber (1990) provides a stepwise process to creating and using a coding scheme, which will be used for this study. First, the researcher must define the recording unit, the

basic unit of text to be classified. The recording unit may vary from a single word to the entire text. After the recording unit has been established, the categories must be determined using two distinctions: (1) will categories be mutually exclusive and (2) will categories be narrowly or broadly defined. Weber prescribes testing of the scheme next using a small sample of test or actual data. Following testing, Weber suggests reviewing the coding rules. Any necessary changes, as indicated by testing, should then be made.

Application of Weber's (1990) coding scheme process led the researchers to the following. For this study, a theme created by contiguous phrases served as the recording unit. Themes, expressed in predefined categories, best suit the desired objectives of both a comparison of reported issues to the represented issues for management programs and their strategic objectives.

Coding Reliability

Three types of coding reliability must be considered for content analysis: stability, reproducibility, and accuracy (Krippendorff, 1980). Also known as intercoder reliability, reproducibility "refers to the extent to which content classification produces the same results when the same text is coded by *more than one* coder" (Weber, 1990). Low reproducibility could indicate ambiguous coding instructions or the lack of a shared understanding with respect to the constructs, themes, or categories. "[R]eferring to the extent to which the results of content classifications are invariant over time" (Weber, 1990), stability can be assessed through multiple codings by the *same coder*. Inconsistencies in the coding represent unreliability. The strongest form of reliability, accuracy "refers to the extent to which classification of text corresponds to a standard or

norm" (Weber, 1990). The lack of established standard codings makes accuracy a seldom used measure.

This study employed all three types of coding reliability. To ensure reproducibility, the interviews were coded by multiple coders. Interviewees and two separate researchers were used as coders in these instances. Issues of low reproducibility were associated with a misunderstanding of the intent of the interview content. Resolving the misunderstandings of the interviewee's intent increased reproducibility and the correctness of the interview transcripts.

Summary

This chapter presented a description of the methodology chosen for this research and justification for the subsequent re-scoping of the effort. This chapter described why and how the case study research strategy was used in this study. Additionally, this chapter covered data collection, data analysis and research design. The next chapter will present the results of the interviews and guided interview questionnaires.

IV. Results and Analysis

Introduction

The focus of chapter three was to discuss the methodology of the research effort. Chapter three also answered how the data for the research question would be collected and analyzed. Chapter four focuses on the guided interview questionnaire findings and alternate collection methods used. The primary research question is: How do Air Force MAJCOMs determine what management strategy represents the optimal choice for their healthcare organization's facility maintenance program? In this chapter, the investigative questions, which form the building blocks for this question are answered.

Cross-Case Analysis of Reported Issues

It is important to analyze the reported issues across all. Establishing the generalizability of the reported issues, a cross-case analysis provides an opportunity to compare and contrast results from the different cases. Issues reported by all MAJCOMs will first be discussed. Then, select issues reported by individual MAJCOMs will be explored. The final analysis will cover any significant issues reported by a single MAJCOM but not already discussed in this section. The following tables represent the collected data from interview subjects and are arranged individually.

Investigative Questions Revisited

From Chapter one, the following investigative questions were posed:

1. What are the current general maintenance programs available to healthcare facilities?
2. How do organizations assess the effectiveness of their maintenance management programs?
3. What is the relative effectiveness of each maintenance management strategy?

The first investigative question was answered in the literature review from chapter two. During the interview process, five of these identified maintenance programs were being used by separate MAJCOMs for further analysis in this research. Chapter two also identified the strategic objectives maintenance organizations use to assess the efficiency and effectiveness of their programs. Within the course of each interview, respondents' addressed certain strategic objectives directly. However in some cases the interviewers had to use subjective judgment to determine which objective the respondents' answers most closely spoke to and categorize them appropriately.

The third investigative question, which assesses the effectiveness of the management programs, is gleaned and aggregated from the individual interviews and displayed using the theoretical relationship model proposed in Chapter two. Adapted from the theoretical relationship model, each interviewee's identified management program is visually depicted using a "strategic fit" model. Later, the common management programs are aggregated and the five underlying programs are displayed using the same outline of the strategic fit models.

Results

Interview Data Results.

The proceeding tables represent the collected data from interview subjects and are arranged individually. Following each table is a brief examination of the strategic objectives resulting in interviewee satisfaction and additional points of interest. These examinations include both information from the tables and observations and impressions gleaned from the interviews themselves. Using the information from the tables, "strategic fit" models were created and are arranged individually and then aggregated to display the five representative programs identified. In some instances, the interviewee never specifically commented or made mention of a specific strategic goal or aspect displayed in the tables. For simplicity, the table indicates these instances with: "interviewee did not discuss this point".

Table 7. Interview Subject 1

	Existing Program	Desired Program
Maintenance Program	***100% Outsourced: *Combination of OEM/ 3rd party—Item specific—Insurers manage equipment repair w/ onsite resources**	***Menu-Driven Maintenance Model**
Timeliness	***Techs unable to accomplish as much as quickly with admin workload**	***Relieving techs of admin burden through work order clerks, will accelerate response times**
Quality of Service	***FACMANs cannot perform QA accurately or adequately *Performed by Contractors *No true visibility into quality or adequacy of Contractor's QA plan**	***Focuses on "best-value" *New initiative to hire a dedicated, trained expert to perform random QA checks at all installations *More objectivity in QA**
Equipment Downtime	***Techs unable to accomplish work as quickly given admin workload**	***Using clerks will allow techs to service HVAC components faster**
Cost Reduction	***Sustainment Budget too high High manpower costs**	***New initiative to estimate collective manpower/sq ft**
Cost Stability	***Over-manned**	***Efficient use of manpower**
Program Flexibility	***Outsourced programs offer more flexibility**	**Initiative to hire more work-order clerks to admin burden**
Management Expertise	***More administrative in nature, more technical proficiency needed**	***Better mix of skillsets *FACMANs oversee program--*Expert performs thorough spot checks for support**
Repair Doc Management	***Data is insufficient Defense Log Mgmt Sys (DMLs) not being used**	***Initiative to gather repair data--Will use DMLs**
Drawbacks	***Short-term focus *More money spent on CR *Insufficient resources for PM**	**Interviewee did not discuss this point**
Benefits	***Predecessors accomplished documentation necessary to eliminate in-source requirements and put outsourced contracts in place**	***Initiatives will allow and validate for true QA to be performed Better visibility into facility infrastructure**
Limiting Factors	***Maintenance "spot checks" performed 10% of time by FACMANs- ill-qualified for QA *Tech over-burdened with administrative duties**	**Interviewee did not discuss this point**
Tradeoffs	***Inefficient use of manpower—Satisfaction of customers at the expense of too much personnel**	**Interviewee did not discuss this point**
Satisfaction	***Customers satisfied, senior management want more cost control**	***Customers and management satisfied**

Overall, Subject one expressed a high level of customer satisfaction on facility maintenance and was satisfied that preventive maintenance (PM) and corrective maintenance (CM) appeared to be accomplished from their vantage point Although high customer satisfaction is one of the top goals, the interviewee felt PM and CM were resulting in huge sustainment costs. The subject also emphasized the difference between customer satisfaction and management satisfaction. Customer's perspective focused on the CMs , whereas management viewed PMs, albeit invisible to most customers until it manifested into a CM problem, were not being performed satisfactory.

The subject also expressed frustration with the limited knowledge and expertise of the facility manager position. Facilities depend on the ability of this individual to accurately assess the condition of facilities from a quality assurance, quality control (QA/QC) standpoint. One of the reasons attributed to the FACMAN not being able to perform these duties, aside from a lack of technical expertise was attributed to the amount of administrative work given the technicians and FACMAN, preventing the from attending to true *maintenance* work. Subject expressed a desire for an outsourced program, as it offered more management flexibility than in-house and hybrid programs.

