BENCHMARKING FOR ACTION AND SATISFACTION IN FACILITY OPERATIONS AND MAINTENANCE

By

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ABSTRACT

JUSTIN ROBERT DODD. Benchmarking for action and satisfaction in facility operations and maintenance. (Under the direction of DR. JAKE SMITHWICK)

While benchmarking is a well-established strategy that organizations have been using to manage performance and seek continual improvement for almost 4 decades, the field of facility management has only started using benchmarking in the last 20 years. While the literature available on organizational benchmarking is readily available from a multitude of sources, the literature specifically addressing facility-oriented benchmarking is much harder to find. Literature addressing large external benchmarking surveys is also scarce. The literature available on the topic was reviewed and several knowledge gaps were identified as needing clarification for facility benchmarking. The fundamental goal of benchmarking is to identify best practices (Camp, 1989) and take action (Spendolini, 1992). There is no identified literature addressing how facility managers are taking action on their benchmarking efforts. In searching the literature for best practices, customer satisfaction was identified as widely used facility KPI, however, there is not a lot of research into how the FM field is using the data or how it related to facility performance management. Customer/Occupant satisfaction was also identified as a regularly utilized KPI in the FM field and while there exists literature on the topic internationally, there is very little data on how it is being used in the North American facility industry. Furthermore, the literature has also identified a gap between facility benchmarking and general performance management (Simoes et al., 2011). In order to address these questions, an industry-wide facility operations & maintenance benchmarking survey was

developed and conducted with an FM organization. The survey provides a wide variety of data on North American facilities representing 2,629,749,032 Exterior Gross Square Feet (GSF) and 1,782,535,342 Rentable Square Feet (RSF). Hypotheses were developed from the topic areas and their relationship to a Key Performance Indicator (KPI), maintenance costs/SF, was tested using a variety of inferential statistical techniques and grouping of variables for making more useful comparisons. Results from the analyses suggest that while 66% of facilities utilize customer satisfaction surveys, there is no clear relationship between their use and facility performance, though differences in survey frequency were found to relate to facility size. Also, while facilities approach taking action on benchmarking studies in a variety of ways, there exists some evidence to suggest that facility managers with unfamiliarity or uncertainty about the benchmarking process may be significantly underperforming when compared to their peers.

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LIST OF ABBREVIATIONS

ASTM (American Society for Testing & Materials)

BOMA (Building Owner's Management Association)

BSC (Balanced Scorecard)

FM (Facilities Management)

GSF (Gross Square Feet)

IFMA (International Facility Management Association)

KPI (Key Performance Indicator)

O & M (Operations & Maintenance)

RSF (Rentable Square Feet)

SF (Square Foot)

TPY (Times Per Year)

CHAPTER 1: INTRODUCTION

PURPOSE OF STUDY

The objective of this thesis was to develop, administer, and analyze an industry-wide benchmarking survey on facility operations and maintenance costs and practices and to bridge the knowledge gap between facility benchmarking and performance management (Simoes et al., 2011). A fundamental function of facility management is to manage and decrease the costs associated with the operations and maintenance of physical assets in support of a greater organizational mission. The nature of this function is such that the pursuit of continual improvement must always be at the forefront to remain competitive in a quickly changing market with ever increasing costs. Benchmarking is a widely used strategy to achieve goals of continual improvement, but not much is known about how the facility management (FM) industry is utilizing these techniques to guide their performance management strategies. In an effort to address this knowledge gap, this thesis will provide information on industry trends and best practices in the use of customer/occupant satisfaction surveys and assess industry awareness and use of benchmarking plans for continual improvement. Practices in both of these techniques will be benchmarked and analyzed in terms of their effect on the maintenance costs/SF, a widely used KPI for the FM industry.

PROBLEM STATEMENT

The literature on facility-oriented benchmarking has primarily been published in the last two decades as the continual improvement technique has been adapted from the general business community and applied to the practice of managing facilities and physical assets. In comparison to the amount of literature on benchmarking, facility benchmarking research tends to be scarce. Camp (1989) and Spendolini (1992) both considered the purpose of benchmarking to be taking action based on best practices to seek continual improvement. The literature on this topic, however, is primarily in the form of brief case summaries or anecdotal tales of success in using the process. This is because the process of taking organizational action on the results of benchmarking studies is an internal process undertaken by the organization. Details of this process are not always readily published as they potentially provide proprietary information about the inner workings of a company. Consequently, little is known about industry trends in taking action and even less known about how the FM industry is utilizing benchmarking data to seek continual improvement. There exists almost no literature on methods for evaluating large scale industry-wide competitive benchmarking surveys.

Within the FM research literature, a commonly emphasized and utilized KPI, or a best practice, is that of customer/occupant satisfaction surveys. Customer satisfaction is consistently considered to be one of the most important KPIs for industry at large, as well as for FM (Briscoe, 2001; Haveerila, Martinsuo. & Maumann, 2013; BIFM, 2004; Walters, 1999; Meng & Minogue, 2011; Lavy et. al, 2010; Fibuch & Van Way, 2013). Surprisingly little is known about how FM organizations approach the use of

customer/occupant satisfaction surveys in general and its role in FM performance management, with some authors noting that it is often difficult to link soft data, such as a customer satisfaction scores, to hard costs more closely related to primary FM functions (Wong et al., 2013).

Complicating the issue still further is a noted knowledge gap between facility-oriented benchmarking and facility performance management (Simoes et al., 2011). In a review of 251 articles on maintenance performance management, Simoes et al. (2011) noted that only 11% of articles even mention benchmarking. This suggests there may be a professional disconnect on how to utilize benchmarking to assist in performance management and continual improvement.

RESEARCH GOALS AND OBJECTIVES

There are three research objectives for this thesis. One objective was to develop profile of how FM organizations are implementing customer/occupant satisfaction surveys as well as FM approaches to taking action on competitive benchmarking surveys. There is no readily available data on these topics and assessing this information will further the body of knowledge on this topic.

A second objective of this research was to determine differences in the use of customer/occupant satisfaction surveys and their effect on the performance KPI of maintenance costs/SF. As an identified facility best practice, understanding the role that these surveys play in the management of facility performance helps to bridge the knowledge gap between benchmarking and facility performance management.

A third objective of this research was to assess how various methods for taking action on benchmarking data representing various levels of benchmarking sophistication effect maintenance costs/SF. Differences between these methods may help to drive strategies for bridging the gap between benchmarking and performance management.

HYPOTHESES

A total of six hypotheses were developed based upon the three areas of research objectives. These hypotheses are grouped into two primary groups, customer satisfaction and benchmarking plans. The hypotheses were developed to test for differences in the dependent variable, maintenance costs/SF, caused by the independent variables of customer satisfaction and benchmarking plans. Differences in the grouping or covariables of type of space reported on and RSF were also tested to further objective 1 and provide insight into making meaningful facility benchmarking comparisons in a diverse group of facilities.

CUSTOMER/OCCUPANT SATISFACTION AND PERFORMANCE MANAGEMENT

HYPOTHESIS 1: The use of satisfaction surveys will have an impact on maintenance costs/SF. A two-tail t-test was used to assess this hypothesis.

HYPOTHESIS 2: The frequency of use of satisfaction surveys will have an impact on the maintenance costs/SF. This hypothesis was tested using an ANOVA and post-hoc t-tests.

HYPOTHESIS 3: The size of the facilities will affect frequency of satisfaction survey use. This hypothesis was tested using an ANOVA and post-hoc t-tests.

BENCHMARKING PLANS AND PERFORMANCE MANAGEMENT

HYPOTHESIS 4: Those who are uncertain of how to utilize the benchmarking data will have higher maintenance costs/SF than their counterparts. A two-tail t-test was used to assess this hypothesis.

HYPOTHESIS 5: Those who do not intend to take action on the benchmarking data will have differing maintenance costs/SF than their counterparts. A two-tail t-test was used to assess this hypothesis.

HYPOTHESIS 6: The following benchmarking plans will not have an effect on maintenance costs/SF: Gauging company performance, Identification of best practices, and use in a performance model. A two-tail t-test was used to assess this hypothesis with each of the three benchmarking plans.

RESEARCH SCOPE

The volume of data contained within the parameters of the industry-wide benchmarking survey that was developed and administered is immense. The survey provides data on North American facilities representing over 2,629,749,032 Exterior Gross Square Feet (GSF) and over 1,782,535,342 Rentable Square Feet (RSF). A total of 2,568 facilities participated in this survey that consisted of over 150 questions. The large

dataset necessitated careful management of the thesis scope, and to address only the information gathered through the literature review that was most pertinent to the benchmarking plans and the use of customer/occupant satisfaction surveys. The data in this analysis was limited to North American facilities who completed the questions on the independent variables in this study. Since not every participant answered these questions, a total of 1,565 surveys were identified as meeting this criterion for the analysis.

RESEARCH METHODOLOGY SUMMARY

The research methodology for this thesis included a five-phase research methodology melded with a five-step benchmarking model to guide the process based on Spendolini's five stage benchmarking model (1992) (See Figure 1: Merged Research and Benchmarking Methodologies). This model was selected for its simplicity and origination in general business consultation. Research into benchmarking models suggests that despite their differences, they all have a common core of phases that accomplish the same fundamental steps (Fernandez, McCarthy, & Rakotobe-Joel, 2001).

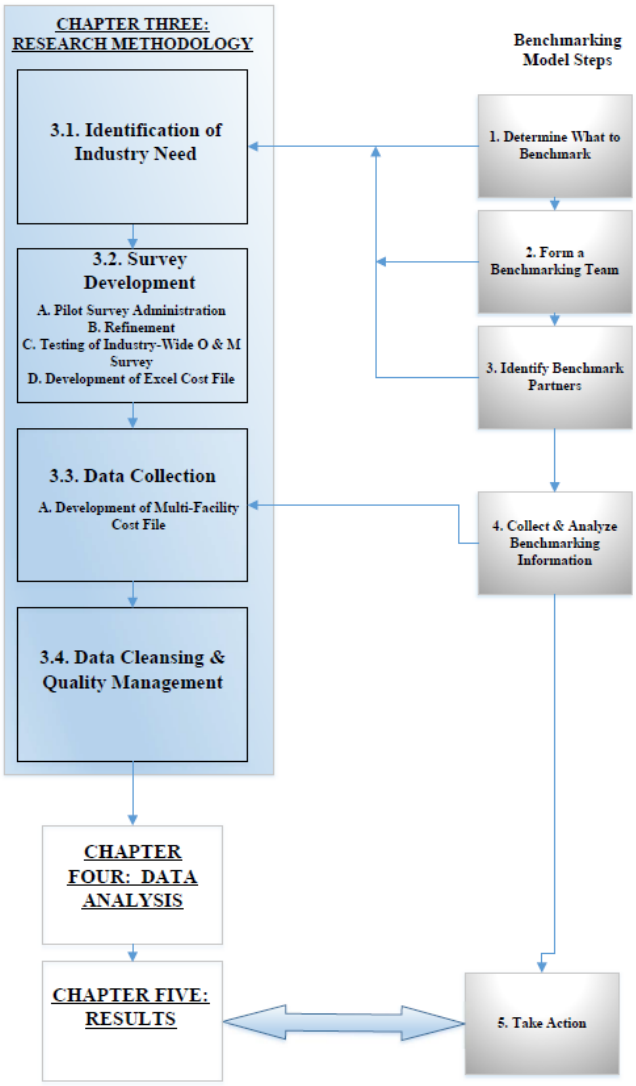


Figure1: Merged Research and Benchmarking Methodologies

SIGNIFICANCE OF STUDY

This thesis provides insight into the current practices and hard costs in facility operations & maintenance throughout North America as well as providing a documented example of the development, administration, and analysis of an industry-wide O & M

competitive benchmarking survey. This study also provides a snapshot of how the FM industry is utilizing the best practice of customer/occupant satisfaction and its relationship to maintenance costs/sf and facility variables related to size. Another contribution that this thesis makes to the field of facility management is to document and assess the various approaches that FM organizations are using to take action on their benchmarking data. This helps to bridge the knowledge gap between benchmarking efforts and performance management strategies for the FM profession.

DEFINITION OF TERMS

The following terms are defined due to their regular use throughout this thesis. The survey collected data on both GSF and RSF, as RSF is the basis for the dependent variable, maintenance costs/RSF. The Subject Matter Experts (SMEs) consulted with the development of the survey, chose to use the older term, RSF, in the survey, rather than using the updated terms, Plannable Gross Area. This is discussed further in SME Contributions in the Research Methodology section of this paper.

Gross Square Footage (GSF) (ASTM E 1836-01): The sum of the floor areas on all levels of a building that are totally enclosed within a building.

Rentable Square Foot (RSF) (ASTM E1836-08: 2008): Basis for most benchmark calculations. To measure rentable area, subtract major vertical penetrations, interior parking space, exterior walls and void areas from the gross area.

Plannable Gross Area (ASTM E1836-08:2016): The gross area minus exterior walls, major vertical penetrations and interior parking spaces: the portion of a floor that is totally enclosed within the interior face of perimeter encroachments at the floor plane and

where there are no perimeter encroachments enclosed at the inside finished surface of the exterior walls. This is an updated term replacing RSF as of 2016.

SUMMARY OF CONTENT

This thesis documents the development, administration, and analysis of a facility operations & maintenance competitive benchmarking survey. It further documents the identification of industry best practices and the testing of hypotheses to examine the knowledge gap between facility benchmarking and performance management.

- Chapter 2 is a literature review of facility benchmarking best practices and discusses the best practices of customer satisfaction and benchmarking plans.
- Chapter 3 is a detailed explanation of how the benchmarking survey was developed, administered, cleaned, and managed.
- Chapter 4 presents the raw data and descriptive statistics on the variables used in hypothesis testing. This section also reviews the hypotheses and introduces how the analyses were conducted.
- Chapter 5 presents the results from the analyses and hypotheses testing.
- Chapter 6 is a discussion of possible interpretations for the results of the analyses and draws conclusions from the research.

CHAPTER TWO: LITERATURE REVIEW

INTRODUCTION

Benchmarking is a tool that was developed in industry as a means of comparative performance evaluation for the purposes of continual improvement (Camp, 1989). There are a number of different types of benchmarking that have evolved over time in an effort to keep up with a rapidly changing business environment and organizational needs to remain ever more competitive. Watson (1993) described the evolution of benchmarking as having begun in the 1940's with first generation reverse benchmarking. This was followed by competitive benchmarking, process benchmarking, strategic benchmarking, and global benchmarking. Other research proposes that benchmarking can be classified according to: the nature of the comparison (internal, competitor, industry, generic, & global); the content of the benchmarking (process, functional, performance, & strategic); and the purpose of the relationship (competitive or collaborative) (Fong, S., Cheng, E., & Ho, D., 1988). Functionally, however, benchmarking can be broken down as either internal or external to the company or organization. Regardless of the subject of the benchmarking, the partnering or comparison process will always be either internal or external (Anand & Kodali, 2008).

BENCHMARKING HISTORY AND MODELS

Despite having a history dating back to at least the 1940's, benchmarking did not become a widely utilized organizational tool until Robert Camp's book, "Benchmarking: The search for industry best practices that lead to superior performance" (1989). This book provided the first detailed description of the benchmarking process to the general business audience and its publication coincided with the Xerox company receiving a Malcolm Baldridge Quality Award. The emergence of Camp's book outlining the Xerox methodology to benchmarking, along with the publicity and interest brought on by the Baldridge Award propelled Xerox and their benchmarking methodology to become highly sought-after by the business public (Spendolini, 1992; Yasin, 2002). Camp, while working at Xerox in the late 1970s, is credited with having initiated the very first benchmarking projects to address the higher production costs of photocopiers in the United States compared to their Japanese counterparts. The efforts of their benchmarking initiatives were able to provide valuable insights into their production efficiency and design, which they in turn were able to use to reduce the costs of manufacturing their equipment. The Baldridge Award recognized this achievement and facilitated the sharing of Xerox's knowledge with the business community (Yasin, 2002).

The work of Robert Camp and his associates at Xerox became the basis for the working definition of benchmarking, "The search for industry best practices that lead to superior performance" (Camp, 1989, p. 12). Camp considered the basic philosophical steps to the generic benchmarking process to be:

1. Know your operation

2. Know the industry leaders or competitors
3. Incorporate the best practices
4. “Gain Superiority” (Camp, 1989, p.4)

Understanding the generic benchmarking process is crucial to effective benchmarking (Figure 1: Generic Benchmarking Process). Benchmarking consists both of metrics and processes (methods). Benchmarking should be initially approached by investigating industry practices and determination of metrics should be determined based upon those practices. It is the practices that give rise to differences in performance outcomes and must be linked to the differences in metrics. Metrics without practices, and practices without metrics provide little in terms of meaningful methodologies for continual improvement. Together, however, they provide a quantification of goals and methods for achieving those goals (Camp, 1989).

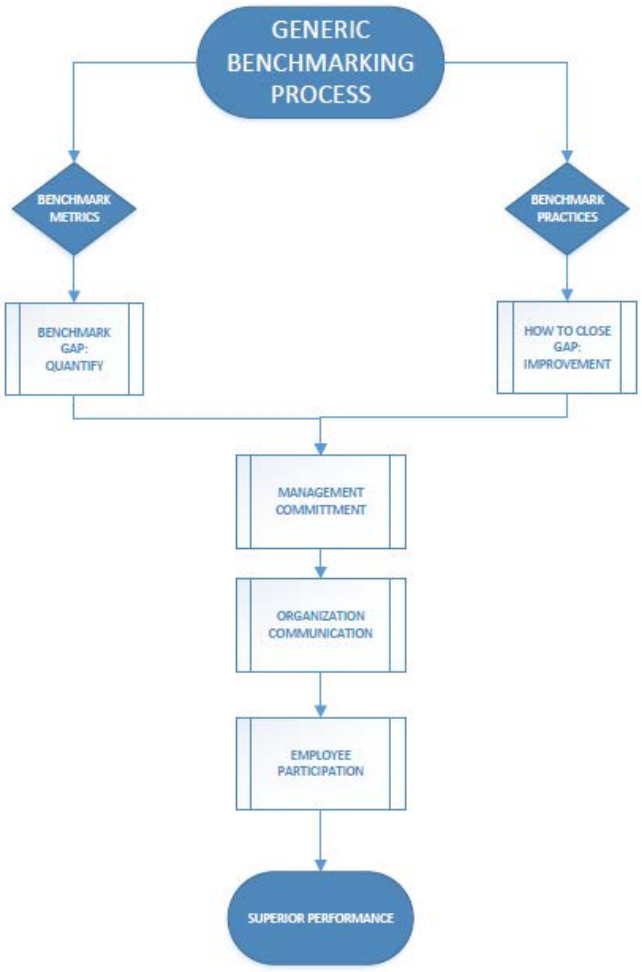


Figure 2: Generic Benchmarking Process (As adapted from Camp, 1989)

Robert Camp, through his work at Xerox helped to develop a Ten-Stage Benchmarking Model which provides examples of how the process is applied to logistics and distribution (Camp, 1989; Spendolini, 1992). He elaborated in great detail upon the model and example applications based upon his experience with them in his book titled after the working definition of benchmarking, “The search for industry best practices that lead to superior performance”. Camp’s Model proposes that there are five primary phases

in benchmarking methodology that can best be represented by 10 distinct steps that through a process lead to maturity and actualization of improvement.

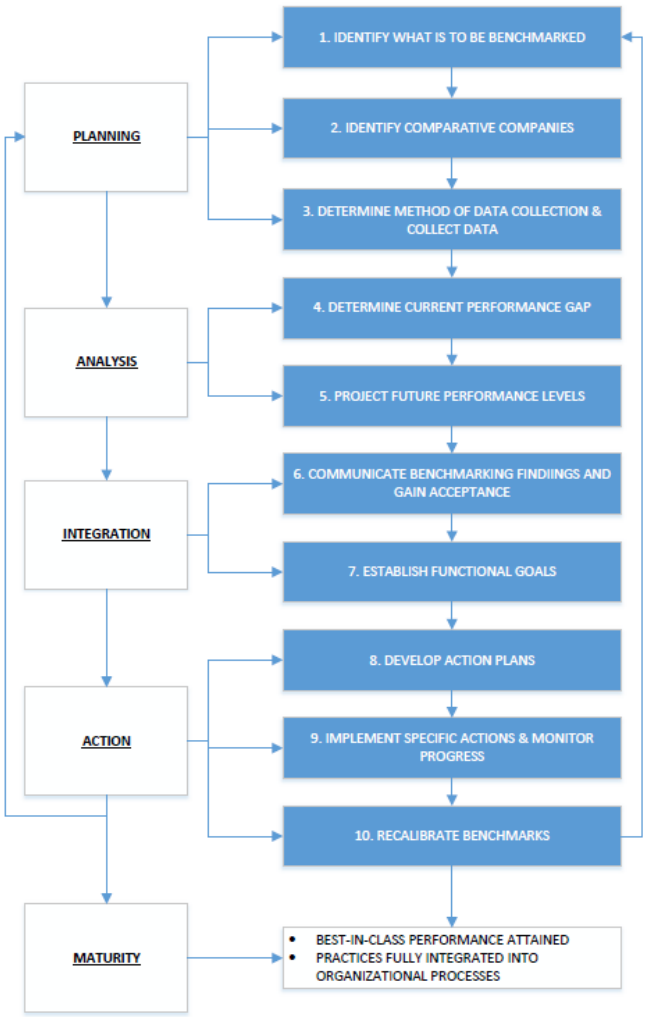


Figure 3: Camp-Xerox Benchmarking Model and Planning Phases (As adapted from Camp, 1989).

Building upon the spike in public interest brought about by the Baldrige Award and Camp's publication, Spendolini (1992) delineated a benchmarking method consisting

of five stages based upon his work as a business consultant. His approach to benchmarking marked the first general business approach to benchmarking, whereas Camp's approach had been developed specifically rooted in logistics and supply chain management (Camp, 1989). Spendolini defined benchmarking as "A continuous, systematic process for evaluating the products, services, and work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Spendolini, M., 1992, p. 9). Spendolini argued that the ideal shape of the benchmarking model should be circular in nature, so as to reflect the process of continual improvement and recycling that an organization goes through as it identifies gaps, makes changes, and remeasures in the pursuit of perfection.

Spendolini's (1992) five-stage benchmarking methodology. These five stages include:

1. Benchmark Identification
2. Forming a Benchmarking Team
3. Soliciting Benchmarking Partners
4. Collecting and Analyzing Benchmarking Information
5. Taking Action

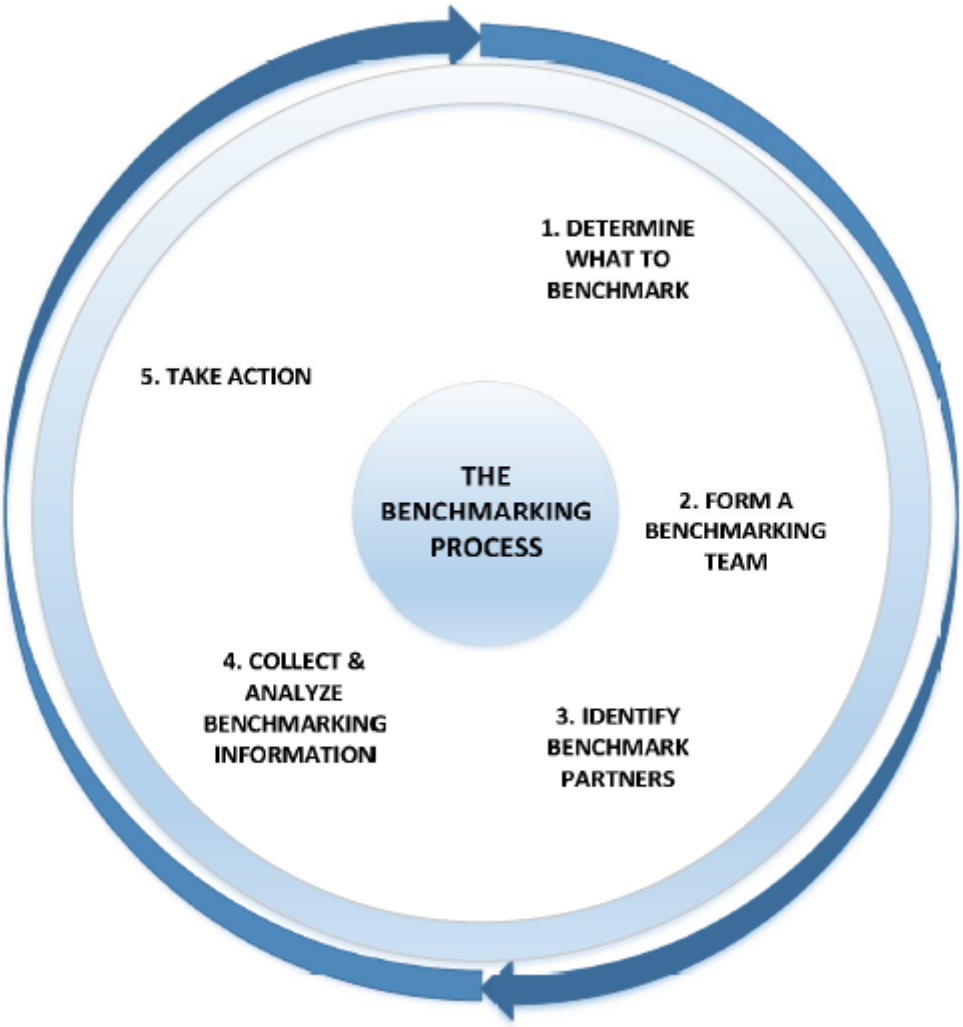


Figure 4: Spendolini's 5 Stage Benchmarking Model (As Adapted from Spendolini, 1992)

The benchmarking process is a continuous one and is usually depicted as a wheel of stages for representation of the ongoing nature of the process (Khurrum S. Bhutta & Faizul Huq, 1999). The initial stage of the planning process includes making a decision as

to the benchmarking model that will be employed to guide the benchmarking process. There are numerous benchmarking models in published literature, all of which contain common themes but have varied in the number of phases and steps, phases ranging from two to seven and steps varying from five to twenty-one (Anand & Kodali, 2008). Camp's (1989) original model included as many as 10 distinct steps to the benchmarking process.

Building upon the works and models of individuals like Camp and Spendolini, many benchmarking models have been published and even more have been modified and incorporated into corporate unpublished models. Many have been created from the core methodologies and adapted to fit the individual needs of the organization, much like adaption of best practices. It has been noted that the models simply provide a framework that must be flexible to adapt to the individual needs of an organization (Emulti & Kathwala, 1997). In an analysis of six leading published benchmarking models, all models were found to have five general phases in common despite the varying purposes or styles of the application. These five phases include planning, analysis & data collection, comparison & results, change, and verification/ maturity (Fernandez, McCarthy, & Rakotobe-Joel, 2001).

In a more recent review of benchmarking models, thirty-five published benchmarking models were compared and classified according to the following categories: Academic & Research -based Models, Consultant/Expert-based Models, and Organizationally-based Models (Anand & Kodali, 2008). The Consultant/Expert based models accounted for 48% of the models studied, which the authors suggest highlights the use of benchmarking by practitioners, since Academic & Research based models

account for 26% of the sample (Anand & Kodali, 2008). All of the models were analyzed and a universal benchmarking model comprised of twelve phases and fifty-four steps was created based upon the analysis. This model is proposed to incorporate all best practices and suitable procedures for all types of benchmarking for the purpose of eliminating common pitfalls in the benchmarking process (Anand & Kodali, 2008).

The importance of conducting benchmarking in the context of a model is to ensure that the benchmarking efforts are within the context of a plan for action. Models provide the guide for turning numbers into metrics and then actions for the purpose of achieving goals and/or producing results (Stauffer, 2003).

In addition to the identification of best-in-class performance, it is important to continue to record and compare the worst-in-class performance as well. There is a tendency in benchmarking to focus on the best, but the worst should be included in analysis as well for a more accurate picture of performance and how that may change over time (Stauffer, 2003).

An essential aspect of best practices for facility benchmarking is the identification of the business needs of the facilities being managed. Benchmarking is purely superficial unless it is rooted in what is needed, rather than what is easy to acquire. This may require some creativity but should result in measures that can be applied to action and are linked to strategic business planning, company goals, and objectives (Stauffer, 2003; IFMA, 2014; Camp, 1989). Part of the process of identifying needs is the formal recognition that improvements can be made and compared to the best in class processes of similar buildings (Stauffer, 2003).

In order to ensure that the benchmarking process will ultimately lead to increased performance for company objectives, it is necessary to employ proper participative mechanisms. Senior leaders and management must be involved in the process in order for the benchmarking efforts to truly be effective (Camp, 1989). All staff impacted by the benchmarking should also be brought into the fold in some manner to ensure their investment in the process. The purpose of the benchmarking and the goals should be disseminated among the participants and motivational or engagement techniques such as incentives will help to ensure that the benchmarking is recorded and undertaken for accuracy, resulting in better performance of the building. Further, the benchmarking process must be made to be beneficial to all participants involved in the benchmarking studies to ensure continued involvement from the best-in-class performers (Stauffer, 2003; Spendolini, 1992; Camp, 1989). This means that in order for your data to be truly representative of industry, it needs to include the best-in-class and worst-in-class, so there must be incentive for all to continue providing data.

The identification of current best practices in benchmarking for construction and facility management will need to incorporate the best practices utilized by other fields, while adapting them to fit their individual needs. Best practices cannot simply be transferred and imposed, but must be adapted to individual organizations (Bhutta, K.S. & Huq, F. 1999: Fibuch et al., 2013).

EFFECTIVENESS OF BENCHMARKING

There exists an abundance of literature demonstrating the effective use and application of benchmarking to improve organizational performance. The evidence for its effectiveness is generally presented in the form of case studies of organizations who implemented the benchmarking process and saw process improvement over time (Camp, 1989: Spendolini, 1992: Fernandez, McCarthy, & Rakotobe-Joel, 2001).

Some of the documented organizational benefits of benchmarking include:

- Determination of measures of productivity (Allan, 1993)
- Supports competitive performance (Camp, 1989)
- Creates industry awareness of best practices (Camp, 1989: Shetty, 1993)
- Provides dramatic leaps in organizational performance (Sedgwick, 1995)

The literature on the topic of benchmarking is generally geared towards the practitioner rather than the academic or research scientist. Hard data may often be missing from these studies as it is often considered proprietary information of a private organization or a small partnership of organizations. Further, the nature of benchmarking as a process is often best presented through time-series data to demonstrate the impact that it has at an organizational level (Camp, 1989). Research and academic studies on the effectiveness of benchmarking are in need as are studies examining the broader use of benchmarking, linking it to organizational performance management, and trying to quantify its effectiveness at an interorganizational competitive level (Collins, Rosetti, Nachtmann, & Oldham, 2006).

A number of researchers have noted that the data analysis aspect of benchmarking is in need of further research and refinement (Collins et al., 2006: Wong, Leung, & Gilleard, 2013; Yasin, 2002: Bhutta & Huq, 1999). The typical tools used by practitioners to study benchmarking results include methods such as, “flow charts, matrix analyses, spider charts, and Z-charts” (Collins et. al, 2006, p. 432). The problem with the rather simplistic tools used to conduct benchmarking analyses is that these tools are incapable of evaluating the data for the purpose of identifying performance gaps and the processes needed to take action and correct those performance gaps.

Previous research has also indicated that disparate analyses techniques and statistical methods can make determination of best-in-class performance difficult (Rodier, 2001). One study proposes the use of multi-attribute utility theory as a means for overcoming the difficulties in determination of best in class performance (Collins, et. al., 2006). Other research indicates that the adoption of best practices tends to be governed by similarity of data, organizational size, and resource constraints (Hinton, Francis, & Holloway, 2000).

A recent study, Wong et al (2013) notes that current facility management benchmarking tends to be rather simplistic in its analysis and is in need of further refinement and more complex tools to analyze benchmarking data. The authors note that relationships between hard cost data and quality focused data such as customer satisfaction can be complex and tend to be problematic. The true nature of their relationship may not be detected through simple statistical analysis. They suggest that the use of more sophisticated techniques that utilize a balanced performance measurement system will allow facility managers to more effectively manage their performance. One

such system that the authors discuss and delineate through a case example is the use of Data Envelopment Analysis (DEA) in analyzing benchmarking data. This analysis is a linear programming technique based upon an Input-Process-Output system that can establish an overall performance evaluation in terms of efficiency.

An early comprehensive review of benchmarking literature from 1986-2000 (Yasin, 2002) uncovered some significant knowledge gaps and problems in the benchmarking literature:

1. The academic community lacks proper models or frameworks for managing the complex nature of organizational benchmarking.
2. Benchmarking research and applications lack a system-wide approach.
3. The literature lacks methodologies for quantifying the costs and benefits of benchmarking.
4. Benchmarking development and utilization occurs primarily in service-based sectors. Manufacturing organizations are trailing behind the innovations of service organizations.

There is large-scale interorganizational evidence to support the effectiveness of benchmarking as a means of improving performance and costs savings. A growing number of states and cities are requiring benchmarking energy rankings for large buildings in their jurisdiction. A study on the effects of this public benchmarking process indicate that in just the first few years since these laws were implemented, there has been a significant 2-3% reduction in energy consumption in those districts. (Palmer & Walls, 2015).

FACILITY MANAGEMENT BENCHMARKING

Facility Management focused benchmarking research tends to be harder to find. Though it has already been suggested that benchmarking research can be problematic and is in need of further refinement (Collins, et. al., 2006), facility-based benchmarking research has the same set of difficulties and even less research literature to work with (Wong et al., 2013)

Spendolini and Camp had worked extensively for business organizations on matters of business directly related to the core objectives of the companies (Spendolini, 1992: Camp, 1989). This work was being done at a time when Facility Management was perceived primarily as cost-center operation, or simply as the cost of doing business. There exists little research from the 1980s on benchmarking in facility management. This may largely be due in part to the fact that it was not until there was a significant amount of outsourcing in the 1990s of facility management services that the profession really began to develop in an effort to better manage rising building costs (Loosemore & Hsin, 2001). An early survey given to facility management professionals “Depicts a fragmented facilities management profession that has an introspective, crude, and unimaginative approach to measuring facilities performance” (Loosemore & Hsin, 2001, p. 464). Though benchmarking in FM began to appear in the mid-1980s with IFMA, early efforts focused primarily on financial indicators and demographics (Pitt & Tucker, 2008).

Since that time facility management research has increased along with an interest in aligning the goals of facility management to core business objectives through

performance management and the utilization of performance modeling techniques utilizing Balanced Score Cards (BSCs) and Key Performance Indicators (KPIs) (Amaratunga, Baldry & Sarshar, 2000: Amaratunga, Haigh, Sarshar, and Baldry, 2002: Rasila, Alho, & Nenonen, 2010; Meng & Minogue, 2011).

PERFORMANCE MANAGEMENT AND BENCHMARKING

Research into the validity of subjective and objective measures suggests that both have an equivalent construct validity and thus both should be used as a means of performance measurement (Wall et al., 2004). This benchmarking should incorporate both type of measures for more accurate assessment.

In an extensive literature review and analysis of 251 articles related to maintenance performance measurement in the UK manufacturing sector, only 11% of the articles referred to benchmarking, despite its fundamental importance to the continual improvement process (Simoes et al., 2011). This suggests that there may be a knowledge gap in maintenance performance modeling literature and the applied benchmarking process. As noted by Yasin (2002), the manufacturing industry tends to be significantly behind service based industries in regard to benchmarking innovation & application.

Many of the functions of Facility Management are evaluated based upon performance, such as maintenance, utility, and janitorial. A previous study on the distribution of performance models in the UK Facility Management industry identified three performance models that have generally found to be more effective than their counterparts. These are the Balanced Scorecard (BSC), Key Performance Indicators

(KPIs) and the Business Excellence Model (BEM). While the BSC and KPI approached to performance management have seen adoption in North America, the BEM model is typically only seen in European organizations and research. Selection of the appropriate performance models and indicators is essential in planning the benchmarking process for proper evaluation of performance (Meng & Minogue, 2011).

BALANCED SCORECARDS (BSCs)

The Balanced Scorecard (BSC) was developed as a result of a year-long study completed with 12 business organizations to develop a "set of measures that gives top managers a fast but comprehensive view of the business" (Kaplan & Norton, 1992, p.71). The Balanced Scorecard includes financial measures relating to action already undertaken and operational measures that serve as the drivers of anticipated financial performance and future actions. The Balanced Scorecard links all these performance measures through strategy, rather than control, to demonstrate how results are achieved by providing answers to the following four questions:

1. Customer: how must we look to our customers?
2. Internal processes: what internal processes must we excel at?
3. Financial: how will we look to the shareholders
4. Innovation: how can the organization learn and improve?

The use of the four perspectives is to ensure that major stakeholders in the business (customers, employees, shareholders) all contribute towards a more holistic view of the organization and is found to guide management with a balanced view of the

business itself. Through the use of the BSC, an organization can monitor its performance through both hard and soft performance measures, and both quantitative and qualitative data (Dilanthi Amaratunga, David Baldry, & Marjan Sarshar, 2000). A scorecard may utilize anywhere from eight to 16 measures (2-4 measures per each perspective), so care should be taken to utilize only the most important performance indicators (KPIs) or critical success factors (Rasila, Alho, & Nenonen, 2010). Using this process in the context of maintenance management ensures that maintenance strategy can be linked to overall business strategy (Kumar, Galar, Parida, Stenström, & Berges, 2013).

Research has documented that companies who are using an integrated and balanced performance measurement system, such as the Balanced Scorecard (Kapan & Norris, 1992) perform better than those who do not use such a performance measurement system (Lingle & Shiemann, 1996; Kennerly & Neely, 2003: Parida & Kumar, 2006). Multiple applications of the Balanced Scorecard approach to performance management in the FM industry can be found in the literature, generally supporting improved performance results with adherence to this methodology (Amaratunga et al., 2002; Rasila et al., 2010; Amaratunga et al., 2000).

KEY PERFORMANCE INDICATORS (KPIs)

The use of KPIs in an FM setting can provide advantages such as the focusing and prioritization of managerial efforts, use in service provider selection, and through the facilitation of a defined outcome along with methodologies for monitoring and control (Meng & Minogue, 2011).

A previous survey indicated that respondents approach the ranking of KPIs differently from a FM based perspective than they would if they were ranking them from a business perspective (Hinks, 2004). Lavy et. al, (2010) further reports findings from a survey conducted at the Facility Management Association "Ideaction" conference that took place in Melbourne, Australia in 2001 where attendees ranked KPIs differently according to whether they were engaging in a business vs. a facility management perspective. One of the only KPIs to be ranked as consistently important despite the perspective was customer satisfaction.