Table 8. Interview Subject 2

	Existing Program	Desired Program
Maintenance Program	*Single comprehensive provider—provides in-house management and on-call service	*Strategic Maintenance Modules Modules (CLINs)—HVAC/Doors etc
Timeliness	*Too slow	*Accelerated response time
Quality	*Poor quality *Prime contractor inexperienced with medical facility maintenance *Subcontractors inexperienced *PM work not being done in a timely manner	*New initiative to quantify an adjusted cost/sq ft for all MTFs *Will lead to more visibility into real infrastructure--Provides a reliable, consistent benchmark *Will highlight quality programs and service providers
Downtime	*Very high	*Will be reduced
Cost Reduction	*No cost controls in place	*Initiative will result in a fully loaded maintenance cost serving as a platform for revived fiscal resp.
Cost Stability	*Non-existent Very little fiscal responsibility	*Initiative will quantify costs of real property and equipment for cost control and budget forecasting
Flexibility	*Directed externally with little control over prime and subs	*Maximum control over prime
Management Expertise	*FACMANs do not have appropriate skillsets—too administrative in nature— *More tech expertise needed *Mgmt not managing the contract	*Will supplement the weaknesses of FACMANs
Repair Doc Management	*Illusion-Contractor controlled comprehensive database not reality	*More thorough with OEMs maintaining equipment
Drawbacks	*Individual MTF goals and objectives not aligned with MAJCOMs *Merging facility and medical equipment under one program flawed—Two separate entities CR/PM being done improperly	Interviewee did not discuss this point
Benefits		*More outcome focused
Limiting Factors	*Front-loaded program *Too process-focused *No fiscal accountability *No external, objective source to judge PM and QA *Local prob become global fixes	Interviewee did not discuss this point
Tradeoffs	*Consolidating management has resulted in redundancies and too many layers of management No external, objective source to judge PM and QA *Insufficient technical workers to perform CRs and PM *Loss of control over Prime	Interviewee did not discuss this point
Satisfaction	*Unsatisfied, frustrated customers and workforce	*Satisfied customers and management

Subject two expressed frustration with the current comprehensive program, and overall was very dissatisfied. The interviewee felt all of strategic objectives discussed were being met on a sub-standard level. The subject did acknowledge the disparity between the concept of the program and the reality that has materialized. In concept, the comprehensive program was implemented to provide additional expertise, cost stability, cost reduction and better quality. The reality was that because accurate accounting data has not been maintained or captured, it is difficult to compare the current program with its predecessor of using multiple OEMs. The subject also identified that the current program had no real cost control mechanisms in place and sacrificed necessary control over the prime for management flexibility and expertise that were "illusory".

Similar to subject one, subject two also expressed dissatisfaction with the expertise and skill-sets of the facility managers. From this subject's perspective, the current FACMAN function was an additional and unnecessary layer of management. The subject suggested that the function could be more effective by requiring additional technical proficiency. The administrative function of the position could be transferred to a work order clerk or administrative assistant.

Table 9. Interview Subject 3

	Existing Program	Desired Program
Maintenance Program	**Varies depending on facility**	**Interviewee did not discuss this point**
Timeliness	**Experiencing difficulties with in CE responsiveness**	**Interviewee did not discuss this point**
Quality of Service	**Experiencing difficulties with in-house CE quality**	**Interviewee did not discuss this point**
Equipment Downtime	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Cost Reduction	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Cost Stability	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Program Flexibility	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Management Expertise	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Repair Documentation Management	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Drawbacks	**Outsourcing often preferred, but all avenues should be exhausted first**	**Interviewee did not discuss this point**
Benefits	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Limiting Factors	**No formalized methodology or initiatives to determine appropriate programs for facilities** **Not enough manpower**	**Interviewee did not discuss this point**
Tradeoffs	**Interviewee did not discuss this point**	**Interviewee did not discuss this point**
Satisfaction	**Varies with facility**	**Interviewee did not discuss this point**

Subject three admitted there were frustrations dealing with base civil engineering, but was cognizant of embracing the "outsource everything" outlook as a solution. Part of this feeling was attributable to the subjects' idea that base civil engineering was the "true" real property managers and should be consulted and collaborated with to determine the best facility maintenance model.

Table 10. Interview Subject 4

	Existing Program	Desired Program
Maintenance Program	• Single OEM—Comprehensive program. Insurer manages repairs and PM with onsite resources	• Initiative to implement: "HVAC+" • Non-insurance, comprehensive prgrm-IDIQmodules • Vendor to have call service
Timeliness	• Satisfied	• Satisfied
Quality of Service	• Satisfied	• Satisfied
Equipment Downtime	• Satisfied	• Satisfied
Cost Reduction	• Costs too high—do not meet objectives or expectations	• Primary driver for new program
Cost Stability	• No stability	• More stability
Program Flexibility	• Too rigid	• Allows facilities to customize services
Management Expertise	• Need more subject experts	• Expertise available through new program
Repair Documentation Management	• Interviewee did not discuss this point	• Interviewee did not discuss this point
Drawbacks	• Far too expensive—Not tailored to Tri-Care's HFDs	• Interviewee did not discuss this point
Benefits	• Interviewee did not discuss this point	• Will not be run by a G.O. so less political pressures—More open-minded and receptive
Limiting Factors	• Too much use of IMPAC cards as a payment vehicle • Poor contracting vehicle-Too much duplication and administration	• Interviewee did not discuss this point
Tradeoffs	• Quality for cost	
Satisfaction	• Satisfied with aspects of quality, but not cost	• Satisfied

Subject four was satisfied overall with the goal of meeting many of the strategic objectives. The top levels of satisfaction were expressed in timeliness, quality of service and equipment downtime. Additionally, the interviewee felt that additional management expertise was necessary for a more effective program.

Table 11. Interview Subject 5

	Existing Program	Desired Program
Program	• Single comprehensive provider	• Different contractor
Timeliness	• Vendors slow to respond, most likely influenced by poor timeliness of payments	• Expect timeliness to improve
Quality	• PMs and CMs are being accomplished. FACMAN performs 10% QA checks	• Desirable but not essential to have expertise to supplement FACMAN and perform QA
Downtime	• Pretty good on average	• Expected satisfaction
Cost Reduction	• Higher premium in order to fund full coverage program	• More PMs should result in fewer CMs decreasing program costs
Cost Stability	• Fixed price w/ rebate program. Renegotiated yearly	• Fixed price will apply
Flexibility	• Very good. Contractor is responsible for PM and CM	• Very good.
Management Expertise	• Current contractor new in market and inexperienced	• Future contractor more established within industry more experience
Repair Doc Management	• Not being performed well. DMLs not being used	• SOW to require DMLs
Drawbacks	• Inefficient contract pricing structure. Contractor was new, inexperienced and had poor management	• Higher cost per sq/ft because of full coverage
Benefits	• Program offers cost stability and comprehensive coverage	• New SOW to include more rigorous standards
Limiting Factors	• Current contract specified how to perform—not perfor based—Contractor's business affected sub payments and quality/ timeliness of PMs/CMs	• Interviewee did not discuss this point
Tradeoffs	• Flexibility and cost stability, for cost reduction, and visibility over CMs through subcontractors	• Higher cost for program flexibility and cost stability.
Satisfaction	• Dissatisfied with Contractor but not program	• Expected satisfaction

Subject five was very frustrated with the current program being utilized, but made a clear distinction between the program and the contractor performing the program. Although the single comprehensive provider program was implemented, the largest limitation cited was that the contractor was a poor choice and inexperienced to perform the contract. Although many of the strategic objectives were not being met, it was attributed to but the contractor's inability, rather than the program design. The interviewee also acknowledges that the program has significant cost tradeoffs. In order to achieve cost stability and increased flexibility, a "premium" is being paid for the comprehensive coverage. Although using a more experienced contractor will most likely not decrease the costs, it should achieve the quality, timeliness, downtime and management objectives outlined by the program but left unfulfilled by the current contractor.