A survey and interview of seventy-three FM leaders in the UK found the following 10 KPIs as the most utilized across industry (Meng & Minogue, 2011):

1. Client satisfaction
2. Cost-effectiveness
3. Response time
4. Service reliability
5. Health
6. Safety
7. Environmental compliance
8. Staff commitment
9. Client-service provider relationship
10. IT application

A considerable amount of research has gone into the identification and categorization of KPIs utilized for the purpose of facility management. A previous study (Amaratunga &

Baldry, 2003) indicated that KPIs could be organized into the following categories: FM internal processes, customer relations, learning & growth, and financial implications. Another study (Augenbroe & Park, 2005) divided facility KPIs into four additional categories that include energy, lighting, thermal comfort, and maintenance. Parida & Kumar (2006) identified the following core maintenance performance indicator categories: customer satisfaction, cost, equipment, maintenance tasks, learning & growth, health, safety & environment, and employee satisfaction. More traditional approaches to maintenance performance tended to be dominated by two types of indicators, Key Performance Indicators evaluated periodically, and detailed indicators, used for examining deviations in the key indicators (Simoes et al., 2011).

A more comprehensive study (Hinks & McNay, 2005) reviewed over 172 identified facility KPIs and proposed that those KPIS could be best represented by eight categories:

1. Business benefits
2. Equipment
3. Space
4. Environment
5. Change
6. Maintenance/services
7. Consultancy
8. General

With so many different KPIs being utilized in the diverse spectrum of facilities and the varying needs of the organizations they represent, the proper categorization of KPIs is

important as it provides a valuable way for organizations to quickly develop and utilize the measures that will best serve them. Some organizations will simply have no use for KPIs that another facility would see as integral to their operation. Based upon a literature review of KPI categorization studies, Lavy et. al. (2010) proposes a categorization strategy of facility KPIs that uses the following four categories: financial, physical, functional, and survey based.

As a potential solution to the diversity and multitude of KPIs utilized by the facility management industry, Lavy, Garcia, & Dixit (2014a, 2014b) proposed the development of wholistic facility KPIs that are more representative of overall facility functioning and performance. They identified, categorized, and derived expressions for a set of core indicators that includes:

1. Maintenance efficiency
2. Replacement efficiency
3. Condition Index (CI)
4. Functional index
5. Indoor/outdoor environmental quality (IOEQ)
6. Absenteeism
7. User perception (satisfaction)

BENCHMARKING FOR SATISFACTION

Customer or client satisfaction has been considered critical to the benchmarking process since it's origin at Xerox (Fibuch & Van Way, 2013). It has been suggested that

the entire benchmarking process should be approached from the customer's point of view from the onset (Stauffer, 2003). Customer satisfaction has also been considered the top KPI for Facility Management for a considerable time (Walters, 1999). Its adoption has been noticed as a continually growing trend (J.M. Simões, C.F. Gomes, & M.M. Yasin, 2011). A number of authors suggests that customer satisfaction and/or service delivery is critical to aligning facility performance with overall business objectives (Pitt & Tucker, 2008: Walters, 1999; Tucker & Smith, 2008). It is considered a holistically oriented core indicator for facility management functions (Lavy et. al, 2014a, 2014b). Customer satisfaction is without a doubt, the most widely recognized and utilized KPI in both the general business and facility management industries. Based on the consistency and volume of reports, it may arguably be the most important KPI for both as well (Briscoe, 2001; Haveerila,et al., 2013; BIFM, 2004; Walters, 1999; Meng & Minogue, 2011; Lavy et. al, 2010; Fibuch & Van Way, 2013).

Several surveys of CEOs have ranked improving customer satisfaction and customer loyalty among the top challenges faced by organizations (Briscoe, 2002; IBM, 2012). High levels of satisfaction and loyalty tend to lead to improved revenue and profitability, as well as improved financial measures and stock prices (Haveerila, Martinsuo, & Naumann, 2013). The British Institute of Facility Management (BIFM) published a report in which the promotion of customer satisfaction was found to be one of the most important facility issues for the next 15 years (BIFM, 2004). Meng & Minogue (2011) found customer satisfaction to be one of the most widely utilized KPIs in facility management. Lavy et. al., (2010) reported that facility managers regard customer

satisfaction as a top KPI regardless of engaging in a business or facility-based perspective for ranking.

With customer satisfaction being such an integrally important KPI for facility management, understanding how that KPI is being used to manage facilities and relating it to hard performance indicators to quantify its impact upon performance is essential. It has been noted that benchmarking satisfaction can be rather difficult as relationships between quality-based soft metrics and the hard cost data essential to facility cost-savings are difficult to detect through simple statistical analyses (Wong et al., 2013). There are, however, a number of studies that have found customer satisfaction to be directly related to functions of facility management. Customer satisfaction has been found to be one of the major contributing factors towards project success (Cheung et al, 2000; Leung et al., 2004; Wang & Huang, 2006; Nzekwe-Excel et al, 2010; Kärnä, S. & Junnonen, J., 2016).

Several studies have examined the role of customer satisfaction in relation to maintenance services and strategy in facility management. User satisfaction was found to negatively correlate with office maintenance downtime variance in a survey of facility management professionals (Au-Yong, Ali, & Ahmad, 2015). End user satisfaction was also found to correlate with proactive maintenance and negatively correlate with corrective/breakdown maintenance (Rani, Baharum, Akbar, & Nawawi, 2015).

A growing body of research is reinforcing the idea that soft metrics, such as customer satisfaction are just as essential to managing facility performance as harder metrics, such as costs. Maintenance decisions tend to come to the optimal solution using

heuristics that are supported with qualitative and quantitative assessment data (Kumar et al., 2013). Tucker & Pitt (2010) suggest that FM performance management should develop a mixed –model utilizing both qualitative data pertaining to customer perceptions of FM service, as well as quantitative data such as customer satisfaction. They contend that simple quantifications of satisfaction are incomplete without gaining insight into the perceptual processes behind the ratings. Understanding how to better provide facility services requires a better understanding of the customer's needs and perceptions. With customer satisfaction being such a critical KPI for facility management, it is also imperative to understand the factors that shape perception of services. It was found that the three main drivers of customer satisfaction are, "the match between order and outcome of an FM service, the transparency of the process, and solution orientation of FM service employees regarding customer needs" (Coenen et al., 2013, p. 274).

BENCHMARKING FOR ACTION

Spendolini (1992) considers taking action as the primary purpose of benchmarking. The motivation for engaging in the effort in the first place is to support a process of continual improvement which denotes ongoing change. He generally regarded this stage of the benchmarking process to be the most straight-forward and least complicated as reported by the companies with whom he had worked (Spendolini, 1992).

Though the focus of a facility-based competitive benchmarking study is to provide an external comparative basis for determination of performance standing in comparable facilities, the action phase of the benchmarking process remains a primarily

internal organizational matter. Consequently, how companies take action based upon the results of their external benchmarking studies is largely reported through case studies, and that data rarely gets published as anything other than examples given in books (Camp, 1989; Spendolini, 1992).

The academic literature is remarkably scarce, if not nonexistent, when it comes to larger surveys about how the facility management industry takes action on the results of their competitive benchmarking studies. It is known from the literature that facilities are regularly using performance modeling techniques such as Balanced Scorecards and Key Performance Indicators (Meng & Minogue, 2011) to link facility metrics to actionable strategies within the organizations they represent. Beyond this, there is little to guide research efforts on this aspect of benchmarking. With action being the primary purpose of engaging in benchmarking, this is an area in need of further research and study.

BENCHMARKING SUMMARY

Benchmarking is a tool for performance management and continual improvement that has readily been embraced by the business community since the late 1980s. Facility management has trailed that embrace by a number of years as the field has grown and become more sophisticated. The research literature clearly shows that the industry is beginning to embrace a variety of techniques and metrics for managing facility performance. Customer satisfaction is considered to be one of the most important metrics for managing facility performance, yet there remains difficulty in linking such a metric to changes in cost data. With the difficulty in linking this data, illumination of how facility's

use and manage by customer satisfaction becomes an ever more important question to answer. Further still, with the most important phase of the benchmarking process considered to be the action phase, how are organizations taking action on the results of their benchmarking studies. These areas are of great importance in understanding the effectiveness of facility-based benchmarking and in need of further study and refinement.

CHAPTER 3: RESEARCH METHODOLOGY

INTRODUCTION

The methodology followed in this paper features a benchmarking model for guiding the benchmarking process integrated into a research methodology applied to survey content for the purposes of quantification of industry trends and testing of research hypotheses developed from the literature. Spendolini's (1992) Benchmarking Model was adapted and customized to fit the unique demands of the researchers and FM organization. The research methodology utilized in this study consisted of a six phase, ten-step sequence that will be discussed in the next three chapters.

3.1.Identification of Industry Need: Benchmarking Information, Team, & Partners

3.2.Survey Development

a. Pilot Survey Administration
b. Refinement
c. Testing of Industry-wide O & M survey (Online)
d. Development of Excel Cost File

3.3.Data Collection: Deployment of FM Industry-Wide O & M survey

a. Development of Multi-Facility Costs File

3.4.Data Cleansing & Quality Management

The benchmarking model steps were incorporated into the corresponding steps of the research methodology as they occurred during the timeline of the research methodology (See Figure 1: Benchmarking Research Methodology). These phases often overlapped.

The first three phases of the benchmarking model were incorporated into Steps One and Two of the Research Methodology. In this circumstance, as researchers participating in a benchmarking exercise, the majority of the fundamental decisions on the nature of what to benchmark, the team, and the partners, was decided without researcher influence. These benchmarking model steps, 1-3 (Determine what to benchmark, Forming a benchmarking team, and Identifying benchmark partners) were incorporated into the first step of the Research Methodology, with minor modifications taking place during Step 2 of the Research Methodology. Step Four of the benchmarking model coincides with Step 3 of the Research Methodology and is carried into Chapter Four: Data Analysis. The Fifth Benchmarking Model Step, Take Action is incorporated and carried out in Chapter Five: Results.

Table 1: Schedule of Research Methodology Execution

No	Schedule Item or Event	Date
1	Identification of Industry Need	08/2016
2	Survey development begins: SME Commentary	08/2016
3	Pilot Survey Administration	10/15/2016
4	Refinement	11/2016
5	Testing of Industry-Wide O & M Survey (Electronic)	01/2017
6	Development of Excel Costs File	01/15/2017
7	Deployment of Industry-Wide O & M Survey	02/13/2017
8	Development of Multi-Facility Costs File	02/15/2017
9	Closing of Industry-Wide O & M Survey	4/19/2017

10	Data Cleansing & Quality Management	04/20/2017
11	Analysis	08/15/2017

3.1 IDENTIFICATION OF INDUSTRY NEED: BENCHMARKS, TEAMS, AND PARTNERS

The benchmarking model steps included in this phase of the research were: Determine What to Benchmark, Forming a Benchmarking Team, and Soliciting Benchmarking Partners. The content for the subject of the survey was derived out of industry need and funded by an FM organization for the purposes of updating existing data. The content of these previous survey was utilized and was updated or revised based upon input from research personnel at the FM organization and members of the organization who were identified as Subject Matter Experts (SMEs). Additional content was added to the survey based upon a research literature review of facility management benchmarking practices.

This phase of the research methodology overlaps with the benchmarking methodology in purpose and timeline. The FM organization funded this project out of an identified industry need to update their benchmarking data that was collected in a previous benchmarking report on facility operations & maintenance in 2009. This previous report included information on facility characteristics, settings, and uses; utility costs and consumption rates; maintenance costs and staffing; janitorial costs and staffing; sustainability and green initiatives, facility practices and procedures, planning horizons, and more. (See Appendix C: Industry-Wide O & M Survey). The content of this survey

was to be recreated for the purpose of providing their members with updated performance data on managing the operations & maintenance functions of their facilities. Though the majority of the survey content suggestions came directly from the FM organization, the researchers were able to contribute minor suggestions to content based upon literature reviews of benchmarking practices. Some of the contribution to the benchmarking content included: Use of cost range value options, inclusion of satisfaction benchmarks, and inclusion of benchmarking action strategies.

The benchmarking team for the development of this survey consisted of the FM organization staff, twelve Subject Matter Experts (SMEs), members of the organization, and researchers at UNC-Charlotte. The benchmarking partners in this process were members of the FM organization, however, participation was also open to the general public. Participation in the survey was incentivized by offering a copy of the benchmarking report to all participants.

3.2 SURVEY DEVELOPMENT

FM ORGANIZATION CONTRIBUTIONS

The FM Organization was the most influential contributor to the development of this survey. The purpose of the survey was to update an existing Research Report on Facility O & M practices. The majority of the questions in this survey came from an established survey question bank tat was established in previous versions of the survey. A more recent attempt to update the survey in 2012 had resulted in low response rates and

survey abandonment leading to an incomplete data update. The goal with this survey was to produce a survey with a greater response rate and response completion, as well as a larger number of participants.

In addition to updating the existing data on facility O & M benchmarking, the FM organization also wanted to add new material to the survey based upon their identification of industry trends. A new section on security costs and practices was added to the 2017 survey to capture industry practices regarding facility security. A new section on technology was also added to capture practices regarding facility technology and staffing.

SME CONTRIBUTIONS

As the content from the previous survey was developed into the modern survey content it was repeatedly reviewed and modified according to commentary and input from twelve identified Subject Matter Experts (SMEs) who assisted in both survey content development and phrasing of questions. The Subject Matter Experts were selected by the FM organization to consult on the content in the O & M survey. They provided the industry expertise to ensure that the survey could be easily completed and employed a language familiar to the FM industry. Throughout the survey development process, the SMEs provided feedback on every question included in the Industry-Wide O & M survey in regard to content, wording, presentation order & appearance, screen appearance (for electronic comprehensive survey), and survey flow. Detailed notes and specifics regarding SME conversations and contributions can be found in Appendix D: SME Commentary and Appendix E: Survey Revisions & Changes. Feedback from the

SMEs was noted and incorporated into the survey content through email exchanges between the FM organization staff, SME's and the researchers. Some examples of SME contributions that had significant impacts on the development of the survey include:

- SMEs suggested that the survey request calendar data from the last completed fiscal year rather than a calendar year to facilitate greater response rates. SMEs suggested that Facility Managers will not always have the data analyzed or prepared based upon fiscal years (12/15/16)
- An SME suggested that the comprehensive O & M survey should use the term "Rentable Square Feet" when referring to Facility Interior Square Footage rather than the updated term "Plannable Area". This term was defined by IFMA originally in 1996 as the "Standard Practice for Building Floor Measurement" and was later updated into an ASTM standard in 2008 called "E1836-08: Building Floor Area Measurements for Facility Management," that multiple FM and building owner's organizations could use as a standard by which to compare buildings. This was primarily done to facilitate terms that could be used both by IFMA and BOMA. This term was used in the 2009 O & M report. The SME believed that the more familiar term from the 2009 survey would be more widely recognized by facility professionals than the recently termed "Plannable Area" as revised in 2016 under ASTM E18306-09M. Their definitions are effectively interchangeable.

SME FEEDBACK INCORPORATION PROCEDURES

A number of the SMEs submitted question by question commentary and suggestions. These questions were addressed by the researchers on an individual basis to ensure that their feedback was understood and addressed into the comprehensive survey. (See Appendix D: SME Commentary: See also Appendix E: Survey changes based on SME commentary).

RESEARCHER CONTRIBUTIONS

In addition to the content in the previous benchmarking report, additional content on organizational structure, agility, customer satisfaction use, action strategies, performance modeling, security costs and staffing, and technology were added to the survey based upon reviews of FM research literature. The use of cost range intervals using the mid-point method was also introduced by the researchers (He & Hu, 2009).

PILOT SURVEY ADMINISTRATION

The pilot survey was developed in cooperation with twelve Subject Matter Experts (SMEs) over a three-month period for the purpose of administering the survey at a major FM conference in October 2016 (See Appendix B: Pilot Survey). The survey consisted of four primary sections printed double-sided on a single sheet of heavy stock lime green paper. It was distributed to participants at a luncheon workshop at a conference for facility managers in October of 2016. Ten surveys were provided to each table at the luncheon along with pencils to complete the survey. Additional surveys and

pencils were provided at overflow seating and at the back of the room. Respondents were asked to simply leave their surveys on the table and at the end of the luncheon, the surveys were collected by research staff.

The first section of the survey collected selected demographics and background information (of the respondent and the buildings they manage), including their role / job title, the number of buildings they manage, level of education, and number of years of professional experience. The respondents were then asked to answer questions about the largest and most active building they manage. The second section asked the respondents to provide the estimated annual cost of janitorial services for their most active building as well as their overall satisfaction on a 1-5 scale (1 = Very dissatisfied to 5 = Very satisfied). Similarly, the third section asked about the respondents' estimated annual utility cost for their most active facility as well as their satisfaction with their organization's energy management / conservation efforts. The final section asked about the respondents' estimated annual maintenance cost and how that cost was allocated to various categories of maintenance tasks (preventive, reactive, or predictive). This survey was analyzed, and the data used to help refine cost range parameters for the comprehensive industry survey to follow.

REFINEMENT

Results from the snapshot survey provided estimates of the range of costs experienced in janitorial, maintenance, and utility functions of facility management. These values were analyzed and compared to previous data to construct cost range

intervals that would result in an approximately normal distribution of frequency responses.

CONSIDERATIONS FOR USING RANGES IN THE INDUSTRY-WIDE O & M SURVEY

While the FM organization's O&M benchmarking study has historically collected a substantial amount of data, the number and quality of responses was likely being hampered by the large volume of specific data being requested from the respondents. An analysis of the abandoned sample data from the 2012 O&M Survey revealed the following:

- Only 44% of the respondents who started the survey actually provided cost data for all three major cost areas (janitorial, utilities, and maintenance).
- Fewer responses were received towards the end of the survey (janitorial: 65% responded, utility: 50% responded, maintenance: 45% responded).The response rate dropped off as the survey progressed through these blocks of questions.
- From those that actually responded, 39% of the respondents appeared to round their cost numbers to the nearest $1K (10% of these rounded to nearest $10K). Janitorial had the highest frequency of rounded values, with 55% of the responses rounded to the nearest $1K (23% rounded to the near $10K or $100K level).

DEVELOPMENT OF RANGE INTERVALS

The researchers proposed an additional alternative option where respondents selected from a "range" of values (as opposed to entering a specific number). For

example, if the user opted to use the “range” survey format, they would be presented with the six options shown below for the question of, “What is the annual cost of external building maintenance?”:

- $0 - $50,000
- $50,001 - $100,000
- $100,001 - $250,000
- $250,001 - $750,000
- $750,001 - $1,500,000
- More than $1,500,000

RANGE INTERVAL MIDPOINT CALCULATIONS

The next step in the process was to calculate the midpoints for each range and assume that this resultant number was the respondent’s actual cost of external building maintenance. For instance, a midpoint of the range of “$50,001 - $100,000” would be $75,000.50 [($50,001 + $100,000) / 2 = $75,000.50). The underlying assumption is that the ranges offered are based on the normal expected values for each cost category, based on the historical O&M cost data. The “midpoint” approach assumes that the respondents are close to the middle of each range. Table 2 below shows a sample of 6 responses and how an average cost of external building maintenance was calculated.

Table 2. Example Mixed Responses to, “What is the annual cost of external building maintenance?”

Respondent	**Selected Answer**	**Calculated Midpoint**
Respondent 1	$50,001 - $100,000	$75,000.50
Respondent 2	$50,001 - $100,000	$75,000.50
Respondent 3	$250,001 - $750,000	$500,000.50
Respondent 4	$100,001 - $250,000	$175,000.50
Respondent 5	$250,001 - $500,000	$375,000.50
Respondent 6	$342,393 [chose to enter specific value]	$342,393
AVERAGE COST OF EXTERNAL BUILDING MAINTENANCE		***$257,065.92***

The use of ranges and subsequently asking fewer questions (for those who choose the “range” route) was selected for providing the greatest chance of increasing overall response rate. However, this comes at a cost of having potentially less accurate data; the midpoint value is simply an average of each range. This risk was mitigated by providing range choices based on historical trends and typical cost responses from past surveys. The range approach will be sufficient to communicate a magnitude of order along various O&M metrics and has been shown to have an equivalent validity in analysis of data (He & Hu, 2009).