Table 12. Interview Subject 6

	Existing Program	Desired Program
Maintenance Program	• **CE A-76—Base-wide single comprehensive provider**	• **Interviewee did not discuss this point**
Timeliness	• **Exceptional. CMs accomplished same day. 24 hr call service.**	• **Interviewee did not discuss this point**
Quality of Service	• **Satisfied**	• **Interviewee did not discuss this point**
Equipment Downtime	• **Satisfied**	• **Interviewee did not discuss this point**
Cost Reduction	• **Analysis unknown since externally driven**	• **Interviewee did not discuss this point**
Cost Stability	• **Unknown since externally driven**	• **Interviewee did not discuss this point**
Program Flexibility	• **Very flexible. Has 2-4 dedicated technicians on site**	• **Interviewee did not discuss this point**
Management Expertise	• **FACMAN and Contractor oversee QA. Has enough in-house expertise to judge PMs and CMs**	• **Interviewee did not discuss this point**
Repair Documentation Management	• **Contractor uses DMLs. Very good documentation management**	• **Interviewee did not discuss this point**
Drawbacks	• **No control over in-house "mix" of manpower. FACMAN needs more administrative skills. Should be more of a program manager**	• **Interviewee did not discuss this point**
Benefits	• **Full coverage, dedicated maintenance techs and 24 hour call service**	• **Interviewee did not discuss this point**
Limiting Factors	• **Cannot select in-house skill sets or number of people**	• **Interviewee did not discuss this point**
Tradeoffs	• **Assuming cost for flexibility**	• **Interviewee did not discuss this point**
Satisfaction	• **Very satisfied**	• **Interviewee did not discuss this point**

Interview Subject 6 was extremely satisfied with the program in place. The base had previously outsourced or "A-76'd the entire civil engineering function and later contracted with a single comprehensive provider to perform all facility maintenance t for all of its facilities. The subject was very candid that they had no previous or current

knowledge of the cost stability or cost reduction since they had not participated in the original source selection for the contractor. The interviewee expressed some dissatisfaction with the program management skills of the current FACMAN. This dissatisfaction carried over into the FACMAN function itself since the interviewee was unable to control the skillsets required for that function. Therefore, any individual, including the current individual, would be perceived as lacking some of the more technical and/or programmatic skills such as software or budgeting expected for a fully capable FACMAN.

Table 13. Interview Subject 7

	Existing Program	Desired Program
Maintenance Program	***Varies by facility. Mixture of in-house and outsourcing**	***Single comprehensive provider with on-site techs**
Timeliness	***Dissatisfied. CE cannot provide accurate CR times**	***Contractor provides schedule of PM and CMs**
Quality	***Cannot enforce through CE**	***Can be enforced in a contract**
Equipment Downtime	***Dissatisfied**	***Expect improvement with qualified vendor**
Cost Reduction	***Not satisfied. No accounting mechanism in place**	***Better negotiation of contracts or use of single provider**
Cost Stability	***No cost stability program in place**	***Long-term contracts or using single provider**
Flexibility	***CE has no understanding of unique nature facility CR has in customer's perception of quality care. *Cannot force CRs faster**	***More flexibility—Could contract for additional admin help *In better position to compete externally**
Management Expertise	***In-house technicians deploy and go TDY. Inconsistent skill set at any one time.**	***FACMAN would have higher skillset-Additional techn expertise could be contracted as-needed**
Repair Doc Management	**Improving**	***Can force Contractor to maintain documentation**
Drawbacks	***No QAE. Not structured for in-house—does not use DMLs FACMANs must be program mgrs. *CE drives strategy by determining scope of work to be outsourced**	***More expensive to contract out than to use existing CE resources**
Benefits	***CE services are cheaper than contractors'**	***QAE built-in. Services can be scheduled. Can force Contractor to use and apply DMLs *Burden of proficiencies shifted from revolving in-house expertise to dedicated contracted support *Can have comprehensive relationship vs piecemeal**
Limiting Factors	***Manpower limited, schedules difficult to predict *Must use base contracting to select vendors—relies on CE to determine quality /experience of vendors *Does not have dedicated FACMAN**	***Not sanctioned to use GSA to purchase qualified services in a "turn-key" fashion**
Tradeoffs	***CE is cheaper, but quality and timeliness sacrificed**	***Management gains quality, scheduling stability and visibility and program flexibility.**
Satisfaction	***Not satisfied w/ current program**	***Would be very satisfied**

Interview Subject 7 was relatively dissatisfied with their general management program since it was perceived as limiting and inflexible. With the exception of repair documentation management, which the interviewee acknowledged was improving, none

of the other strategic objectives were viewed as being optimized. The subject was dissatisfied and very frustrated with the current relationship with base civil engineering. Specifically, the interviewee was frustrated with balancing the needs of the facility with the CE fluctuating manning levels due to TDYs, deployments and PCSing. The interviewee felt CE was under-staffed and ill-suited to perform PM and CM for the medical facility. The CE staff and its relative skill-sets were unreliable due to the previously mentioned TDY and deployment schedules and not prepared to keep pace technically with the evolving facility maintenance expertise needed. The interviewee felt that using CE was by far the cheapest solution, but was adamant that it sacrificed necessary quality oversight, timeliness and downtime. The interviewee felt CE was unaware and perhaps unsympathetic to the unique nature of medical facility maintenance. The interviewee feels the base is competing with private healthcare and therefore must present a stellar image. Because of poor workmanship in the past and many CMs being performed during duty hours, this image may have been tarnished in the view of patrons.

Summarized Results

The following sections summarize the results obtained during the interviews and analysis. The results are summarized by strategic objectives.

Table 14. Summarized Strategic Objectives Optimized

Strategic Objectives Optimized	Insurance OEM/3rd party	Non-Insur Single Comp Provider	Combination Insur/Out	Insurance Single OEM	Non-Insur Base-wide Single Comp Provider
Timeliness				**X**	**X**
Quality				**X**	**X**
Downtime				**X**	**X**
Cost Reduction					
Cost Stability		**X**			
Flexibility	**X**	**X**			**X**
Management Expertise					**X**
Repair Doc Mgmt			**X**		**X**

Timeliness: 2 of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. Of the satisfied interviewees, the following management programs were being used: single OEM management program and a single base-wide comprehensive provider. 5 of the 7 interviewees expressed mild to strong dissatisfaction with their current management program's ability to optimize timeliness. Of the dissatisfied interviewees, the following management programs were used: OEM/3rd party, single comprehensive provider and CE/3rd party (combination in/outsource).

Quality: 3 of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. Of the satisfied interviewees, the

following management programs were being used: a single OEM management program, single comprehensive provider and a base-wide comprehensive provider. 4 of the 7 interviewees expressed dissatisfaction with their current management programs' ability to optimize quality. Of the dissatisfied interviewees, the following management programs were being used: OEM/3rd party, single comprehensive, CE/3rd party.

Equipment Downtime: 3 of the 7 interviewees expressed moderate to high satisfaction with their current management program's ability to achieve this strategic objective. Of the satisfied interviewees, the following management programs were being used: a single OEM management program, a single comprehensive provider and a base-wide comprehensive provider. 3 of the 7 interviewees expressed dissatisfaction with their current management program's ability to optimize equipment downtime. Of the dissatisfied interviewees, the following management programs were being used: OEM/3rd party, single comprehensive provider and CE/3rd party. One of the respondents made no comment of this objective and is therefore not included in the aggregate number.

Cost Reduction: 6 of the 7 interviewees expressed dissatisfaction with their current management program's ability to achieve this strategic objective. One of the interviewees was unable to determine if the current management program achieved this strategic objective since they had no visibility into the base-wide provider contract.

Cost Stability: 1 of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. The satisfied

interviewee utilized a single comprehensive provider. 4 of the 7 interviewees expressed dissatisfaction with their current management program's ability to optimize cost stability. Of the dissatisfied interviewees, the following management programs were being used: OEM/3rd party, single comprehensive provider, CE/3rd party and single OEM. One of the respondents made no comment of this objective and is therefore not included in the aggregate number. One other respondent had no direct knowledge of this objective and is therefore not included in the aggregate number.

Flexibility: 3 of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. Of the satisfied interviewees, the following management programs were being used: a single comprehensive provider, a 100% outsourced combination of OEM/3rd party program and a base-wide comprehensive provider. 3 of the 7 interviewees expressed dissatisfaction with their current management program's ability to optimize flexibility. Of the dissatisfied interviewees, the following management programs were being used: single comprehensive provider, CE/3rd party and single OEM. One of the respondents made no comment of this objective and is therefore not included in the aggregate number.

Management Expertise: 1of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. The satisfied interviewee utilized a base-wide comprehensive program. 5 of the 7 interviewees expressed dissatisfaction with their current management program's ability to optimize equipment downtime. Of the dissatisfied interviewees, the following management

programs were being used: OEM/3rd party, single comprehensive provider, single OEM and CE/3rd party. One of the respondents made no comment of this objective and is therefore not included in the aggregate number.

Repair Documentation Management: 2 of the 7 interviewees expressed satisfaction with their current management program's ability to achieve this strategic objective. Of the satisfied interviewees, the following management programs were being used: base-wide comprehensive provider and a hybrid of in-house CE and outsourced 3rd party providers. 3 of the 7 interviewees expressed dissatisfaction with their current management program's ability to optimize equipment downtime. Of the dissatisfied interviewees, the following management programs were being used: OEM/3rd party, single comprehensive provider and CE/3rd party. Two of the respondents made no comment of this objective and are therefore not included in the aggregate number.

Drawbacks and Limiting Factors.

The following table (15), highlights and summarizes the common drawbacks and limiting factors determined during the interviews and subsequent transcription process. Although more drawbacks and limitations were noted on an individual basis, this table intends to capture only those drawbacks and limitations that were unique to more than one management program listed. In the event only one particular type of management program was listed, as is the case with OEM/3rd party, Single OEM, and Base-wide Single Comprehensive Provider, program-specific drawbacks and limitations were listed.

Table 15. Summarized Drawbacks and Limiting Factors

Drawbacks/Lim Facs	Insur OEM/3rd party	Non-Insur Single Comp Prov	Combination Insur/Out	Insur Sngle OEM	Non-Insur Base-wide Single Comp Prov
Short-term focus	X	X	X	X	
Too much money spent on CR	X	X		X	
Insufficient resources for PM	X	X	X		
Inefficient use of manpower	X	X	X	X	X
Insufficient expertise for QA/QC	X	X	X		
Program is too expensive	X	X		X	
Unreliable contractor		X			
Not performance-based		X			
FACMAN needs additional skill-sets	X	X	X		X
CE drives contract strategy			X		

Short-term focus: 4 of the 5 management programs are viewed as having a short-term focus. Only one management program was seen as having a long-term focus.

Too much money spent on CR: 3 of the 5 management programs are viewed as spending too much money on corrective repairs/maintenance. The remaining 2 management programs did not cite this as a specific drawback.

Insufficient resources for PM: 3 of the 5 management programs are viewed as not having enough money for preventive maintenance. The remaining 2 programs did not cite this as a specific drawback.

Benefits.

The following table (16), highlights and summarizes the common benefits determined during the interviews and the subsequent transcription process. Although more benefits were noted on an individual basis, this table intends to capture only those benefits that were unique to more than one management program listed. In the event that only one particular type of management program was listed, as is the case with OEM/3rd party, Single OEM, and Base-wide Single Comprehensive Provider, program-specific benefits were listed.

Table 16. Summarized Benefits

Benefits	**Insur OEM/3rd party**	**Non-Insur Single Comp Provider**	**Combination Insur/Out**	**Insur Single OEM**	**Non-Insur Base-wide Single Comp Prov**
Documentation accomplished to outsource	**X**				
Good Quality				**X**	
Comprehensive Coverage		**X**		**X**	**X**
Cost Stability		**X**			
CE services are cheaper than external 3rd party			**X**		

Documentation: 1 of the 5 reported management programs is viewed as having documentation completed during prior programs as a benefit to the existing outsourcing program. Although no direct conclusions should be drawn, the other 4 reported management programs did not specifically cite this as a benefit.

Good Quality: 1 of the 5 reported management programs are viewed as having superior quality as a benefit. Although no direct conclusions should be drawn, the other 4 reported management programs did not specifically cite this as a benefit.

Comprehensive Coverage: 3 of the 5 reported management programs are viewed as having comprehensive coverage as a benefit. Respondents reported that comprehensive coverage in itself was a benefit. Although the researcher has reported this result, care should be taken when extrapolating if comprehensive coverage automatically translated into intangible benefits such as flexibility or satisfaction. In this instance, comprehensive coverage was interpreted to mean the security and peace of mind offered by a full coverage program. Although no direct conclusions should be drawn, the other 4 reported management programs did not specifically cite this as a benefit.

Cost Stability: 1 of the 5 reported management programs is viewed as having cost stability as a benefit. Although no direct conclusions should be drawn, the other 4 reported management programs did not specifically cite this as a benefit.

Cheap In-house Work: 1 of the 5 reported management programs is viewed as having competitive CE costs as a benefit. Although no direct conclusions should be drawn, the other 4 reported management programs did not specifically cite this as a benefit.

Tradeoffs.

The following table (Table 17), highlights and summarizes the common tradeoffs determined during the interviews and the subsequent transcription process. Although

more tradeoffs were noted on an individual basis, this table intends to capture only those tradeoffs that were unique to more than one management program listed. In the event that only one particular type of management program was listed, as is the case with OEM/3rd party, Single OEM, and Base-wide Single Comprehensive Provider, program-specific tradeoffs were listed.

Table 17. Summarized Tradeoffs

Tradeoffs	**Insur OEM/3rd party**	**Non-Insur Single Comp Provider**	**Combination Insur/Out**	**Insur Single OEM**	**Non-Insur Base-wide Single Comp Prov**
Customer Satisfaction for Cost	**X**			**X**	**X**
Cost Stability for less management control and visibility		**X**			
Cost Reduction for Cost Stability		**X**			
Cost Reduction for Quality and Timeliness			**X**		

Customer Satisfaction for Cost: 3 of the 5 reported management programs traded an increase in program costs for a improved customer satisfaction.

Cost Stability for Management Control: 1 of the 5 reported management programs traded a loss of management control and program visibility for increased cost stability.

Cost Stability for Cost Reduction: 1 of the 5 reported management programs traded cost an increase in program costs for a higher level of cost stability.

Cost Reduction for Quality and Timeliness: 1 of the 5 reported management programs traded an increase in program costs for increased quality and improved timeliness. As this table reports, cost is the #1 tradeoff. Each interviewee reported trading cost reduction in favor of customer satisfaction, cost stability, quality and timeliness. Also reported was trading management control and visibility for cost stability.

Individual Strategic Fit Models.

This next section visually illustrates the interview tables and related discussions from the previous section. Using the strategic fit model developed in Chapter 2, individual strategic fit models are used to show the relationship between the stated management programs and *specific* strategic objectives that led to customer satisfaction for each interview. Later, common management programs are aggregated to visually depict all of the management programs and all of the strategic objectives that resulted in customer satisfaction. For simplicity, "strategic fit" is replaced with "fit" in the models.

For the purposes of this research and this analysis and discussion, customer satisfaction is viewed very narrowly as the satisfaction of the interviewee as a representative advocate for the MAJCOM senior decision makers and the healthcare facilities' internal and external customers. Therefore, this research relies on the assumption that the overall satisfaction of the interviewee takes into account the relative satisfaction of these other interest groups.

Because the level of satisfaction varied with each strategic objective and by respondent, in order to be objective, the researcher categorized the optimized objectives as those clearly articulated in the interviews as being satisfied, if not outwardly pleased with and explained in the previous section. However, certain objectives, albeit not optimized, were put in the models if the sub-optimization was deemed by the respondent as due to the contractor in place and not the nature of the maintenance program. In these instances, the respondent felt strongly they *would* have been satisfied with a better performing contractor, but not necessarily a different program as was the case with Interview subject 5.

Insurance program utilizing an OEM/3rd party optimized flexibility

Using Table 7 as a reference, the above statement illustrates the findings of Interview subject 1: The program utilizing an OEM/3rd party yields customer satisfaction for its flexibility. The interviewee felt the technicians were overburdened with an administrative workload, which hindered their ability to respond in a timely manner and correct the deficiency, thus negatively impacting timeliness and downtime. Additionally, the interviewee had little faith that the facility managers possessed the necessary skillsets to accurately perform QA/QC. Not withstanding these negatives, the interviewee was adamant that their outsourced program and outsourced programs in general, offered far more flexibility than using in-house resources.

Non-insurance program utilizing a comprehensive provider optimized no strategic objectives

Using Table 8 as a reference, the above statement illustrates the findings of Interview subject 2: The program utilizing a comprehensive program optimized no strategic objectives, leading to no customer satisfaction in any areas. Interview subject 2 felt that comprehensive programs by nature were flawed for facility management. They were cost prohibitive and offered no customer satisfaction for any strategic objectives. The interviewee used their recent issues with a non-performing contractor as proof that the comprehensive program and thus *any* contractor was destined to fail.

Insurance/In-source program utilizing CE/3rd party optimized no strategic objectives

Using Table 9 as a reference, the above statement illustrates the findings of Interview subject 3: The program utilizing a CE/3rd party program optimized no specific strategic objectives yielding no real customer satisfaction in any areas. The interviewee felt that some programs "fared better than others", but was inconclusive as to which, if any, strategic objectives were optimized in any case. The interviewee did not support outsourcing as a "first response", but acknowledged that many of the MAJCOM bases still utilizing base civil engineering were experiencing difficulties. For this reason, the strategic fit model for CE/3rd party should be viewed as inconclusive due to the respondent's vague statements rather than a negatively perceived "no strategic objectives optimized". Although these results did not sway the ultimate analysis of CE/3rd parties, for simplicity, the figure illustrates no strategic objectives optimized.