RANGE INTERVALS DEVELOPED WITHOUT PILOT SURVEY DATA

There were a number of cost subcategories that were not included on the pilot survey for which range intervals had to be created. These costs categories included:

- External Building Maintenance Costs
- Interior Systems Maintenance Costs
- Roads & Grounds Maintenance Costs
- Utility & Central System Maintenance Costs
- Process Treatment/Environmental Systems Costs

The raw data from previous benchmarking reports was not available to the researchers, so the available data from the older 2009 report had to be analyzed to create survey choice options for all of the cost subcategories addressed in the comprehensive 2017 O & M Report. The Data available in these reports was in the form of Tables presenting the Costs/RSF in a percentile ranking from 1-100, which made exact recreation of the data impossible. The building RSF was also presented in a similar percentile ranking table. See Table 3: Previous Report RSF Percentiles..

In order to create the range intervals to use in the Industry-Wide O & M Survey, the size and costs/RSF ranking tables were multiplied to generate a range of possible costs. The Table on Facility Rentable Area was multiplied by the values on the data table for each of the subcategories of maintenance costs. See Table 4: Previous Report Costs * RSF Percentiles.

Table 3: Previous Report RSF Percentiles

Facility Rentable Area	
Percentile	**Area (sf)**
99	3911117
95	1199596
90	722457
75	350000
50	128,050
25	43,501
10	11458
5	5665
1	1982

Table 4: Previous Report Costs * RSF Percentiles

External Building Maintenance Costs multiplied by Facility Rentable Area										
	Percentile	**$/RSF**	**99th%**	**95th %**	**90th%**	**75th%**	**50th%**	**25th%**	**10th%**	**5th%**
	99	2.76	10794682.92	3310885	1993981.3	966000	353418	120062.8	31624.08	15635.4
	95	1.11	4341339.87	1331551.6	801927.27	388500	142135.5	48286.11	12718.38	6288.15
	90	0.59	2307559.03	707761.64	426249.63	206500	75549.5	25665.59	6760.22	3342.35
	75	0.22	860445.74	263911.12	158940.54	77000	28171	9570.22	2520.76	1246.3
Median	50	0.1	391111.7	119959.6	72245.7	35000	12805	4350.1	1145.8	566.5
	25	0.04	156444.68	47983.84	28898.28	14000	5122	1740.04	458.32	226.6
	10	0.03	117333.51	35987.88	21673.71	10500	3841.5	1305.03	343.74	169.95
	5	0.02	78222.34	23991.92	14449.14	7000	2561	870.02	229.16	113.3
	1	0.01	39111.17	11995.96	7224.57	3500	1280.5	435.01	114.58	56.65

The values generated by this process were then sorted in an ascending order and grouped into intervals such that the estimated frequency of responses per interval would approximate a normal distribution of costs. See Figure 5: Previous Report Data: Example Creation of Range Values.

External Building Maintenance		
435.01	0-2500	
870.02		
1280.5		
1305.03		
1740.04		
2561	2500-7500	
3500		
3841.5		
4350.1		
5122		
7000		
7224.57		
9570.22	7500-15000	
10500		
12805		
14000		
14449.1		
21673.7	15,000-50,000	
25665.6		
28171		
28898.3		
35000		
48286.1		
72245.7	50,000-150,000	
75549.5		
77000		
120063		
142136		
158941	150,000-500,000	
206500		
353418		
388500		
426250	500,000-1,000,000	
801927		
966000		
1993981	>1,000,000	

Figure 5: Previous Report Data: Example Creation of Range Values

The researchers utilized the cost feedback from the pilot survey to create cost range values for use in the Industry-Wide O & M survey and continued to solicit feedback from the FM organization and 12 SMEs on the development of the industry-wide survey over a seven-month period from August 2016 through January of 2017.

The survey was originally developed in MS Word and was later transferred to the Qualtrics platform for online deployment. The Industry-Wide O & M survey was refined on the Qualtrics platform through further feedback from organizational staff and SMEs. After gathering this feedback, the revised pilot version of the Industry-Wide O & M survey was run live for 46 SMEs and FM organizational participants as the final test run of the survey. The survey was further revised based upon this test run and was prepared for deployment.

TESTING OF INDUSTRY-WIDE O & M SURVEY (ONLINE)

The Industry-Wide O & M survey was tested with SMEs and volunteer facility managers prior to the release of the survey to the public on February 13th, 2017. Feedback gathered during this period included testing the Qualtrics based online questions for logic, presentation, and errors. The Survey Questions were piloted and tested with the SMEs and volunteers for ensure language, style, etc. were appropriate with the audience and that the survey met the most comprehensive industry needs. SMEs and FM Organization staff were tasked with trying to crash the survey and intentionally making errors to check the survey for inconsistencies or other problematic behavior that could represent an impediment to completing the survey in its entirety. Some of the problems encountered and fixed during this stage of development included:

- Question order, presentation, and survey flow
- Identification of need to give participants a choice in how they could gather and input their cost information for the survey (SME Recommendation).

Previous surveys allowed users to also submit an excel file of their costs, allowing for completion of this section of the survey while not online.

The final form of the Qualtrics survey consisted of 134 questions, although not every participant was asked every question as the survey was developed for presentation logic that would eliminate unnecessary questions based upon responses to questions earlier in the survey (See Appendix C: Industry-Wide O & M Survey). This was done to avoid repetition and to facilitate a faster time to completion to combat survey fatigue. It was organized into the following sections (blocks): General information, contact name, facility description, janitorial, maintenance, maintenance plans, sustainability, utilities, energy management practices, security, technology, organizational, costs section introduction, costs-from-download management, costs-janitorial, costs-remaining janitorial, costs-maintenance, costs-utilities, and organizational culture (See Figure 6: Industry-Wide O & M Survey Flow). This survey required approximately 90 minutes for the average participant to complete. Respondents did not have to complete the survey in one sitting due to an IP address computer association tracked by the Qualtrics platform. Participants could complete the survey in sections as long as they utilized the same computer throughout the length of the survey. Figure 6 depicts the survey flow of question presentation.

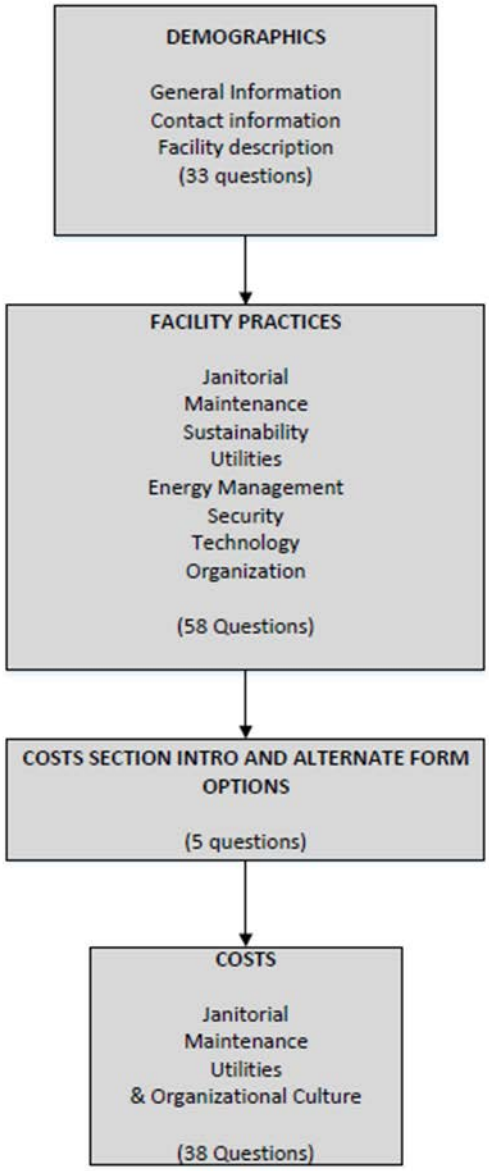


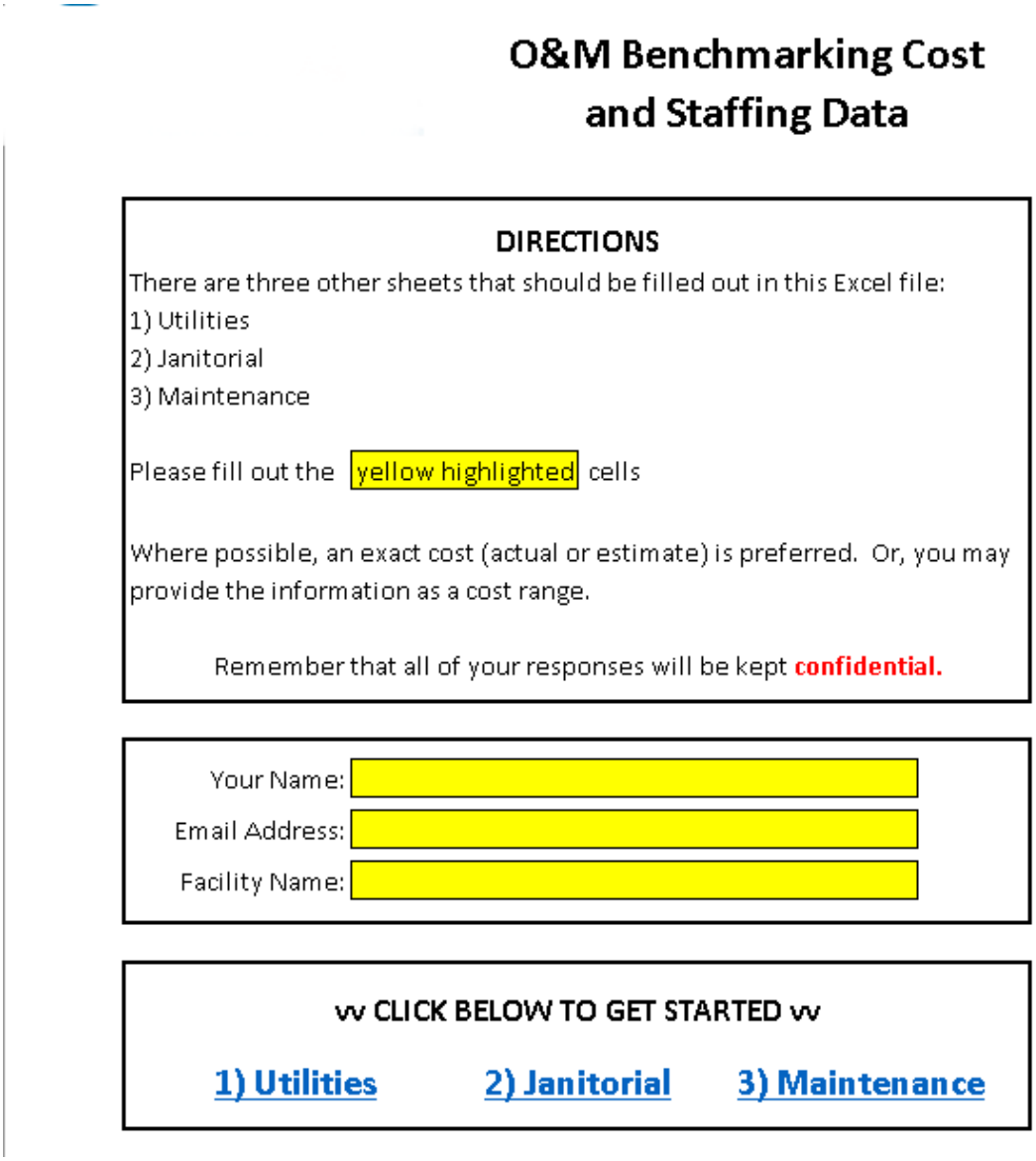
Figure 6: Industry-Wide O & M Survey Flow

The survey further offered a variety of formats for FM organizations to submit their costs to the Qualtrics site. Respondents were given a choice as to how they would

submit their costs; either directly into the Qualtrics survey or manually into a provided excel file that they could later manually upload to the Qualtrics site.

DEVELOPMENT OF MANUAL EXCEL COST FILE

An additional option of an excel file for providing data on specific facility costs was provided to participants during the completion of the online survey. SMEs identified the need for alternate options to provide cost information during the testing of the Industry-wide O & M survey, as it had been an option in earlier versions of the survey. Participants were given the option to download an Excel file for their cost information that they could later upload into the original survey. The intent of the Excel Cost File was to give participants more options for gathering the cost details they needed to complete the survey. An Excel file was created to gather this cost information for merging into the Master data set. See Figure 7: Front Page of Excel Cost File for a snapshot of the file and see Appendix F: Manual Excel Costs File for screenshots of the complete excel file.



O&M Benchmarking Cost and Staffing Data

DIRECTIONS

There are three other sheets that should be filled out in this Excel file:
1) Utilities
2) Janitorial
3) Maintenance

Please fill out the yellow highlighted cells

Where possible, an exact cost (actual or estimate) is preferred. Or, you may provide the information as a cost range.

Remember that all of your responses will be kept **confidential.**

Your Name:
Email Address:
Facility Name:

vv CLICK BELOW TO GET STARTED vv

1) Utilities 2) Janitorial 3) Maintenance

Figure 7: Front Page of Excel Cost File

3.3 DATA COLLECTION

DEPLOYMENT OF INDUSTRY-WIDE O & M SURVEY

The surveys were administered to IFMA members & the public through the Qualtrics survey service. Respondents were invited to participate through emails blasts and links to the online survey. The survey was open for a period of three months from February 13th, 2017 until April 19th, and reminders were sent out weekly throughout the period to continue to invite and/or remind people to participate. The originally scheduled ending data was for March 31st, but the window to complete the survey was extended by the FM organization to facilitate a greater number of responses. Members were incentivized to participate in the survey by offering access to the results of the O & M Benchmarking Report. See Figure 8: Email invitations to participate in survey

Dear Participant.

We are conducting a national benchmarking study on facility Operations & Maintenance and your participation is earnestly requested. The survey is easy to fill out and will be useful to the entire profession. Anyone who completes the full survey will receive a free copy of the FM Organization's new O & M Benchmarking Report.

Please browse to www.fmorganization.org/omsurvey to complete the survey.

Your responses will be kept confidential.

Please contact me if you have any questions.

Regards

John Hancock

Manager Benchmarking & Analytics

John.hancock@FM.org

+1-555-555-1234

Figure 8: Email invitation to participate in survey

DEVELOPMENT OF MULTI-FACILITY COST FILE

During the course of deployment, an additional need for collecting data was identified. The industry survey being deployed was asking participants to report on their largest facility for the purposes of identifying facility specific details for proper “apples to apples” comparisons of benchmarking data. Several members of the FM organization had data on numerous buildings that they wanted to contribute. A Multi-facility Excel file was created to provide participants with a means to voluntarily contribute the facility costs and other information to the benchmarking data set. See Figure 9: Multi-facility Excel File Screenshot and Appendix G: Multi-Facility Costs File.

Multi-Facility Spreadsheet

General Information							Utility costs		
Facility Name or Identifier	Year built	Exterior Gross Area	Rentable Gross Area	Primary Use of facility	zip or postal code of facility	Facility Setting	Are Utility - Water and Sewage costs combined	Main grid cost	Main g consump (kwH
				Assembly Building			Yes		

Figure 9: Multi-Facility Excel File Screenshot

Prior to the closing of the surveys in mid-May, reminders were sent out to inform potential participants that the survey would be closing. The raw data was exported from the Qualtrics survey management platform as Excel files for data merging, cleansing, quality management, initial analysis, and production of the Industry-Wide O & M Benchmarking Research Report.

Once all the data had been collected from the various sources, it was then merged in a Master data file that combined all the sources of the data. See Figure 10: Data Merging Process.

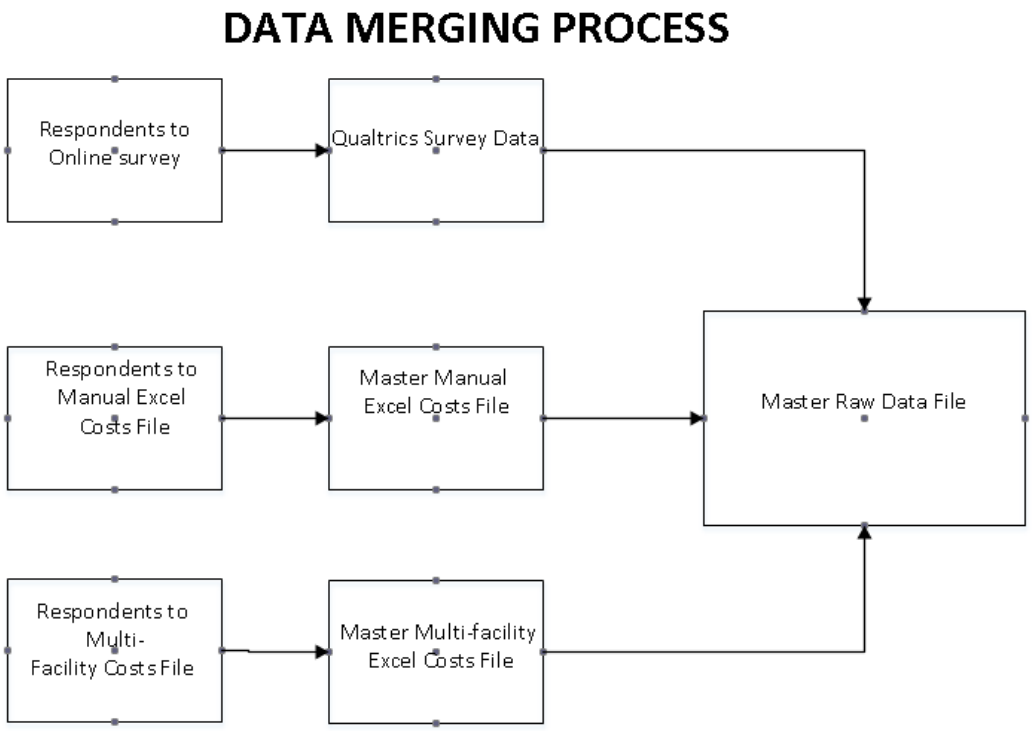


Figure 10: Data Merging Process

3.4 DATA CLEANSING AND QUALITY MANAGEMENT

The data was cleansed and managed for quality from Mid-May until August 2017. The raw data was initially examined and sorted to exclude survey attempts who did not provide content to participate or provided no facility data and abandoned the survey early.

The first phase of the data cleansing was merging the various forms in which the data had been collected into one MS Excel file. Respondents who chose to submit their costs to the survey in a MS Excel file had to be collected separately through the Qualtrics platform and they were merged into a Master Excel file for the purposed of transferring the data to the comprehensive survey data downloaded from Qualtrics. The Multi-facility Qualtrics survey data was also downloaded as an Excel file and was merged with the corresponding Excel Multi-Facility Costs Forms. These data points were then merged into the Master Excel file into the corresponding question columns.

An additional contribution to the data came from an organization providing an excel file on over 800 buildings managed by the federal government. The data from this file was also added to the benchmarking database primarily on the form of facility demographics and characteristics and operating costs.

The second phase of cleansing & quality management consisted of checking he combined MS Excel data file of respondents' surveys for errors, typos, and logical inconsistencies to ensure the quality of the self-report data. Survey responses that contained unusual data were marked for the purposes of following up and verifying the content of their responses. Respondents with data that needed to be clarified or confirmed

were contacted first through email and asked to verify the data points that were in question. Respondents that failed to confirm the accuracy of their data through email were then contacted via telephone for confirmation of their responses. Data that were confirmed were included in the analysis of the survey and data that were not confirmed by the respondents were sequestered and excluded from the analysis to ensure the accuracy of the data for the report.