Insurance program utilizing a single OEM optimized timeliness, quality and downtime

Using Table 10 as a reference, the above statement illustrates the findings of Interview subject 4: The program utilizing a Single OEM program resulted in customer satisfaction for the following optimized strategic objectives: timeliness, quality of service and downtime. The Interviewee was very satisfied with the overall quality of this maintenance program. The Interviewee felt very strongly that PMs and CMs were being accomplished very well in a time-sensitive manner. The OEM was knowledgeable and capable and they had no issues with the OEM's expertise. However, the interviewee noted that the program's costs were exorbitant and they (costs) were the primary driver for initiating a new maintenance program. Therefore, this model shows the three key objectives identified by the interviewee as being "optimized".

Non-insurance program utilizing a single comprehensive provider optimized cost stability, quality, flexibility and timeliness

Using Table 11 as a reference, the above statement illustrates the findings of Interview subject 5: The program utilizing a comprehensive program resulted in customer satisfaction for the following optimized objectives: cost stability, quality of service, flexibility and timeliness. The interviewee made a very clear distinction between the management program (comprehensive) and their current provider. Unlike Interview Subject 2, the interviewee felt a comprehensive program was well-suited to facility maintenance. Furthermore, the interviewee felt more if not all of the strategic objectives should be optimized were it not for the non-performing contractor. The interviewee felt the provider currently being contracted, would validate the inherent benefits of the comprehensive program. The Interviewee felt that quality had never been sacrificed—

PMs and CMs had always been accomplished well. However, some of the difficulties with the former provider resulted in vendors who were reluctant to respond, which adversely impacted timeliness. Interestingly, the interviewee felt that comprehensive programs were not less costly. In fact, they are by nature more expensive since the program is paying an additional "premium" for *cost stability*. For this reason, the previous fit model displays cost stability and quality as being optimized and yielding customer satisfaction. The model also *tentatively* includes *flexibility and *timeliness as being optimized since the interviewee was very adamant that a more experienced provider would validate the comprehensive program and that these specific objectives would soon be optimized.

Non-insurance program utilizing a base-wide single comprehensive optimized timeliness, quality, downtime, flexibility, management expertise and repair documentation management

Using Table 12 as a reference, the above statement illustrates the findings of Interview subject 6: The program utilizing a base-wide comprehensive program resulted in customer satisfaction for its optimization of the following strategic objectives: timeliness, quality, downtime, program flexibility, management expertise and repair documentation. Interview subject 6 could not have been more pleased and satisfied with the performance of the comprehensive provider. The interviewee felt this type of arrangement (base-wide provider) offered maximum flexibility since the provider had a more intimate relationship with all base facilities. In particular, the interviewee cited timeliness as "exceptional".

Because the interviewee did not participate or have direct knowledge of the provider's contract, they could not determine if the program was cost effective. With none of these insights, they could not discuss cost reduction or cost stability issues. Although the interviewee was pleased with this model, they did acknowledge much of the success to the quality work of the provider. Therefore, all strategic objectives with the exception of cost stability and cost reduction are included as being optimized in this model.

Insurance/Outsourcing program utilizing a combination of CE/3rd party optimized repair documentation management

Using Table 13 as a reference, the above statement illustrates the findings of Interview subject 7: The program utilizing a CE/3rd party program resulted in customer satisfaction for its optimization of the following strategic objective: repair documentation management. The interviewee was generally dissatisfied with many of the aspects of their management program. Without the authority to outsource the parts of facility maintenance they deemed necessary, the interviewee felt bound by the decisions of civil engineering. Furthermore, the interviewee felt outsourcing bits and pieces of facility management (as directed by CE) was extremely inefficient and ineffective. However, the interviewee was very clear that repair documentation management was really improving. Although repair documentation management is indicated as being optimized, the relationship should not be construed as being very strong since the interviewee felt it was "improving" and not excellent or exceptional.

Insurance program utilizing OEM/3rd party optimized flexibility

Using Table 14 (Summarized Strategic Objectives Optimized) as a reference, the above statement illustrates the findings of Interview subject 1: The program utilizing an OEM/3rd party yields customer satisfaction for its flexibility. Since there was only one program interviewed utilizing this model, it was included as a stand-alone program. With only one model represented, results should not be generalized to all OEM/3rd party programs.

Non-insurance program utilizing a single comprehensive provider optimized cost stability and flexibilty

Using Table 14 (Summarized Strategic Objectives Optimized) as a reference, the above statement illustrates the findings of Interview subjects 2 and 5: The programs utilizing a single comprehensive provider program resulted in customer satisfaction (collectively) for their optimization of the following (collective) strategic objectives: cost stability and program flexibility. This model attempts to incorporate two widely disparate views of a comprehensive program. The interviewer attempted to de-conflict the findings and determine if there was any commonality between interview subjects 2 and 5. After reviewing interview subject 2, the interviewer determined that responses directed toward cost and flexibility targeted the provider and the program. Since the interview subject (2) acknowledged that the program has a level pricing structure and offers management more flexibility than previous programs, the interviewer tentatively identifies cost stability and program flexibility as being optimized. However, these results should be validated with additional data points to be sufficiently generalized to all comprehensive programs.

Non-insurance program utilizing a base-wide single comprehensive provider optimized timeliness, quality, downtime, flexibility, management expertise and repair documentation management

Using Table 14 (Summarized Strategic Objectives Optimized) as a reference, the above fit model illustrates the findings of Interview subject 6. The programs utilizing a base-wide comprehensive provider program resulted in customer satisfaction for its optimization of the following strategic objectives: timeliness, quality, downtime, program flexibility, management expertise and repair documentation management. Since there was only one program interviewed utilizing this model, it was included as a stand-alone program. With only one model represented, results should not be generalized to all base-wide comprehensive programs.

Insurance/Outsourcing program utilizing a combination of CE/3rd party optimizes repair documentation management

Using Table 14 (Summarized Strategic Objectives Optimized) as a reference, the above statement illustrates the findings of Interview subjects 3 and 7: The programs utilizing a combination of base civil engineering and external 3rd party programs resulted in customer satisfaction (collectively) for their optimization of the following (collective) strategic objective: repair documentation management. The results for this model are inconclusive and tenuous at best. Interview subject 3 offered no real substantive data to analyze and interview subject 7 was relatively dissatisfied with all of their strategic objectives—but admitted to being more satisfied with repair documentation management.

Therefore, this fit model represents the aggregation of the two interviews but does not and should not be generalized for the entire population employing a combination of in-house and outsourced resources.

Insurance program utilizing a single OEM optimized timeliness, quality and downtime

Using Table 14 (Summarized Strategic Objectives Optimized) as a reference, the above statement illustrates the findings of Interview subjects 4: The program utilizing a single OEM provider program resulted in customer satisfaction for its optimization of the following strategic objectives: timeliness, quality of service and downtime. Since there was only one program interviewed utilizing this model, it was included as a stand-alone program. With only one model represented, results should not be generalized to all Single OEM programs.

Summary

This chapter outlined the guided interview questionnaire findings. Using the primary research question and investigative questions, it displayed the findings in both tables and figures and outlined how each investigative question had been answered during the course of the research. Additionally, it examined each strategic objective within the context of each management program and assessed if the "strategic fit" resulted in customer satisfaction.

V. Discussion

Introduction

The purpose of this chapter is to use the analysis from chapter four and determine if the analysis answered the primary research question. Additionally, this chapter will offer significant findings and key insights gleaned from the data collection and analysis of chapter four. Finally, it will conclude with recommendations for the sponsoring agency, overall impressions and perceptions of the research, limitations to the research effort and recommendations for future research.

Study Findings

This research has offered not only a re-conceptualized view of facility maintenance management models (Chapter two), but significant findings that are applicable to the individual maintenance programs and facility maintenance programs in general. Detailed below are the findings developed from the analysis of the interviews in Chapter Four. These findings are geared toward the management perspective and offer key recommendations for consideration and/or implementation. The ordering of the findings are grouped according to context and applicability of management programs and do not reflect any perceived order of importance on the part of the researcher.