Some of the common cleaning issues with the data that could be easily identified and corrected without follow-up included:

- Use of letter abbreviations for numbers reported in the costs sections:
    - "1 M" had to be changed to 1,000,000
    - "6 million had to be changed to 6,000,000"
    - Reported Acres had to be converted to Square Feet and vice-versa depending upon the measure asked for in the question
- Other assortments of strings representing numbers that had to be changed into numerical format for analysis

Some of the common mistakes caught during this process that had to be followed up through email and phone calls with the respondents included:

- Reporting a Rentable Area larger than the reported Exterior Gross Area
- Misunderstanding of the term "Rentable Square Feet or Rentable Area"
- Large differences (>40%) between the Rentable Area and Exterior Gross Area.

- Incomplete or missing data such as Rentable Square Feet and Gross Area. Both costs and floor area are needed to compute the vast majority of cost metrics in the report.
- Reporting of “No Costs” for a particular section
- Reporting of extreme outliers in costs, employees, or space

There appeared to be some regularly occurring confusion over the term “Rentable Square Feet” in the survey. Though this term has been used by the FM organizations for years and refers to an ASTM standard that allows proper comparison across both IFMA and BOMA standards, it was clear that not all participants were familiar with the term. The ASTM E1836 standard was updated in 2016 to use the term “plannable area” rather than “Rentable Square Feet”. When asked to report their Rentable Square Feet, several respondents indicated that they either didn’t rent their space out, reported 0 SF or that they were leasing space, suggesting a misunderstanding of the term despite it being defined within the survey. Follow up calls with the participants further corroborated that not all participants readily used the term or were familiar with its definition.

CHAPTER 4: DATA ANALYSIS

INTRODUCTION

A fundamental goal of this research was to explore the knowledge gap between facility management benchmarking and performance management. More specifically, to analyze the relationship between the use of satisfaction measures and facility performance in the terms of maintenance costs/sf. Additionally, the relationship between various approaches to the use of benchmarking data and their effect on facility performance in terms of costs/sf will also be analyzed.

PILOT SURVEY

The pilot survey was used to provide information on the type of data that would be collected for the industry-wide O & M survey and the range of costs that could be anticipated for creating range intervals for use in the industry-wide O & M survey as well. The completed surveys (n = 285) were manually entered into MS Excel by research staff, providing a response rate of about 24 percent. The analysis for the pilot survey was conducted in Microsoft Excel and consisted of descriptive statistics and frequencies.

INDUSTRY-WIDE O & M SURVEY

A total of 2,368 surveys were downloaded from the Qualtrics Management Platform. Data from the Manual Excel Cost File and Multi-facility costs file were merged

with the Qualtrics data into an excel file that was coded for the variables from the survey as well as the source of the data. These files were alternative methods for collecting costs data that were provided to the respondents of the survey based upon individual needs and preferences in how the organizations reported their data.

The industry Wide O & M survey was prepared for analysis of customer satisfaction and benchmarking plans by further screening the data for surveys that contained relevant content for the analysis. Surveys which did not provide information on these topics were excluded from inclusion and analysis, while incomplete surveys were excluded from this portion of the analysis. The data in this analysis were also filtered for U.S data only and to exclude data which had previously been marked as outliers or unverified data. A total of 1,565 surveys met these criteria and were used for the thesis topic analysis. This data was transferred into SPSS for analysis.

RESEARCH OBJECTIVE 1

The measures to achieve Research Objective 1 are included throughout this section of the thesis. In addition to the descriptive statistics covered in this section, additional measures for this objective can be seen in the Results Section: Correlation Analyses. Linear relationships among the following variables were tested: facility size, facility size category, maintenance costs/SF, and satisfaction survey frequency.

RESEARCH OBJECTIVES 2 & 3

INDEPENDENT VARIABLES

The independent variables for this thesis were customer/occupant satisfaction and benchmarking plans.

CUSTOMER/OCCUPANT SATISFACTION SURVEY FREQUENCY

The data for this variable originates from 2 questions included in the industry-wide O & M benchmarking survey (See Appendix A: Independent Variable Survey Questions).

This question was analyzed for content. Respondent's direct answers to this question revealed a high percentage of respondents (N =141) selecting the "Other" response and providing a frequency of use that was not included in the main answers of the survey (See Figure 11: Frequency of Satisfaction Survey Use: Raw Data). In order to increase the effectiveness of the available data in this question, the answers to the Other Category were reviewed and recoded into quantifiable categories of frequencies. Some answers had to be excluded because the respondents did not provide an answer that could be quantified into an annual frequency rate. For example, a number of respondents indicated an informal use of customer/occupant satisfaction that relied upon more qualitative data as obtained through meetings and direct contact with staff.

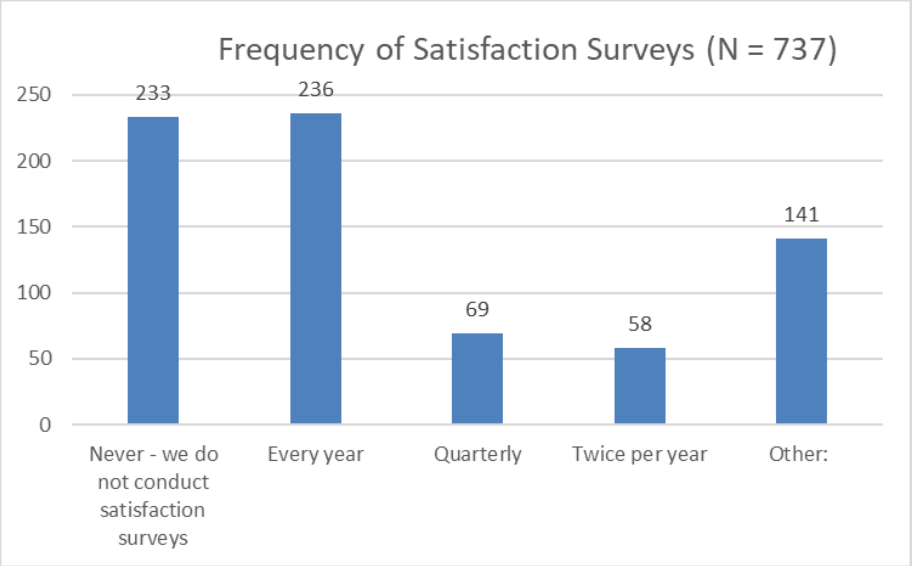


Figure 11: Frequency of Satisfaction Survey Use: Raw Data

The following represent the categories of frequencies that were established from recoding the “other” category from the original question. They are represented in times per year (tpy)

- Never = 0
- Every 5 years = 0.20 tpy
- Every 3-4 years = 0.29 tpy
- Every 3 years = 0.33 tpy
- Every 2 years = .5 tpy
- Every year = 1 tpy
- Twice per year = 2 tpy
- Quarterly = 4 tpy
- Bi-monthly = 6 tpy
- Monthly = 12 tpy
- After every work order, daily, continuous = 365+ tpy
-

Figure 12 lists the frequencies of responses after the data was recoded to include responses to the “other” category that could be quantified into categories.

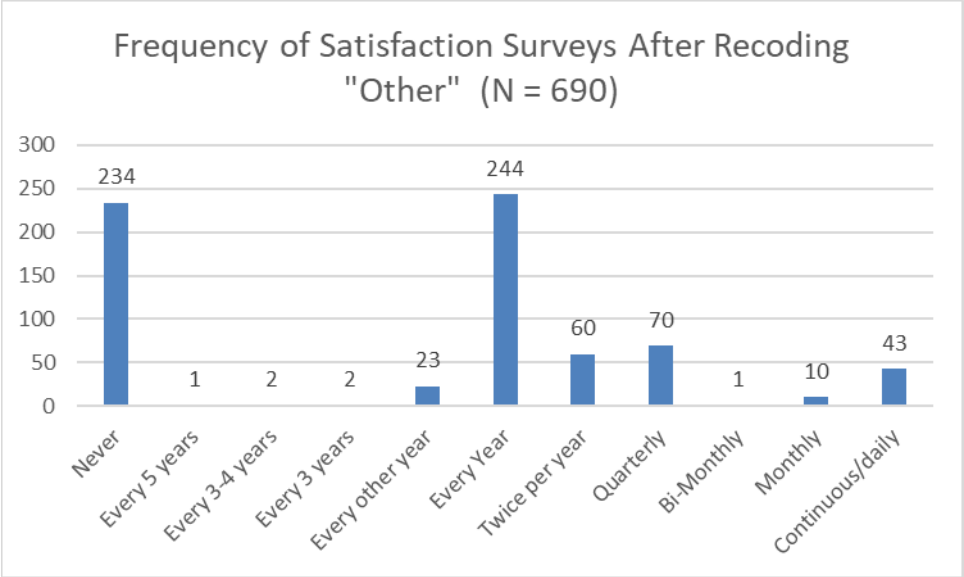


Figure 12: Frequency of Satisfaction Survey Use (Other Category Integrated)

SATISFACTION SURVEY USE

The data from this question was also recoded to examine whether there were differences in those who use customer satisfaction surveys vs. those who don't. Those who responded to the question with the choice of "Never" were coded into a "No" category. All other responses of varying frequencies were coded into a "Yes" category. The purpose of this recoding was to compare differences between those who use satisfaction surveys and those who don't. See Figure 13: Satisfaction Survey Use

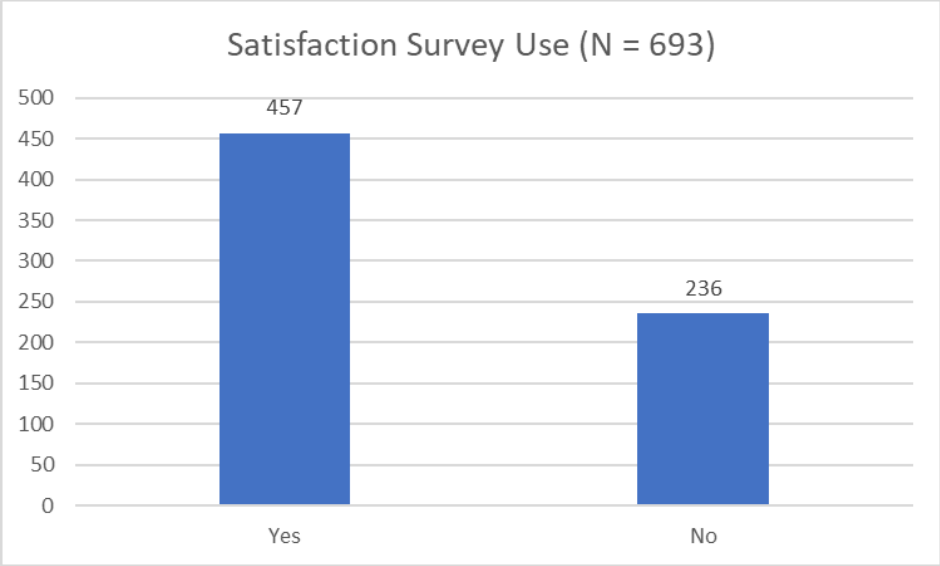


Figure 13: Satisfaction Survey Use

SATISFACTION ACTION PLANS

The specific industry-wide O & M survey question that provided that data for this subject can be found in Appendix A: Independent Variable Survey Questions. This question was the only open-ended question on the questionnaire. Respondents tended to provide very brief answers that primarily consisted of statements reflecting some sort of action plan or follow-up based upon the results of the survey. Some examples of responses to this question include:

- “Depends-We have union contracts-Each action would be implemented as appropriate”
- “We do follow-up for corrective actions”
- “Assign corrective implementation to managers and supervisors”
- “Develop action plans”
- “Analyze responses and plan corrective actions based on the negative issues identified in our survey”
- “training”
- “Surveys are reviewed and action plans are discussed with management staff”
- “If deficiencies are identified, they are reviewed for feasibility and/or funding support”

- “Action plan follow-ups-Closure of major customer concerns”

As a result of the variability and complexity of the responses to this question, it was determined that a proper analysis of the responses was beyond the scope of this thesis. The nature of the responses may be indicative of the complex nature of customer satisfaction use in managing facilities and warrants the attention to detail and follow-up interviews that should be conducted to properly understand how the customer satisfaction surveys are utilized to manage quality of operations in facilities. Software such as N-Vivo may provide a good means of shedding light on the classification and organization of these responses and will be addressed in follow-up research to this thesis.

BENCHMARKING ACTION PLANS

The specific survey question that provides the data for this variable can be found in Appendix A: Independent Variable Survey Questions. The responses to the benchmarking plans can be seen in Figure 14: Responses to Benchmarking Action Plans.

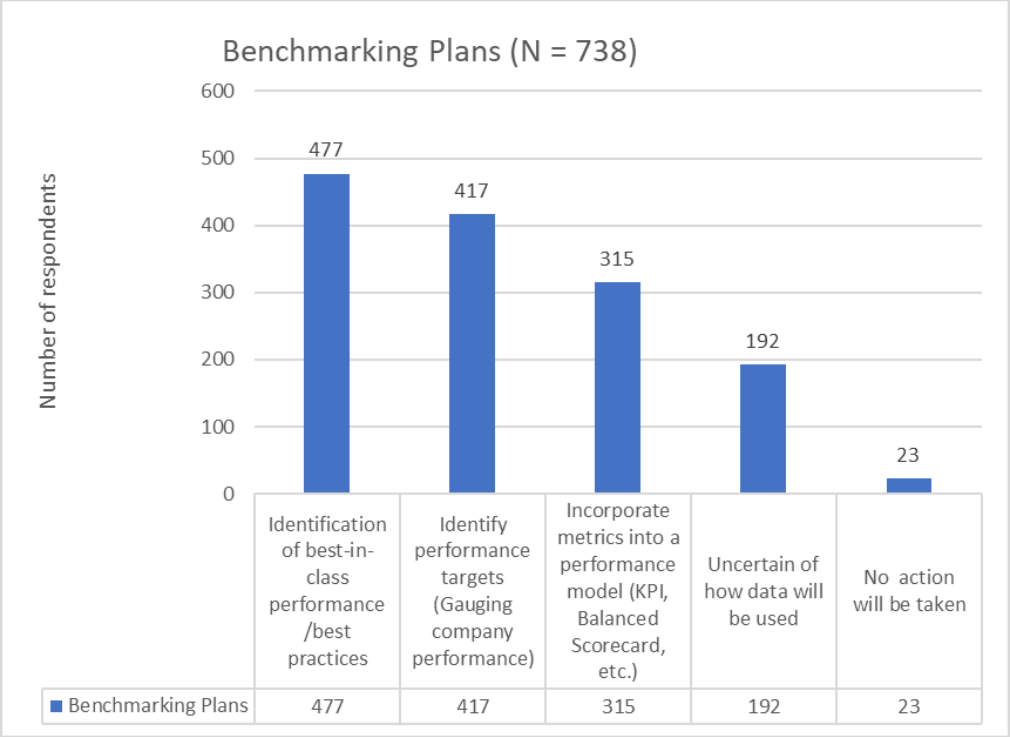


Figure 14: Benchmarking Plans

DEPENDENT VARIABLE

The dependent variable chosen for this thesis is Facility Maintenance Costs/SF. Though other categories of facility costs were part of the Industry-wide benchmarking survey, the scope of this project had to be carefully managed and the maintenance costs/sf were chosen as being the most pertinent to the analysis and topic of the thesis. Maintenance Costs/SF were calculated using the respondents reported total maintenance costs and dividing them by the facility's reported RSF. These costs were screened to exclude any respondents who reported a $0.00 maintenance costs value. See Table 5: Industry-Wide O & M Survey Maintenance Costs/RSF.

Table 5: Industry-Wide O & M Survey Maintenance Costs/RSF

N	1378
Range	$57.03
Minimum	$0.01
Maximum	$57.03
Mean	$3.37
Std. Error	$0.12
Std. Deviation	$4.39
Variance	19.25
Skewness	
Statistic	5.49
Std. Error	0.07
Kurtosis	
Statistic	45.06
Std. Error	0.13

Due to the high (>2) skewness and kurtosis values of the dependent variable, maintenance costs/sf, an exploratory analysis of the data was undertaken in an effort to identify factors in the variance of the variable that could potentially interfere with or mask trends in the analysis of the data and hypotheses testing. Since the distribution of the dependent variable does not approximate normal, non-parametric inferential statistics will be used to draw appropriate conclusions from the data.

GROUPING & COANALYSIS VARIABLES

Two variables, type of space reported on, and facility size (RSF) were also included in the analysis of the data. These variables were included to examine the role that these variables may play in making meaningful comparisons across a diverse group of facilities. An early preliminary analysis of the data suggested that these variables have a significant effect on the independent variable of satisfaction survey frequency and the dependent variable of maintenance costs/RSF. Figure 15: Type of Space Reported On, shows the frequency of space type in the survey.

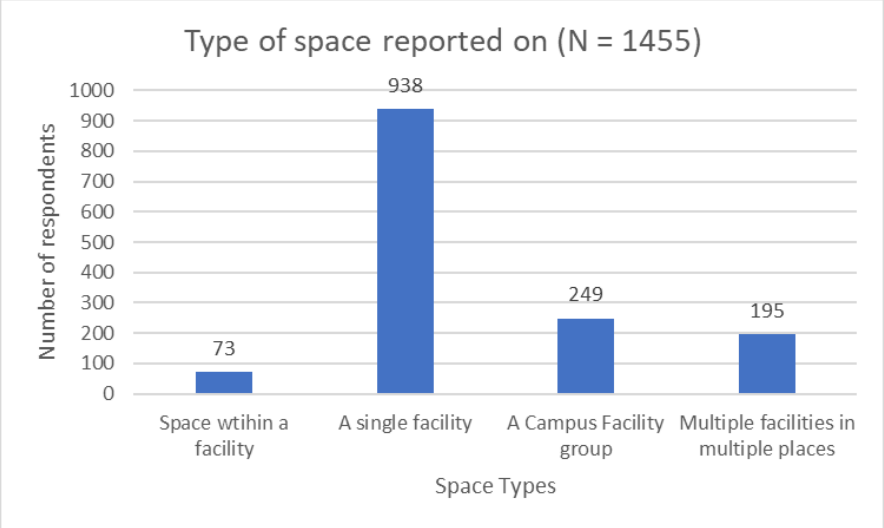


Figure 15: O & M Survey: Type of Space Reported On

Table 6: Industry-Wide O & M Survey Facility Size (RSF) lists the descriptive statistics describing the spread of the RSF across industries in the survey. Figure 16: Building Size Category Distribution demonstrates the distribution of the RSF scores when compared using size categories.