As an insight inspired from Investigative Questions 2 and 3, the following finding was formed:

Finding 1: Having a more strategic partnership may enable a more strategic focus.

Of the interviewed facilities, the MAJCOM, which implemented a base-wide single provider was viewed as having a stronger relationship with the outsourced provider (Table 12 and 15). Subsequently, it reflected a more long-term, *strategic* focus than the other management programs. This focus is further materialized in the optimized strategic objectives displayed and gathered from Table 14. Interviewees utilizing a single OEM and a single base-wide comprehensive provider reported more strategic objectives optimized than programs that utilized combinations of providers and combinations of internal/external resources (Table 14). From tables 8 and 11, it is unknown at this time if programs utilizing a single comprehensive provider for the facility will benefit from a stronger strategic focus since the researched MAJCOM is in transition.

As an insight inspired from Investigative Question 2, the following finding was formed:

Finding 2: Outsourcing programs may result in more dollars spent on CR .

From Table 15, it suggests the programs which utilize outsourcing (combining the use of OEMs and 3rd parties and a single comprehensive provider), were viewed as spending too much money on corrective maintenance. A common theme among outsourcing programs (Tables 8, 11 and 13) was the higher costs relative to in-house work. From Table 7 it may be hypothesized that more dollars spent on CRs may result in short-term customer satisfaction, but sacrifices long-term satisfaction, higher life cycle costs and generally lower facility life cycles through the neglect of PMs.

As an insight inspired from Investigative Questions 1 and 3, the following finding was formed:

Finding 3: Consolidated outsourcing programs may provide more if not sufficient resources for PMs.

Unlike the OEM/3rd party, CE/3rd party and single comprehensive provider programs, the outsourcing programs which used a *single* base-wide comprehensive provider and a *single* OEM were viewed as having sufficient resources (to include both expertise and manpower) to perform satisfactory preventive maintenance (Tables 10, 12 and 15). It must be noted at this point that the interviewer was unable to obtain conclusive results regarding the use of a single comprehensive provider (Tables 8 and 11) since the MAJCOM utilizing the program in question in transitioning to a different provider and may or may not experience the same benefit from a consolidated program.

As an insight inspired from Investigative Questions 1, 2 and 3, the following finding was formed:

Finding 4: Consolidated outsourcing programs may result in a higher level of management expertise for QA/QC.

Part of the appeal of using comprehensive providers is the expertise they are able to leverage. From Tables 11 and 12, it is suggested that the program utilizing a single base-wide comprehensive provider was viewed as having both sufficient management expertise to judge or evaluate the quality of preventive maintenance and the true condition of the facility's infrastructure. Once again, it is premature to generalize this finding to all consolidated programs since the program utilizing a single comprehensive provider (Tables 8 and 11) is transitioning to a new provider. However, discussions with base personnel indicate they have real confidence they too will receive this expected level of expertise with the new provider.

As an insight inspired from Investigative Questions 2 and 3, the following finding was formed:

Finding 5: Comprehensive programs may be more vulnerable to poor provider performance.

From the literature review and Table 11, it may be determined that comprehensive programs purport to offer stable pricing, qualified management and peace of mind for the risk-averse facility. However, the potential downside still exists that the provider will be unable to perform the work or deliver results as shown in Tables 8, 11 and 15. In essence, comprehensive programs trade cost risk for program flexibility as shown in Table 17. By utilizing only one provider, an installation or facility is gambling on the potential benefits from a strategic partnership.

However, if this partnership sours (Tables 8 and 11), the entire maintenance program experiences the repercussions as evidenced by the MAJCOM utilizing a single comprehensive provider. The converse to this is the MAJCOM utilizing a single base-wide comprehensive provider (Table 12). In this situation, the installation selected a provider that is performing and is delivering results. Therefore, the risk still remains, but the gamble has paid off thus far.

As an insight inspired from Investigative Questions 2 and 3, the following finding was formed:

Finding 6: Using in-house programs may not accurately capture true facility maintenance costs.

From tables 13 and 16, the programs utilizing in-house capabilities have acknowledged lower repair charges. However, they have also noted poorer quality of PMs and less reliability for CRs and PMs as shown in Table 15. These intangibles, once quantified, would reveal a higher "fully burdened" maintenance cost to use base civil engineering. Additionally, the base civil engineering was cited by one interviewee (Table 13) as not understanding or appreciating the unique nature of facility maintenance.

The "perception" of external appearances in healthcare facilities is reflective of the quality of care. This same interviewee was very candid about the perception of healthcare facilities and how the base hospital in essence competes with the local and regional hospitals for patient care. If healthcare facilities are seen as unclean, or poorly maintained, this translates into poor quality of care to many customers and potential customers, which is not presently captured using static in-house billing rates.

As an insight inspired from Investigative Questions 1, 2 and 3, the following finding was formed:

Finding 7: Using any program utilizing in-house capabilities may limit a facility's flexibility in selection and design of management programs.

From Table 9, it is suggested that one of the consequences of using base civil engineering is the reality they are the "real property managers" of the installation—and the facilities. Therefore, from Tables 9, 13 and 15, it can be concluded this function can determine the scope of work they are willing to have outsourced or retain inhouse. One of the interviewees utilizing a combination of in-house and outsourcing felt constrained using in-house work. Even programs that offer base civil engineering "right of first

refusal" must acknowledge the possibility that the CE function will *not* refuse the work and limit the type of outsourcing arrangements that can be explored and implemented.

As an insight inspired from Investigative Question 2, the following finding was formed:

*Finding 8: A disparity may exist between the **effectiveness** and **efficiency** of the management programs.*

From Tables 7-13, it can be determined each management program examined optimized a minimum of one strategic objective. From Table 14, it is shown that in each case, the optimized objective was achieved at the expense of higher costs or less cost stability. More importantly, from Table 15 it is shown that not one of the management programs was viewed as using manpower efficiently. Therefore, the satisfaction experienced from optimized objectives did not correlate with efficient use of resources (Tables 14 and 15). This leads the researcher to hypothesize that management programs are spending additional resources to achieve comparable results and will continue to do so until they have achieved more cost visibility. In order to decrease costs while maintaining a consistent level of quality, the facility must gain needed visibility/insight into its costs. Programs or projects designed to determine the optimal cost/square foot or needed amount of manpower/square foot are necessary to gain cost and manpower efficiency.

Final Recommendation

Prior to selecting a particular management program, a facility must first determine its existing strengths and weaknesses and even level of risk. Those facilities that prefer less broad insurance policies may be more satisfied with a program that hedges its risk by utilizing multiple OEMs or 3rd party providers. Facilities that desire stable pricing and cost structures and consolidated management would do well to investigate single OEMs or single comprehensive providers. However, this program structure transfers the facilitiy's risk to the contractor. Therefore care and research should be taken when selecting a provider given the level of responsibility transferred in the relationship.

Additionally, a facility must first evaluate where they lay in the outsourcing spectrum. If they are relatively new and are in the initial stages, a more balanced program utilizing two or more OEMs or 3rd party providers may be more appropriate. Based on the limited results of this research, a facility should <u>not</u> enter into a consolidated or comprehensive program until it is mature enough to determine its needs, properly evaluate providers and calculate comparable program costs. If these prerequisites are not met, the facility is put at significant risk of selecting a poor provider, or paying for more resources than are actually needed.

Through the interviews, it was uncovered the scope and depth of new initiatives being undertaken by the MAJCOMs to drive more efficiency and visibility into their existing programs. Efforts to articulate a dollar/square foot and manpower/square foot are excellent areas of research, which should be wholly supported by AFMC/SG. They should provide solid methodologies, prototypes and pilot programs from which many DoD installations may emulate and/or tailor to their benefit.

Limitations to the Study

The original research question looked at both medical equipment and facility maintenance. Upon the advice of statisticians and subject matter experts, the original research question was deemed to broad to appropriately analyze within given time and resource constraints, and after research into the literature and discussions with subject matter experts, it was determined that time and resource constraints would prevent a thorough analysis of both fields adequately. Therefore, the decision was made to down-scope the initial research and focus solely on the facilities side during data collection and analysis. This allowed for a more probing exploration of this maintenance arena and more focused interviews with health facilities experts.

The data collection and analysis of the revised research focused solely on facility maintenance within healthcare organizations of the Air Force. The decision to focus on facility maintenance versus medical equipment maintenance was based on the relative criticality of facility infrastructure, presented in Chapter 1, which initially drove the research sponsorship.