Table 6: Industry-Wide O & M Survey Facility Size (RSF)

N	1481
Range	4,998,000 SF
Minimum	2000 SF
Maximum	5,000,000 SF
Mean	322,224.11 SF
Std. Error	13,792. 08 SF
Std. Deviation	530,771 SF
Variance	281,700,000,000,000 SF
Skewness	
Statistic	3.93
Std. Error	0.064
Kurtosis	
Statistic	20.615
Std. Error	0.127

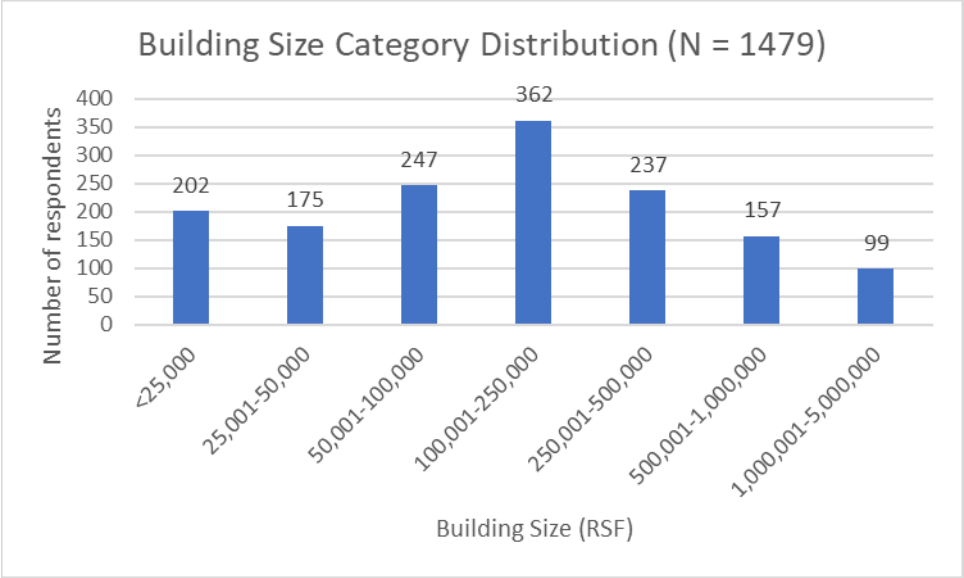


Figure 16: O & M Survey: Building Size Category Distribution

HYPOTHESES

This section will review the hypotheses for this study. A total of six hypotheses were developed to examine the effect of the Independent Variables of customer satisfaction and benchmarking plans on the dependent variable of maintenance costs/RSF. The covariables of facility size and type of space were also examined to determine their effects on the independent and dependent variables. See Figure 17: Hypotheses and Research Variables. A total of six hypotheses were developed and are grouped into two major groups representing the independent variables and Research Objectives discussed in Chapter 1.

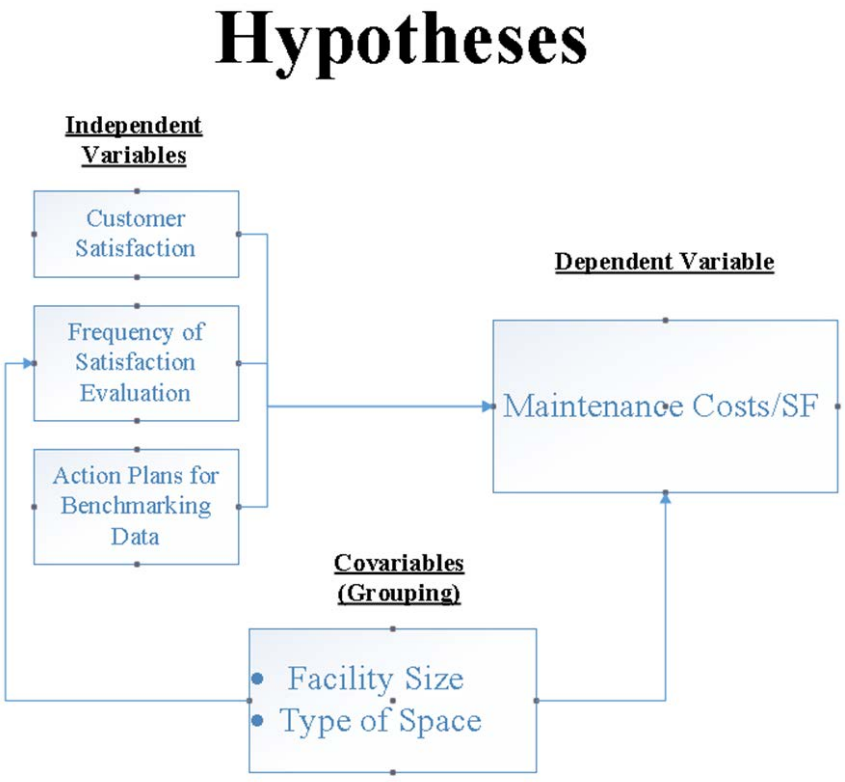


Figure 17: Hypotheses and Research Variables

CUSTOMER/OCCUPANT SATISFACTION AND PERFORMANCE MANAGEMENT

HYPOTHESIS 1: The use of satisfaction surveys will have an impact on maintenance costs/sf. A two-tail t-test was used to assess this hypothesis.

H1: $\mu 1-\mu 2 \neq 0$: Ho1: $\mu 1-\mu 2 = 0$

HYPOTHESIS 2: The frequency of use of satisfaction surveys will have an impact on the maintenance costs/sf. This hypothesis was tested using an ANOVA and post-hoc t-tests.

H2: Means are not equal: Ho2: $\mu 1=\mu 2=\mu 3=\mu 4=\mu 5=\mu 6=\mu 7=\mu 8=\mu 9=\mu 10$

HYPOTHESIS 3: The size of the facilities will affect frequency of satisfaction survey use. This hypothesis was tested using an ANOVA and post-hoc t-tests.

H3: Means are not equal: Ho3: $\mu 1=\mu 2=\mu 3=\mu 4=\mu 5=\mu 6=\mu 7=\mu 8=\mu 9=\mu 10$

BENCHMARKING PLANS AND PERFORMANCE MANAGEMENT

HYPOTHESIS 4: Those who are uncertain of how to utilize the benchmarking data will have higher maintenance costs/sf than their counterparts. A two-tail t-test was used to assess this hypothesis.

H4: $\mu 1-\mu 2 \neq 0$: Ho4: $\mu 1-\mu 2 = 0$

HYPOTHESIS 5: Those who do not intend to take action on the benchmarking data will have differing maintenance costs/sf than their counterparts. A two-tail t-test was used to assess this hypothesis.

H5: $\mu 1-\mu 2 \neq 0$: Ho5: $\mu 1-\mu 2 = 0$

HYPOTHESIS 6: Other Benchmarking Plans will not have an effect on maintenance costs/sf. A two-tail t-test was used to assess this hypothesis.

H6: $\mu 1-\mu 2 \neq 0$: Ho6: $\mu 1-\mu 2 = 0$

CHAPTER 5: RESULTS

This section will present the results from the analyses discussed in the previous section. First the results from the Pilot Survey will be reviewed. This will be followed by the results from the Industry-Wide O & M survey pertaining to the three research objectives and hypotheses testing.

PILOT SURVEY RESULTS

Respondents to the pilot survey administered at an FM conference survey reported on facilities dispersed throughout the continental United States. 81 percent of the respondents identified as a "Facility Manager", 15 percent identified as a "Services Provider", and the remaining 4 percent identified as "Other". 37 percent of the respondents reported having obtained a Bachelor's degree and 33 reported having obtained a Master's degree. Approximately 24 percent reported having obtained an Associate's degree or some college education, and the remaining respondents reported being either high school graduates or having obtained a PhD. On average, the respondents reported that they manage about 54 buildings (*SD* = 135 buildings). Most of the respondents (93 percent) were located in the United States (See Figure 18: Pilot Survey Respondent Location). Other countries of respondents include Canada, South Africa, Malaysia, Hong Kong, and Australia.

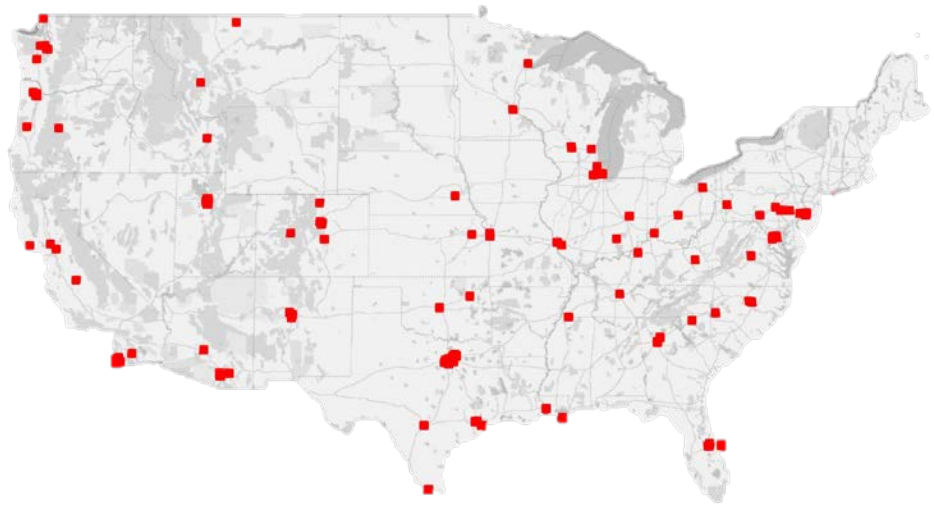


Figure 18: Pilot Survey Respondent Location

Figures 19 & 20 present the respondents educational and primary roles as reported in the pilot survey. Figures 21-23 present the facility cost category frequencies of janitorial, maintenance, and utility costs.

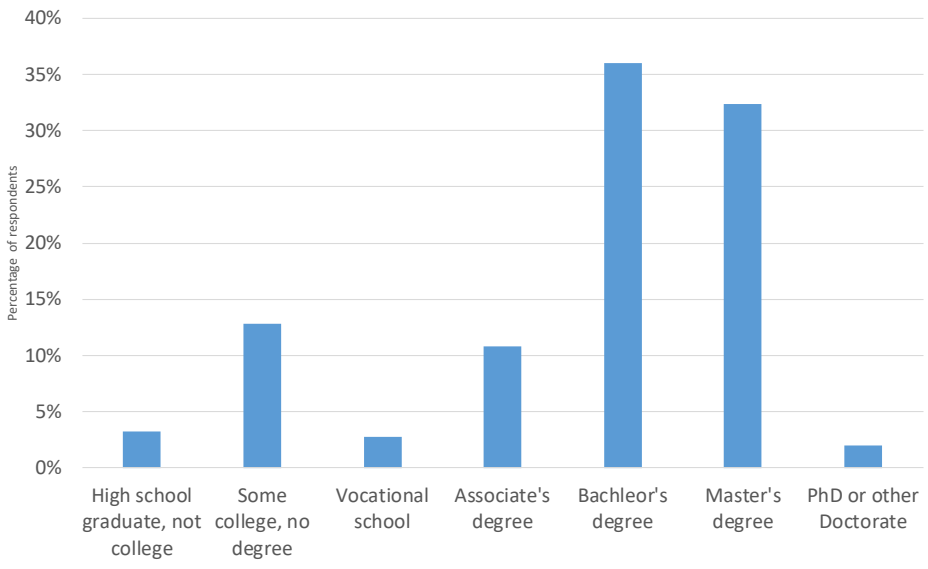


Figure 19: Pilot Survey: Respondent's Highest Level of Educational Attainment

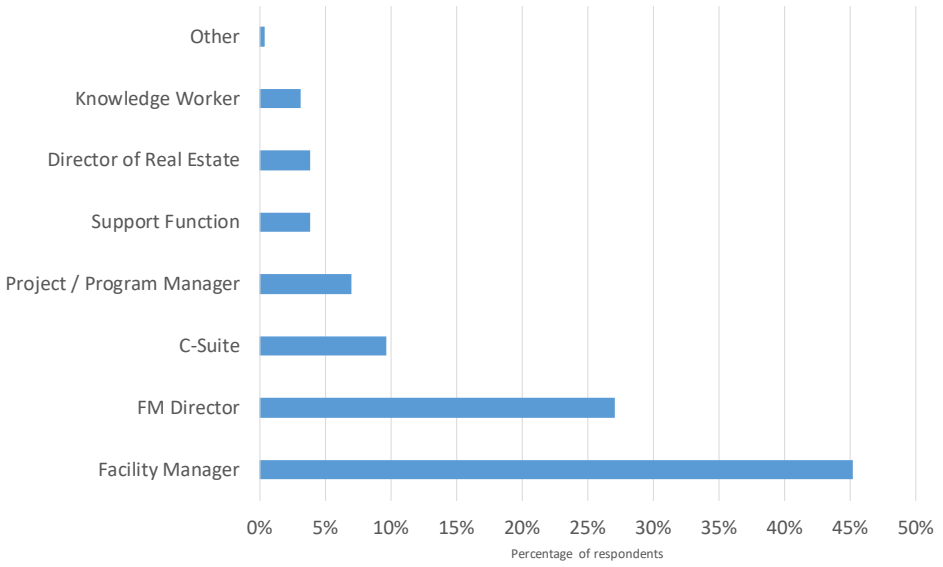


Figure 20: Pilot Survey: Respondent's Primary Role / Job Title

COSTS

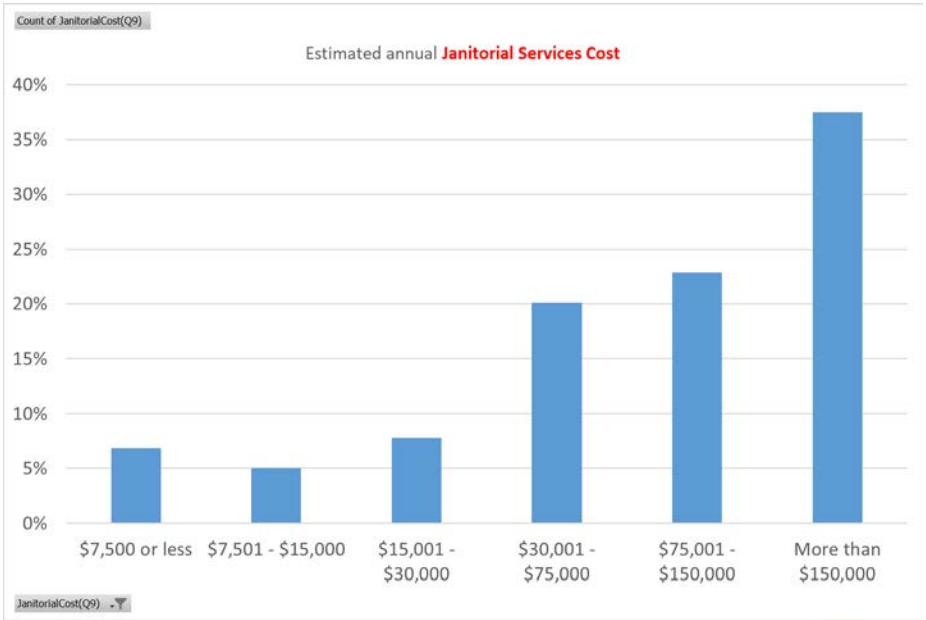


Figure 21: Pilot Survey Janitorial Costs

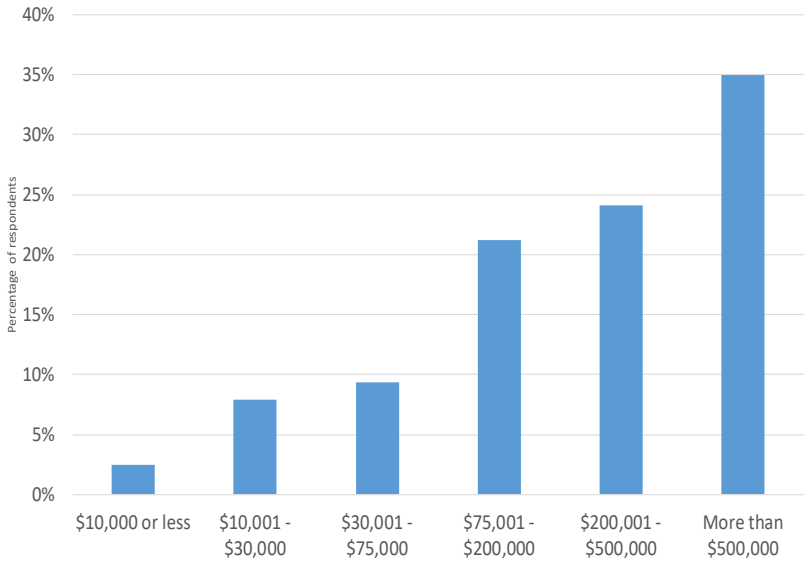


Figure 22: Pilot Survey Utility Costs

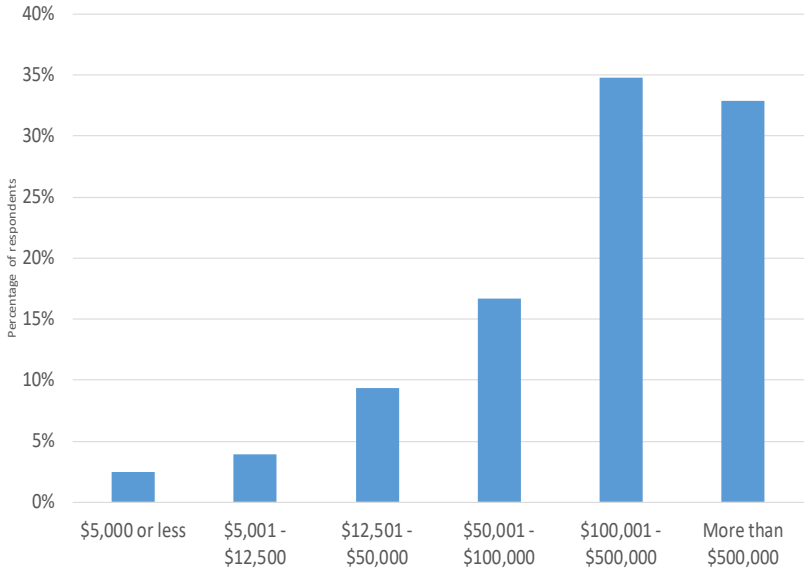


Figure 23: Pilot Survey Maintenance Costs

SATISFACTION

Figures 24 & 25 present the frequencies of responses to satisfaction with janitorial and energy management efforts. Figure 26 presents the average percentage of maintenance expense allocation as reported in the pilot survey.

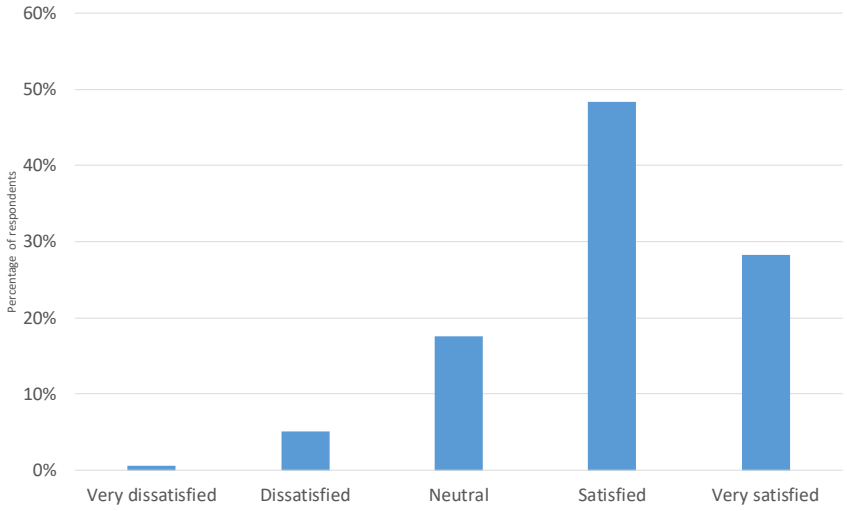


Figure 24: Pilot Survey Satisfaction with Janitorial Services

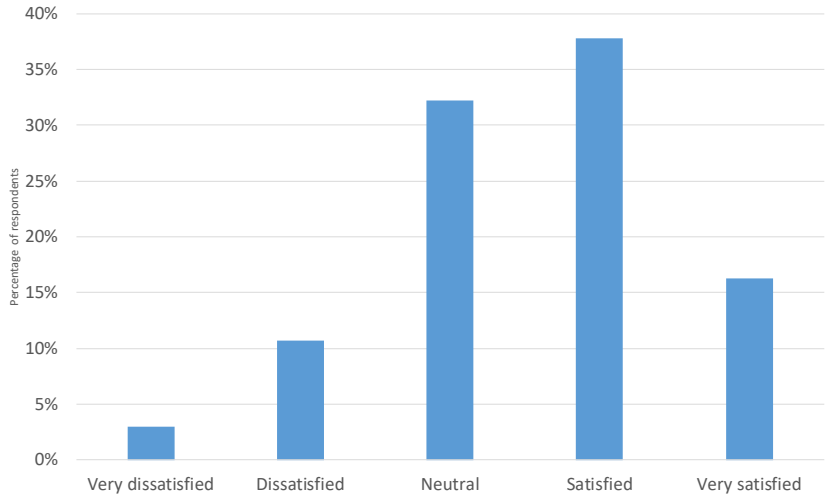


Figure 25: Pilot Survey Satisfaction with Energy Management Efforts

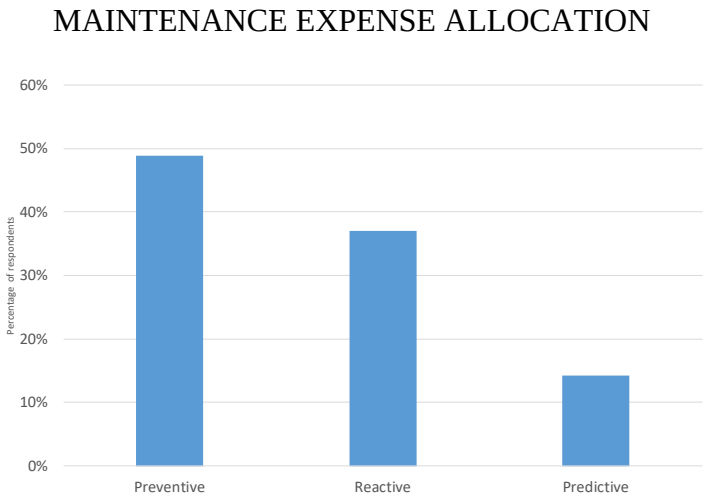


Figure 26: Pilot Survey Maintenance Expense Allocation

INDUSTRY-WIDE O & M SURVEY RESULTS

The following section presents the results from the Industry-Wide O & M survey and hypothesis testing for the six hypotheses of this study. Table 7: Spearman's rho Correlation Analyses of Research Variables presents the results from an initial exploration of linear trends among the research variables.

Table 7: Spearman's rho Correlation Analyses of Research Variables

Spearman's rho correlations	rho	P-value	Sample N
Satisfaction frequency and RSF	0.155	0.000	648
Satisfaction frequency and maintenance costs/SF	-0.02	0.639	648
Maintenance costs/sf and RSF	-0.07	0.013	1339

HYPOTHESIS TESTING: RESEARCH OBJECTIVE 2

SATISFACTION USE AND MAINTENANCE COSTS/SF

Ho1: $\mu 1 - \mu 2 = 0$; H1: $\mu 1 - \mu 2 \neq 0$

This section will present the results of hypothesis testing for hypotheses 1-3 pertaining to Research Objective 2. This includes analyses of satisfaction use (Table 8: Effect of Satisfaction Use on Maintenance Costs/RSF) and frequency (Table 9: Effect of Satisfaction Frequency on Maintenance Costs/RSF). This will be followed by an analysis of the effect of facility size on satisfaction frequency (Tables 10 & 11, Figures 27 & 28).

Table 8: Effect of Satisfaction Use on Maintenance Costs/SF

Effect of Satisfaction Use on Maintenance Costs/SF				
		N	Mean	St. Dev.
Use Satisfaction Surveys		351	$4.65	$5.33
Do Not Use Satisfaction Surveys		187	$4.29	$4.45
t=	0.788 df = 536	2 tailed P =	0.431	
Levene's Test for Equality of Variance	F = .019	P = .889		

The Levine's test for equality of variances between those who use satisfaction and those who don't did not indicate a significantly different amount of variance between the two groups, F = .019, p = .889, α=.05. The t-test did not indicate a significant difference in mean values between the two groups, t = .788, p = .431, α=.05. As a result, there was not sufficient evidence to reject the null hypothesis.

SATISFACTION FREQUENCYAND MAINTENANCE COSTS/SF

Ho2: μ1=μ2=μ3=μ4=μ5=μ6=μ7=μ8=μ9=μ10=μ11; H2: Means are not equal

Table 9: Effect of Satisfaction Frequency on Maintenance Costs/SF

Effect of Satisfaction Survey Frequency on Maintenance Costs/SF

ANOVA

	Sum of Squares	df	Mean Square	F	P
Between Groups	106.8	11	9.71	0.38	0.97
Within Groups	13504	524	25.77		
Total	13611	535			

An ANOVA was conducted to determine if the different frequencies of satisfaction survey use had an effect on maintenance costs/sf, F (11,524) = .377, p = .965, α=.05. As a result, there was not sufficient evidence to reject the null hypothesis.

SATISFACTION FREQUENCY AND FACILITY SIZE

H3: Means are not equal: Ho3: μ1=μ2=μ3=μ4=μ5=μ6=μ7=μ8=μ9=μ10

Table 10: Effect of Facility Size on Satisfaction Survey Frequency

Effect of Facility Size on Satisfaction Survey Frequency

ANOVA

	Sum of Squares	df	Mean Square	F	P
Between Groups	5.648	6	0.94	4.29	0.00
Within Groups	140.6	641	0.22		
Total	146.3	647			

The results of the Spearman's rho correlation between satisfaction frequency and RSF indicated that there was a significant, but weak positive linear relationship (Spearman's rho = .155, p = .000, N = 648). An ANOVA was conducted to determine if building size using the size category distinction had an effect on satisfaction frequency, F (6,641) = 4.291, p = .000, α=.05. There is sufficient evidence to reject the null hypothesis. A Tamhane post-hoc t-test procedure was conducted to determine which size categories were significantly different from each other. This test does not assume a parametric distribution (See Table 11: Tamhane Post-hoc Comparison of Size Categoriesand Satisfaction Survey Frequency).

Table 11: Tamhane Post-hoc Comparison of Size Categories and Satisfaction Survey Frequency

Building Size Category and Satisfaction Survey Frequency

Tamhane Post-hoc Multiple Comparisons

		Mean Difference	Std. Error	P-Value
25,001-50,000 RSF	<25,000 RSF	-0.217	0.092	0.342
	50,001-100,000 RSF	-0.188	0.076	0.263
	100,001-250,000 RSF	-0.224	0.071	0.043
	250,001-500,000 RSF	-0.274	0.074	0.006
	500,001-1,000,000 RSF	-0.346	0.074	0.000
	1,000,001-5,000,000 RSF	-0.294	0.080	0.007

The results of the Tamhane post-hoc analyses indicate that the buildings in the 25,001-50,000 RSF category were significantly different from buildings ranging from 100,001-5,000,000 RSF.

A graph of the facility size category averages was created using the average satisfaction survey frequency for each of the seven facility size categories to visually represent the nature of the linear relationship between the two variables. See Figure 27: Satisfaction Survey Frequency by Facility Size.

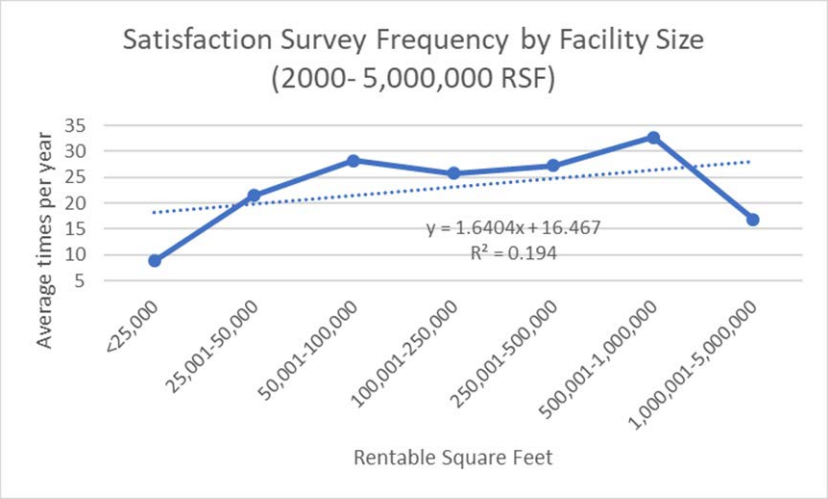


Figure 27: Satisfaction Survey Frequency by Facility Size (2,000-5,000,000 RSF)

Figure 27 was subsequently recreated to remove the out of trend data from facilities in the category of 1,000,001-5,000,000 RSF. Removing the largest category results in a stronger linear relationship between satisfaction survey frequency and facility size (See Figure 28: Satisfaction Survey Frequency by Facility Size (2,000-1,000,000 RSF).

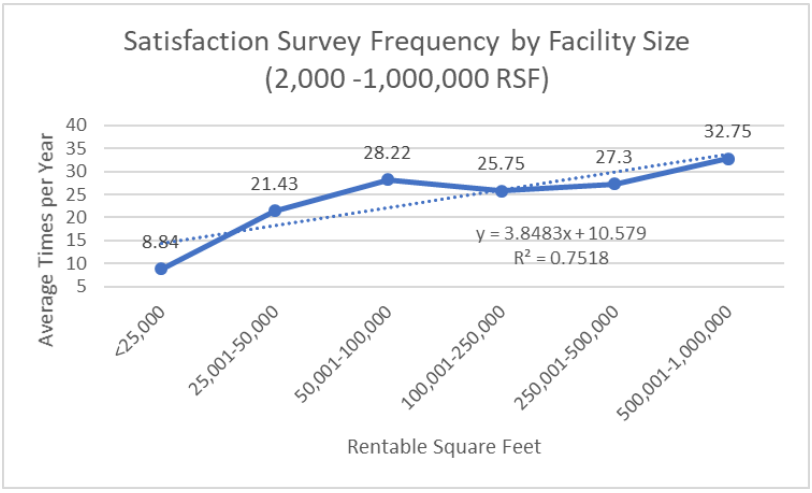


Figure 28: Satisfaction Survey Frequency by Facility Size (2,000-1,000,000 RSF)

FACILITY SIZE AND MAINTENANCE COSTS/SF

The relationship between facility size and maintenance costs/SF was inadvertently discovered when try to estimate the impact of grouping or covariables for the analyses. A negative linear relationship was found between the two variables, Spearman's rho = .068 (p = .013, N = 1339). It does not represent a testing of hypotheses, but understanding the magnitude of this effect on benchmarking data contributes to Objective 1 of the research. A graph of the average maintenance costs/SF by facility size category was made to illustrate the nature of the linear relationship between the two variables. See Figure 29: Mainteance Costs/SF by Facility Size (2,000-5,000,000 SF).

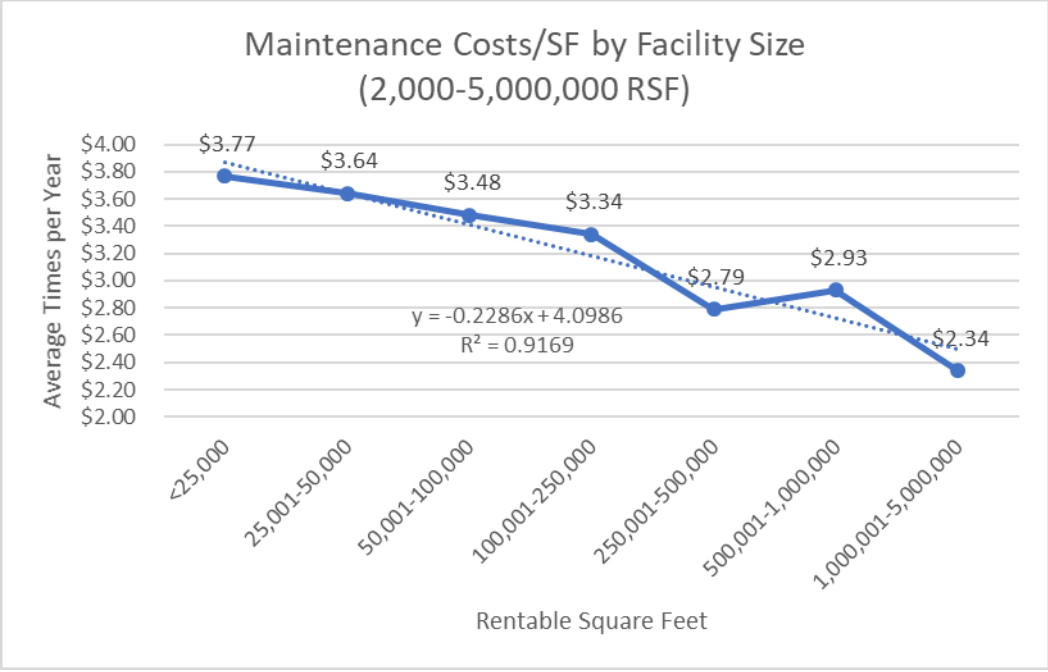


Figure 29: Maintenance Costs/SF by Facility Size (2,000-5,000,000 SF)

TYPE OF SPACE REPORTED ON AND MAINTENANCE COSTS/SF

Another variable that was tested as a potential covariable was that of the type of space reported on in the benchmarking survey. Figure 30 presents the average maintenance costs/RSF by type of space reported on. Table 12 presents the same information along with sample size and standard deviations. Table 13 lists the type of space reported on and the average size of those spaces, along with sample size and standard deviations. Table 14 presents the results of the ANOVA to determine if the type of space reported on has an effect on maintenance costs/RSF. Table 15 presents the post-hoc analyses of the ANOVA.

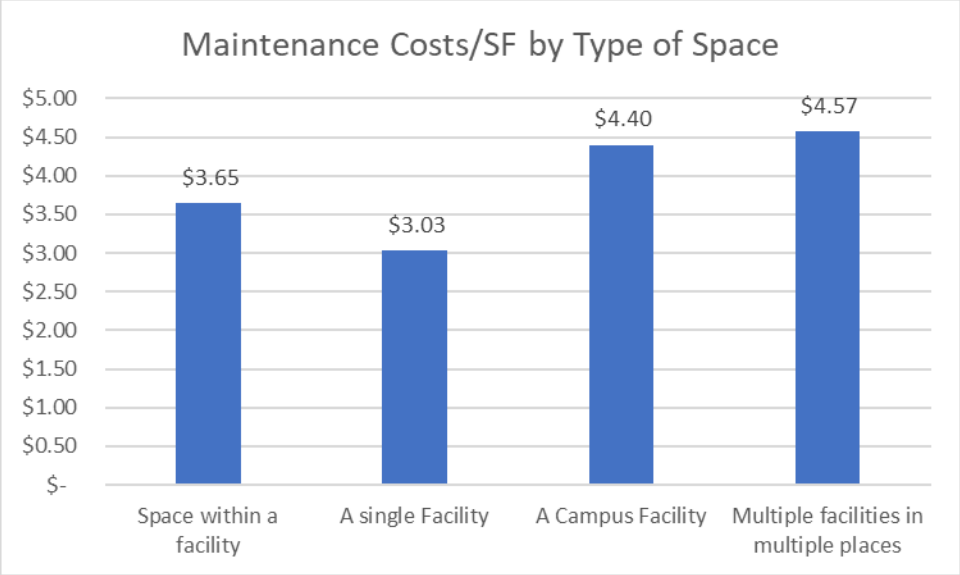


Figure 30: Maintenance Costs/Sf by Type of Space Reported on

Table 12: Average Maintenance Costs/SF by Type of Space Reported On

	Maint. Costs/SF		N	St. Dev.
Space within a facility	$ 3.65		48	$ 5.70
A single Facility	$ 3.03		887	$ 3.50
A Campus Facility	$ 4.40		191	$ 4.79
Multiple facilities in multiple places	$ 4.57		147	$ 5.47

Table 13: Facility RSF by Type of Space Reported On

	RSF	N	St. Dev.
Space within a facility	240,045.60	68.00	309,506.35
A single Facility	213,753.74	915.00	311,305.67
A Campus Facility	654,990.68	231.00	788,327.05
Multiple facilities in multiple places	589,845.43	172.00	817,410.60

Table 14: Effect of Type of Space on Maintenance Costs/SF

Effect of type of space on Maintenance Costs/SF

ANOVA

	Sum of Squares	df	Mean Square	F	P
Between Groups	515.52	3	171.84	10.33	0.00
Within Groups	21,111.91	1269	16.64		
Total	21627.43	1272			

An ANOVA was conducted to determine if the type of space reported on had an effect on maintenance costs/SF, F (3,1269) = 10.329, p = .000, α=.05. A Tamhane post-hoc t-test procedure was conducted to determine which size categories were significantly different from each other. This test does not assume a parametric distribution.

Table 15: ANOVA Tamhane Post-hoc Type of Space Analyses

Tamhane Post-hoc Multiple Comparisons

		Mean Difference	Std. Error	P-Value
A Single Facility	Space within a facility	$ (0.63)	$ 0.83	0.974
	A Campus Group	$ (1.37)	$ 0.37	0.001
	Mutiple building/locations	$ (1.54)	$ 0.47	0.007

The post-hoc analyses indicated that those who reported on single facilities, reported a significantly lower maintenance costs/SF than those who reported on campus facility groups or multiple facilities in multiple places. Given the results of this analysis, an additional Spearman's rho correlation was run between RSF and Maintenance Costs/SF using only the data from single facilities.

Single Facilities	Rho	P-Value	N
RSF & Maintenance Costs/SF	-.119	.000	870

These results indicated a significant increase in the Spearman's rho correlation value from -.068 to -.119 by limiting the analysis to only single facility respondents.

HPOTHESIS TESTING: RESEARCH OBJECTIVE 3

The results in this section focus on Research Objective 3. This objective is to determine what effect differing types of benchmarking plans have on maintenance costs/RSF. This section will present the results from 5 analyses for the testing of 3 hypotheses. The results are presented in Tables 16-21.

HYPOTHESIS 4 H4: $\mu 1-\mu 2 \neq 0$: Ho4: $\mu 1-\mu 2 = 0$

Table 16: Effect of Benchmarking Uncertainty on Maintenance Cost/SF

Effect of Benchmarking Uncertainty on Maintenance Costs/SF			
T-test (unequal variance)	**N**	**Mean**	**St. Dev.**
Uncertain of how data will be used	**143**	**$5.45**	**$6.55**
Did not select response	**426**	**$4.11**	**$4.22**
t= -2.29 df = 103.816	**2 tailed P =**	**0.023**	
Levene's Test for Equality of Variance	**F = 16.904 p = .000**		

The Levine's test for equality of variances between respondents who indicated they were uncertain of how to use the benchmarking data and those who did not, indicated a significantly different amount of variance between the two groups, F = 16.904, p = .000, α=.05. An unequal variance t-test indicated a significant difference in mean values between the two groups, t = -2.291, p = .023, α=.05. There is sufficient evidence to reject the null hypothesis. Those respondents who indicated that they were uncertain of how to use the benchmarking data from the survey reported a statistically significant (p>.05) higher mean value for maintenance costs/sf than their counterparts, $5.45/sf vs. $4.11/sf.

HYPOTHESIS 5: H5: μ1-μ2 ≠0: Ho5: μ1-μ2 = 0

Table 17: Effect of No Benchmarking Action on Maintenance Costs/SF

Effect of No Action on Maintenance Costs/SF			
T-test	**N**	**Mean**	**St. Dev.**
No action will be taken	**12**	**$1.63**	**$1.61**
Did not select response	**556**	**$4.47**	**$4.86**
t= 2.019 df = 566	**2 tailed P =**	**0.044**	
Levene's Test for Equality of Variance	**F = 2.706 p=.101**		

The Levine's test for equality of variances between those who selected this response and those who didn't, did not indicate a significantly different amount of variance between the two groups, $F = 2.706$, $p = .101$, $\alpha=.05$. The t-test indicated a significant difference in mean values between the two groups, $t = 2.019$, $p = .044$, $\alpha=.05$. There is sufficient evidence to reject the null hypothesis. Respondents who indicated that they did not intend to take action based upon the results of the benchmarking survey reported statistically significant lower mean maintenance costs/sf than their counterparts, $1.63/sf vs. $4.47.