Furthermore, from the interviews, it was gleaned facility and medical equipment maintenance are diverse and separate entities, with divergent strategic and tactical needs. Whereas comprehensive maintenance may be feasible for medical equipment, it is ill-fated with facility maintenance. Medical equipment maintenance is more “clear-cut”. The equipment either works or does not work. Preventive maintenance can be camouflaged on expensive facility components such as HVAC.

However, because of the nature of the study, a limited number of health facilities experts could be interviewed. For a more thorough analysis, a larger sample of individual

bases should be included in addition to the MAJCOM perspective to increase the validity of the results. Furthermore, quantitative data could not be obtained with time and resource constraints. Quantitative data would be a critical aspect of substantiating the perspectives and opinions of the interviewees, which would increase the validity and generalizability of the findings.

Future Research

Research of this nature must be well-scoped and very focused. Suggestions for future research would include analyzing one type of management program and its relative strengths and weaknesses in real-world settings. Future research may take a variety of avenues from this foundational study. Comparative analysis of Air Force medical equipment programs would provide needed insight into the current programs being used for medical programs and their relative effectiveness and efficiency. In addition, a type of post "audit" procedure analyzing and comparing the expected and realized results of the previously mentioned new program initiatives.

Conclusion

The purpose of this research was to determine the optimal management program for a facility maintenance program. Using a blend of qualitative approaches, the researcher interviewed seven representatives from Air Force MAJCOMs and performed pattern matching to determine and analyze the strategic objectives that were viewed as being "optimized". This research has met its intended objective in that using a

purposeful sampling of respondents, it has provided some foundational insights into the benefits, drawbacks and tradeoffs of four distinct maintenance management models.

Each MAJCOM must assess its inhouse strengths, weaknesses and level of risk before selecting a management program. If an outsourced program is selected, the facility directly benefits from thorough research performed prior to provider selection. This upfront research into comparable programs and providers mitigates the inherent program risk of using external capabilities. Although more research should be spent to analyze the true, "quantified" costs of each program, this research offers a solid basis from which to begin. At a minimum, this research question should be down-scoped to investigate one MAJCOM's facility at a time to more thoroughly capture facility-unique issues, which would influence selection of one program over another.

Appendix A: Guided Interview Questionnaire

Sponsored by:

AFMC/SG

Section I Demographics

1. Organization: ___Clinic___Hospital___Med Center

2. If facility offers inpatient services, approx number of beds:___

3. Please fill in your Facility Name/City/MAJCOM/Base: _____.

4. What is your position and, how long have you been in that position?:_____

Section II Survey of Medical Equipment Maintenance Management

5. Please indicate the status of your equipment management strategy.
_____Formal program in place _____Formal program currently being implemented

_____No formal program

6. Please indicate how long your current program has been in place?_____

7. Was the program you have in place now directed by an external authority?____

8. Which strategy best describes your equipment maintenance management program?
_____Total In-sourcing ____Total Outsourcing ____Combination

9. If your organization uses or will use outsourcing, please indicate which of the following primary (greater than 50%) strategies it employs/will employ:

Outsourcing Medical Equipment Maintenance Management Strategies

_____Insurance Program: A service provider who underwrites equipment repair costs and charges the organization fixed prices to provide repair coverage for equipment.

Number of Insurers

_____Single insurer

_____Multiple insurers

Provider

_____Original Equipment Manufacturer(s) insures equipment

_____A third party service provider(s) insures equipment

_____Combination of both insures equipment

Coverage

_____Comprehensive Program: All or most of the equipment's preventive maintenance and/or repair is covered under one insurance provider.

_____Item Specific Program: All or most of the equipment's preventative maintenance and/or repair is covered by different insurers based on the item.

Management

_____Insurer(s) manages equipment repairs and/or preventive maintenance with internal or onsite resources.

_____Insurer(s) manages equipment repairs and/or preventive maintenance with subcontracted resources.

_____Health care facility manages equipment repairs and/or preventive maintenance with reimbursement from insurance provider(s).

_____Non-Insurance Program

Number of Vendors

_____Single vendor

_____Multiple vendors

Coverage

_____Episodic Program: Medical equipment's preventative maintenance and/or repair is covered on an "as needed" basis.

_____Comprehensive Program: Medical equipment's preventive maintenance and/or repair is covered under one pre-negotiated program.

Management

_____Vendor provides in-house management.

_____Vendor provides in-house management and on-site technicians.

_____Vendor provides on-site technicians.

_____Vendor provides an on-call service.

10. Please rank the outsourcing objectives in order of their importance to your organization with 1 being the most important. If outsourcing was not selected please select insourcing and the primary motivator for remaining in-house. Ranking objectives does not imply any objectives are unimportant.

_____Response time

_____Quality of Service

_____Equipment Downtime

_____Cost Reduction

_____Cost Stability

_____Program Flexibility

_____Management Expertise

_____Repair Documentation Management

_____Other _____

11. Please indicate your satisfaction with your medical equipment maintenance program by circling the number with 1 being the lowest score and 7 the highest.

11A) Timeliness: Supplier's average response time

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11B) Quality of Service

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11C) Equipment Downtime

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11D) Cost Reduction

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11E) Cost Stability

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11F) Program Flexibility

Did not meet needs/objectives					Met needs/objectives	
1	2	3	4	5	6	7
Did not meet any expectations					Exceeded expectations	
1	2	3	4	5	6	7

11G) Management Expertise

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

11H) Repair Documentation Management

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

12. What is the largest drawback to your equipment maintenance program?

13. What is the largest benefit of your equipment maintenance program?

14. What is the single most limiting factor in your equipment maintenance program?

15. If you could change one thing about your current medical equipment maintenance management strategy, what would it be?

16. If you could keep one thing about your current medical equipment maintenance management strategy, what would it be?

17. What trade-offs, if any, did your organization experience as a result of selecting its current medical equipment management program?

18. Please mark the overall satisfaction of the current equipment management program.

_____Very Dissatisfied _____Somewhat Dissatisfied _____Neither Satisfied Nor Dissatisfied _____Somewhat Satisfied _____Very Satisfied

19. Please rank the following issues and the degree to which they were existent in your organization during the <u>outsourcing determination process</u> of medical equipment maintenance, with 1 being noticeably absent and 7 being clearly present.

Noticeably Absent Clearly Present

19A) Organization-wide understanding of company goals and objectives with regard to medical equipment maintenance and sourcing solution

1 2 3 4 5 6 7

19B) Senior executive support and involvement

1 2 3 4 5 6 7

19C) Open communication with affected individuals and groups/Good flow of information and updates

1 2 3 4 5 6 7

19D) Use of outside expertise/Consultants, etc.

1 2 3 4 5 6 7

19E) Consideration of your perspective when selecting the vendor

1 2 3 4 5 6 7

19F) Ongoing management of the relationships between and among those parties impacted by the sourcing decision

1 2 3 4 5 6 7

19G) Sourcing arrangement (contract, process) clearly defined and easy to follow

1 2 3 4 5 6 7

19H) Careful attention provided to those personnel impacted by sourcing decision

1 2 3 4 5 6 7

_____Other(s)_____

1 2 3 4 5 6 7

20. Please rank the following factors and the level that they were existent in your organization during the <u>outsourcing sustainment process</u> of medical equipment maintenance, with 1 being noticeably absent and 7 being clearly present.

Noticeably Absent Clearly Present

20A) Organization-wide understanding company goals and objectives with regard to medical equipment maintenance and sourcing solution

1 2 3 4 5 6 7

20B) Senior executive support and involvement

1 2 3 4 5 6 7

20C) Open communication with affected individuals and groups
1 2 3 4 5 6 7

20D) Use of outside expertise/Consultants, etc.
1 2 3 4 5 6 7

20E) Consideration of your perspective when the relationship was continued

1 2 3 4 5 6 7

20F) Ongoing management of the relationships between and among those parties impacted by the sourcing decision
1 2 3 4 5 6 7

20G) Sourcing arrangement (contract, process) clearly defined and easy to follow
1 2 3 4 5 6 7

20H) Careful attention provided to those personnel impacted by sourcing decision
1 2 3 4 5 6 7

_____Other(s)_____

1 2 3 4 5 6 7

Section III Survey of Facility Maintenance

21. Please indicate the status of your organization's facility management program.

_____Formal program in place _____Formal program currently being implemented

_____No formal program

22 Please indicate how long your current program has been in place?_____

23. Was the program you have in place now directed by an external authority?____

24. Please indicate which of the following strategies best describes your organization's facility maintenance management program:

_____Total In-sourcing ____Total Outsourcing ____Combination

25 If your organization uses or will use outsourcing, please indicate which of the following primary (greater than 50%) strategies it employs/will employ:

Outsourcing Facility Maintenance Management Strategies

_____Insurance Program: A service provider who underwrites facility repair costs and charges the organization fixed prices to provide repair coverage for facilities.

Number of Insurers

_____Single insurer

_____Multiple insurers

Provider

_____Original Equipment Manufacturer(s) insures facilities

_____A third party service provider(s) insures facilities

_____Combination of both insures facilities

Coverage

_____Comprehensive Program: All or most of the facility's preventive maintenance and/or repair is covered under one insurance provider.

_____Item Specific Program: All or most of the facility's preventative maintenance and/or repair is covered by different insurers based on the item.

Management

_____Insurer(s) manages facility repairs and/or preventive maintenance with internal or onsite resources.

_____Insurer(s) manages facility repairs and/or preventive maintenance with subcontracted resources.

_____Health care facility manages facility repairs and/or preventive maintenance with reimbursement from insurance provider(s).

_____Non-Insurance Program

Number of Vendors

_____Single vendor

_____Multiple vendors

Coverage

_____Episodic Program: Facility's preventative maintenance and/or repair is covered on an "as needed" basis.

_____Comprehensive Program: Facility's preventive maintenance and/or repair is covered under one pre-negotiated program.

Management

_____Vendor provides in-house management.

_____Vendor provides in-house management and on-site technicians.

_____Vendor provides on-site technicians.

_____Vendor provides an on-call service.

26. Please rank the following outsourcing objectives in order of their importance to your organization with 1 being the most important. If your organization has objectives not shown, please write them in using the space provided. If outsourcing was not selected please select insourcing and the primary motivator for remaining in-house. Ranking objectives does not imply any objectives are unimportant, only that some are more critical to your organization.

_____Response time

_____Quality of Service

_____Equipment Downtime

_____Cost Reduction

_____Cost Stability

_____Program Flexibility

_____Management Expertise

_____Repair Documentation Management

_____Other _____

27. Please indicate your satisfaction with your facility maintenance program by circling the number that best gives your answer with 1 being the lowest score and 7 the highest.

27A) Timeliness: Supplier's average response time

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27B) Quality of Service

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27C) Equipment Downtime

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27D) Cost Reduction

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27E) Cost Stability

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27F) Program Flexibility

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27G) Management Expertise

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

27H) Repair Documentation Management

Did not meet needs/objectives				Met needs/objectives		
1	2	3	4	5	6	7
Did not meet any expectations				Exceeded expectations		
1	2	3	4	5	6	7

28. What is the largest drawback to your equipment maintenance program?

29. What is the largest benefit of your equipment maintenance program?

30. What is the single most limiting factor in your equipment maintenance program?

31. If you could change one thing about your current medical equipment maintenance management strategy, what would it be?

32. If you could keep one thing about your current medical equipment maintenance management strategy, what would it be?

33. What trade-offs, if any, did your organization experience as a result of selecting its current medical equipment management program?

34. Please mark the overall satisfaction of the current equipment management program.

_____Very Dissatisfied _____Somewhat Dissatisfied _____Neither Satisfied Nor Dissatisfied _____Somewhat Satisfied _____Very Satisfied

35. Please rank the following issues and the degree to which they were existent in your organization during the outsourcing determination process of medical equipment maintenance, with 1 being noticeably absent and 7 being clearly present.

Noticeably Absent Clearly Present

35A) Organization-wide understanding of company goals and objectives with regard to medical equipment maintenance and sourcing solution

1 2 3 4 5 6 7

35B) Senior executive support and involvement

1 2 3 4 5 6 7

35C) Open communication with affected individuals and groups/Good flow of information and updates

1 2 3 4 5 6 7

35D) Use of outside expertise/Consultants, etc.

1 2 3 4 5 6 7

35E) Consideration of your perspective when selecting the vendor

1 2 3 4 5 6 7

35F) Ongoing management of the relationships between and among those parties impacted by the sourcing decision

1 2 3 4 5 6 7

35G) Sourcing arrangement (contract, process) clearly defined and easy to follow

1 2 3 4 5 6 7

35H) Careful attention provided to those personnel impacted by sourcing decision

1 2 3 4 5 6 7

_____Other(s)_____

1 2 3 4 5 6 7

36. Please rank the following factors and the level that they were existent in your organization during the outsourcing sustainment process of medical equipment maintenance, with 1 being noticeably absent and 7 being clearly present.

Noticeably Absent Clearly Present

36A) Organization-wide understanding company goals and objectives with regard to medical equipment maintenance and sourcing solution

1 2 3 4 5 6 7

36B) Senior executive support and involvement

1 2 3 4 5 6 7

36C) Open communication with affected individuals and groups

1 2 3 4 5 6 7

36D) Use of outside expertise/Consultants, etc.

1 2 3 4 5 6 7

36E) Consideration of your perspective when the relationship was continued

1 2 3 4 5 6 7

36F) Ongoing management of the relationships between and among those parties impacted by the sourcing decision

1 2 3 4 5 6 7

36G) Sourcing arrangement (contract, process) clearly defined and easy to follow

1 2 3 4 5 6 7

36H) Careful attention provided to those personnel impacted by sourcing decision

1 2 3 4 5 6 7

_____Other(s)_____

1 2 3 4 5 6 7

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Vita

Captain Daria J. Gaillard entered undergraduate studies at Duke University in Durham, North Carolina, in 1994. She graduated with a Bachelor of Science degree in Economics in May 1998. She was commissioned a Second Lieutenant through Air Force Reserve Officer Training Corps Detachment 365 that same year.

Her first assignment was as a Contracts Negotiator in the Aeronautical Systems Center, Wright-Patterson AFB, Ohio, in June 1998. While stationed at Wright-Patterson, she received an assignment to work for the Deputy Assistant Secretary for Environment, Safety and Occupational Health, Headquarters Pentagon in August 2000. While stationed at the Pentagon, she assisted in building evacuations during the terrorist attacks on September 11, 2001. In August 2002, she entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation she will be assigned to L.A. Air Force Base

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14. ABSTRACT

Reacting to the need to transform and the increasing pressure to outsource all non-core activities, Air Force Material Command Surgeon General discontinued its previous use of full service contracts with original equipment manufacturers and adopted a relatively new maintenance outsourcing strategy: strategic partnering with an equipment management firm. The objective of this study is to create a decision-model for selecting the optimal management strategy for a healthcare organization's facility maintenance program. This study used personal interviews with facility management personnel from MAJCOMs to collect and analyze data.

This study offers a re-conceptualized framework for viewing and understanding the various maintenance programs and their interrelationships. Additionally, the study evaluates the strategic fit between maintenance programs and strategic objectives and finally examines the strength of the strategic fit and how it relates to overall customer satisfaction of the maintenance program. The data from the interviews tested the interviewee's relative satisfaction with their programs and analyzed each management program and determined which strategic objectives resulted in satisfaction.

This research found that facilities should determine their particular level of risk. Facilities that prefer "term vs. whole" insurance may be more satisfied with a program that hedges its risk by utilizing multiple OEMs or 3rd party providers. Facilities that desire stable pricing and cost structures and consolidated management would do well to investigate single OEMs or single comprehensive providers.

15. SUBJECT TERMS
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DEPARTMENT OF THE AIR FORCE

AIR FORCE RESEARCH LABORATORY (AFMC)

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

12

December 2003

MEMORANDUM FOR AFIT/ENV

ATTN: Daria Gaillard

FROM: AFRL/HEH

SUBJECT: Approval for the Use of Volunteers in Research

1. Human experimentation as described amendment to Protocol 04-20-E, "Investigating the Optimal Management Strategy for a Healthcare Facility Maintenance Program", may begin.

2. In accordance with AFI 40-402, this protocol was reviewed and approved by the Wright Site Institutional Review Board (WSIRB) on 11 December 2003, the AFRL Chief of Aerospace Medicine on 11 December 2003.

3. Please notify the undersigned of any changes in procedures prior to their implementation. A judgment will be made at that time whether or not a complete WSIRB review is necessary.

Signed 12 December 2003

HELEN JENNINGS

Human Use Administrator