BENCHMARKING PLANS

HYPOTHESIS 6: Ho6: $\mu1-\mu2 = 0$; H6: $\mu1-\mu2 \neq 0$

There were a total of three benchmarking action plans for respondents to choose from. They will be presented on an individual plan basis.

Table 18: Average Maintenance Costs/SF by Type of Benchmarking Plans

	Maintenance Costs/SF		N
Identification of best-in-class performance/ best practices	$	4.34	379
Identify performance targets	$	4.25	336
Incorporate Metrics into a performance model	$	4.20	248
Uncertain of how data will be used	$	5.45	143
No action will be taken	$	1.63	12

PLAN1: IDENTIFY PERFORMANCE TARGETS (GAUGING COMPANY PERFORMANCE)

Ho6: μ1-μ2 = 0; H6: μ1-μ2 ≠0

Table 19: Effect of Plan 1 on Maintenance Costs/SF

Plan 1: Identify Performance Targets (Gauging Company Performance)					
T-test				**N**	**Mean**	**St. Dev.**
Identify Performance Targets				**336**	**$4.25**	**$4.83**
Did not select response				**233**	**$4.62**	**$4.84**
t=	**0.899 df = 567**		**2 tailed**	**P =**	**0.369**	
Levene's Test for Equality of Variance			**F = 1.132**	**p = .288**		

The Levine's test for equality of variances between those who selected this response and those who didn't, did not indicate a significantly different amount of variance between the two groups, F = 1.132, p = .288, α=.05. The t-test did not indicate a significant difference in mean values between the two groups, t = 0.899, p = .369, α=.05. As a result, there was not sufficient evidence to reject the null hypothesis.

PLAN 2: INCORPORATE METRICS INTO A PERFORMANCE MODEL

Ho6: μ1-μ2 = 0; H6: μ1-μ2 ≠0

Table 20: Effect of Plan 2 on Maintenance Costs/SF

Plan2: Incorporate Metrics into a Performance Model (KPI, Balanced Scorecard, etc.)					
T-test (unequal variance)			**N**	**Mean**	**St. Dev.**
Incorporate Metrics into a Performance Model			**248**	**$4.20**	**$4.24**
Did not select response			**321**	**$4.56**	**$5.25**
t=	**0.911 df = 565.925**	**2 tailed**	**P =**	**0.363**	
Levene's Test for Equality of Variance		**F = 3.886**	**p = .049**		

The Levine's test for equality of variances between those who selected this response and those who didn't, indicates a significantly different amount of variance between the two groups, $F = 3.886$, $p = .049$, $\alpha=.05$. The unequal variance t-test did not indicate a significant difference in mean values between the two groups, $t = 0.911$, $p = .363$, $\alpha=.05$. As a result, there was not sufficient evidence to reject the null hypothesis.

PLAN 3: IDENTIFICATION OF BEST-IN-CLASS PERFORMANCE/BEST PRACTICES

$H_o6: \mu1-\mu2 = 0$; $H6: \mu1-\mu2 \neq 0$

Table 21: Effect of Plan 3 on Maintenance Costs/SF

Plan 3: Identification of Best-in-Class Performance/ Best Practices					
T-test				N	Mean	St. Dev.
Identification of Best-in-Class Performance/Best Practices				379	$4.34	$4.63
Did not select response				190	$4.53	$5.24
t=	0.443 df = 567		2 tailed	P =	0.659	
Levene's Test for Equality of Variance			F = 1.798	p = .181		

The Levine's test for equality of variances between those who selected this response and those who didn't, did not indicate a significantly different amount of variance between the two groups, $F = 1.798$, $p = .181$, $\alpha=.05$. A t-test did not indicate a significant difference in mean values between the two groups, $t = 0.443$, $p = .658$, $\alpha=.05$. As a result, there was not sufficient evidence to reject the null hypothesis.

CHAPTER 6: DISCUSSION

The discussion on interpretation and significance of these results will be addressed by first addressing each of the objectives of this research followed by a more general discussion of the value that this research provides to the FM industry and directions for future research uncovered in this initial study.

OBJECTIVE 1: FM INDUSTRY BENCHMARKING PROFILE

The measures of Objective 1 were intertwined throughout Objectives 1 & 2 as they were explored and summarized during the methods and analysis section of this thesis. This objective was to develop an wide-scale industry profile of how FM organizations are implementing customer/occupant satisfaction surveys as well as FM approaches to taking action on competitive benchmarking surveys. This was accomplished through the analyses and use of descriptive statistics on a large sample that can be generalized to the North American FM industry. This was further accomplished through the publication of the results of the industry-wide O & M survey by the facility management organization for practitioners to use in aiding their benchmarking efforts. A number of organizations report relying heavily upon the data from these surveys for assistance in guiding their performance management and in supporting their requests for funding to provide further costs savings for the organizations they support. This report provides facility managers with benchmarking data on facility costs and practices including janitorial, maintenance, utilities, security, sustainability and energy

management, as well as demographic data such as: industry, facility use, age, setting, occupants, operating hours, and much more.

Another interesting result that was inadvertently discovered within this research objective was the finding of a statistically significant, but weak linear relationship between facility size and maintenance costs/sf (Spearman rho = -.068, p=.013, N = 1481). The results of the ANOVA on size categories compared over maintenance costs/SF with only one category, 25,001-50,000, proving statistically significant from the other, may suggests that further statistical analyses and consideration should be given to the ranges used in building size categorization.

The finding of a significant effect of the type of space reported on, with single facilities reporting a lower maintenance costs/SF than campus facility groups or multiple facilities in multiple places (F = 10.33 [3,1269], p = .000), is also an informative result that could help to further the proper analysis of competitive benchmarking surveys. Those respondents reporting on multiple facilities are reporting total costs/total RSF for all of their facilities, meaning that best-in-class and worst-in-class are all included in their data. This means that they are reporting average performance across their facilities, rather than performance of best-in-class facilities, which may account for the significantly different maintenance costs/RSF averages among the types of space reported on.

When the linear relationship between maintenance costs/SF and RSF was analyzed looking only at the respondents who reported on single facilities, the strength of the linear relationship almost doubled (Spearman's rho = -.119, p =.000, N = 870). These results suggest the importance of making reasonable comparisons between facilities, or "apples to apples" comparisons. Including data from some many dissimilar sources can

increase the odds of making Type I or Type II errors in statistical conclusions. Including data from disparate groups in organizational reports could also lead to organizations making financial decisions based upon skewed data that could lead to assessment and correction errors. In short, competitive FM benchmarking surveys should rely upon single facility comparisons to make informed and accurate performance assessments or the types of space should be analyzed separately to ensure that these differences aren't masking trends.

Future research efforts should try to address why the differences in type of space reported on effect maintenance costs/SF. Further understanding of the relationship between maintenance costs/SF and facility size (RSF) should also be addressed. Understanding the differences in performance caused by these grouping or demographic variables will help to further the field of facility management benchmarking by helping to address the largest impacts to performance differences that can occur across industries.

OBJECTIVE 2: THE IMPACT OF CUSTOMER/OCCUPANT SATISFACTION ON PERFORMANCE MANAGEMENT

The results of these analyses were unexpected, but consistent with previous researchers' observations regarding difficulties linking soft measures such as satisfaction to more performance oriented hard measures, such as costs/SF. There was no statistical support for the hypotheses that use and frequency of customer satisfaction surveys have an effect on maintenance costs/sf in a competitive benchmarking survey. This may be reflective of the nature of its use in the industry as a quality management tool rather than a performance management tool, but it begs a deeper question. If the core purpose of

facility management is to manage performance and keep costs down, is a best practice that does not contribute directly to this goal truly a best practice. Best practices do not always translate but must be adapted to fit the needs of an industry (Camp, 1989: Stauffer, 2003). This could be evidence that it may not be best practice for the FM industry, despite 66% of respondents indicating that they do use it. Conversely, 34% of respondents indicated that they do not use it, which may suggest its lack of utility for the Industry. On the other hand, this may simply be evidence of its lack of utility in an external competitive benchmarking survey. This survey did not address the particulars on how the benchmark may be used as an internal benchmark within the company, nor did it evaluate the methodology with which it is employed within the company, so the effectiveness with which the measure is utilized to manage quality or performance can't be gauged by the information in the survey. The survey also did not distinguish between the type of surveys people were utilizing. Different respondents indicated they were using satisfaction surveys after projects and others after work orders. This diverse group of satisfaction survey use should be examined in greater specificity to differentiate between these various approaches serving different FM organizations.

Specific research is needed to follow up this study which should include a more qualitative approach to obtaining information on this subject such as interviews regarding action plans for customer satisfaction surveys. Additionally, a follow up analysis of the qualitative answers to how people were planning on taking action should be conducted using a technique such as N-Vivo software to further the analysis of the responses. This analysis was beyond the scope of this current thesis.

A statistically significant, but weak linear relationship was also found between facility size and satisfaction survey frequency (Spearman's rho = .155, p = .000, N = 648). It is believed that this difference in frequency may be accounted for by the difference in organizational size and the differing strategies that large-scale organizations use when compared to smaller businesses. In a large organization it is not possible to have a direct relationship with all members of staff to gather informal qualitative information about customer/occupant satisfaction. While smaller organizations can gather this information frequently and informally through meetings and direct contact, larger organizations most likely have to rely upon more informal gathering of this data such as obtained with customer satisfaction surveys. Several respondents to the industry-wide O & M survey reported to use customer satisfaction in this more informal manner.

OBJECTIVE 3: THE IMPACT OF BENCHMARKING PLANS ON PERFORMANCE MANAGEMENT

There are several interesting results from the analyses conducted in this thesis on this topic. To begin with only 66% of the respondents who answered the question on benchmarking data plans selected the identification of best practices as a planned use for the benchmarking survey data. With the identification of best practices to take action upon as the fundamental goal of benchmarking, it is rather curious that more respondents did not select this option. There could be a few possible interpretations as to the reasoning behind the respondents' lower than anticipated response to this selection, such as unfamiliarity with benchmarking methodology, or simply uncertainty about how to use the data from the FM organization's O & M Benchmarking Report. This is impossible to

determine from the data in the survey but would lend well to follow-up research and in-depth interviews.

An unexpected result from the survey was that respondents who reported that they would not be taking action on the benchmarking data reported significantly lower maintenance costs/sf than their counterparts, $1.62/sf vs. $4.46/sf ($t = 2.019$, $p = .044$, $\alpha=.05$). Though the results of this analysis were significant at the required alpha level, the no action group was a very small sample (N=12) when compared to their counterparts (N = 556). This small sample size may limit the extent to which this result can be generalized to the population, but it is interesting nonetheless. Clearly, there is something different about the respondents who answered the question in this manner as they report a much smaller costs/sf than their counterparts. Understanding why this occurred with the available data will be speculative at best. It's impossible to determine the motives for responding to the question in this manner, which could range from prior incorporation of best practices and being a best-in-class performer, already having a system in place, or simply responses from people who are uncertain of how a report could be used to achieve benchmarking methodology. Again, this result would also be worthy of follow research and interviews to find out more about the characteristics of the few respondents who did not intend to take action.

Respondents who indicated they were uncertain about how to take action on the benchmarking results reported higher maintenance costs/sf than their counterparts, $5.45 vs. $4.11 ($t = -2.291$, $p = .023$, $\alpha=.05$). This result could be interpreted as support for the idea that those with unfamiliarity with benchmarking methodology or uncertainty over how to go about the process do not perform as well as their peers. This would certainly be

consistent with the literature available on this topic as benchmarking can be a very effective tool for continual improvement. Some caution should be taken in this interpretation though. This interpretation does not take into account whether the respondents were unfamiliar with the benchmarking process or simply unfamiliar with the FM organization's O & M benchmarking surveys.

Another interesting result from the analyses was that there does not appear to be any statistical support for significant differences in maintenance costs/sf for respondents who indicated that had some sort of plan to take action on the benchmarking data. This suggests that one individual strategy may not necessarily outperform another one. When this is taken into consideration with the analysis suggesting that uncertainty about how to use the data was linked to poor performance in the form of higher costs than their counterparts, this could be suggestive about the impact of taking action on benchmarking data. Those respondents who had some sort of plan for taking action on the data outperformed those who were uncertain of how to go about taking action on the data. This topic should also be addressed further in follow-up research. Possible limitations on the interpretation of these results may center around the form of the question itself and the need for a more in-depth coding and analysis of the data to explore all possible answer combinations that were given to this question.

The fact that 37% of respondents selected the strategy of incorporating the data from the survey in a performance model such as a KPI or Balanced Scorecard is also interesting in and of itself. This may suggest that there is a growing awareness in the FM filed of the complementary role that benchmarking and performance can play for an

organization. It may be that there is a growing need and demand in the field to address the knowledge gap between these two techniques and the industry is responding.

CONCLUSION

This thesis provides a number of significant contributions to the field of facility management as well as some interesting insights into the use of customer satisfaction and benchmarking plans. It further helps to provide information on the potential knowledge gap between benchmarking and performance management. It provides a profile of how FM organizations are implementing customer/occupant satisfaction surveys as well as FM approaches to taking action on competitive benchmarking surveys. It provides no support for an industry-wide relationship between satisfaction surveys and facility performance, but raises some interesting questions about how differing facility sizes may use different approaches to such surveys. The results also suggest that facility managers who are familiar with benchmarking methodology may actually have a performance advantage over their peers. In addition, it stimulates directions for future research on the relationship of size and facility costs, size and cost differences in the type of space reported on, and their effect on maintenance costs/SF.

Understanding the factors that significantly effect facility performance will help to contribute to better facility benchmarking and more accurate performance assessments when making benchmarking comparisons. This research also demonstrates that further understanding of the role that the use of customer satisfaction plays in managing facilities is needed, perhaps in a more qualitative form to address the intra-facility use of these surveys and how they may be used to mange internal benchmarks pertaining to quality,

rather than performance. Finally, this study addresses the role that benchmarking plans may play in facility performance and suggests that further understanding of the internal organizational processes for taking action is warranted.

REFERENCES

Allan, C. F. (1993). “Benchmarking practical aspects for information professionals”. *Special Libraries, Vol 84, No. 3,* pp. 123-30.

Amaratunga, D. & Baldrey, D. (2003). “A conceptual framework to measure facilities management performance”. *Property Management, Vol. 21 No.2,* pp. 171-89.

Amaratunga, D., Baldry, D. & Sarshar, M. (2000). “Assessment of facilities management performance – what next?” *Facilities*, *18*(1/2), 66–75. https://doi.org/10.1108/02632770010312187

Amaratunga, D., Haigh, R., Sarshar, M., & Baldry, D. (2002). Application of the balanced score-card concept to develop a conceptual framework to measure facilities management performance within NHS facilities. *International Journal of Health Care Quality Assurance*, *15*(4), 141–151. https://doi.org/10.1108/09526860210431805

American Society of Testing & Materials (ASTM) (2016). ASTM E1836 / E1836M-09(2016), Standard Practice for Building Floor Area Measurements for Facility Management, ASTM International, West Conshohocken, PA, 2016, www.astm.org

Anand, G., & Kodali, R. (2008). Benchmarking the benchmarking models. *Benchmarking: An International Journal*, *15*(3), 257–291. https://doi.org/10.1108/14635770810876593

Au-Yong, C. P., Ali, A. S., & Ahmad, F. (2015). Participative Mechanisms to Improve Office Maintenance Performance and Customer Satisfaction. *Journal of Performance of Constructed Facilities*, *29*(4), 4014103. https://doi.org/10.1061/(ASCE)CF.1943-5509.0000609

Augenbroe, G. & Parks, C.S. (2005). Quantification methods of technical building performance”. *Building Research and Information, Vol. 33 No. 2*, pp. 159-72.

British Institute of Facility Management (BIFM) (2004). “Rethinking facilities management: accelerating change through best practice”. www.bifm.org.uk. (Accessed 01/20/2018).

Bhutta, K. & Huq, F. (1999). Benchmarking – best practices: an integrated approach. *Benchmarking: An International Journal*, *6*(3), 254–268. https://doi.org/10.1108/14635779910289261

Camp, R. C. (1989). *Benchmarking: the search for industry best practices that lead to superior performance*. Milwaukee, WI: White Plains, N.Y: Quality Press ; Quality Resources.

Coenen, C., Waldburger, D., & Felten, D. von. (2013). FM Servicebarometer: monitoring customer perception of service performance. *Journal of Facilities Management*, *11*(3), 266–278. http://dx.doi.org.librarylink.uncc.edu/10.1108/JFM-06-2012-0024

Collins, T., Rosetti, M., Nachtmann, H. & Oldham, J. (2006). "The use of multi-attribute utility theory to determine the overall best-in-class performer in a benchmarking study". *Benchmarking: An International Journal, Vol. 13 No. 4*, pp.431-46.

Denrell, J. (2005). Selection bias and the perils of benchmarking. *Harvard Business Review, 83(4). p. 114-119.* Retrieved from http://content.ebscohost.com.librarylink.uncc.edu/ContentServer.asp?T=P&P=AN&K=16572717&S=R&D=bth&EbscoContent=dGJyMNLr40Sep684zdnyOLCmr06ep7ZSs6i4TbSWxWXS&ContentCustomer=dGJyMPGrtkqwr7VRuePfgeyx44Dt6fIA

Emulti, D. & Kathwala, Y. (1997). "An overview of the benchmarking process: a tool for continuous improvement and competitive advantage", *Benchmarking for Quality Management & Technology, Vol. 4, No. 4*, pp.229-43.

Fernandez, P., McCarthy, I. P., & Rakotobe-Joel, T. (2001). An evolutionary approach to benchmarking. *Benchmarking*, *8*(4), 281.

Fong, S.W., Cheng, E.W.I., & Ho, D.C.K. (1988). "Benchmarking: a general reading for management practitioners". *Management Decision, Vol. 35, No. 6*, pp. 407-418.

Fibuch, E., & Van Way, C. W. (2013). Benchmarking's Role in Driving Performance. *Physician Executive*, *39*(1), 28–32.

Haverila, M. J., Martinsuo, M., & Naumann, E. (2013). Drivers of customer satisfaction and relationship quality in system delivery projects. *Journal of Strategic Marketing*, *21*(7), 613–636. https://doi.org/10.1080/0965254X.2013.804860

He, L. T., & Hu, C. (2009). Midpoint method and accuracy of variability forecasting. *Empirical Economics*, *38*(3), 705–715. https://doi.org/10.1007/s00181-009-0286-6

Hinks, J. (2004). "Business-related performance measures for facilities management". In Alexander, K., Atkin, B., Brochner, J., & Haugen, T. (Eds.), *Facilities Management: Innovation and Performance*, SPON Press, New York, NY, pp.97-107.

Hinks, J. & McNay, P. (1999). "The creation of a management by variance tool for facilities management performance assessment". *Facilities, 17(1/2),* pp. 31-53.

Hinton, M., Francis, G., and Holloway, J. (2000). "Best practice benchmarking in the UK". *International Journal of Benchmarking, 7(1),* pp.52-62

Hong, S.-M., Paterson, G., Mumovic, D., & Steadman, P. (2014). Improved benchmarking comparability for energy consumption in schools. *Building Research & Information*, *42*(1), 47–61. https://doi.org/10.1080/09613218.2013.814746

International Facility Management Association (IFMA) (2014). Benchmarking-for-facility-professionals-ifma-foundation-whitepaper-small.pdf. Retrieved from https://foundation.ifma.org/docs/default-source/Whitepapers/benchmarking-for-facility-professionals-ifma-foundation-whitepaper-

Kaplan, R. S., & Norton, D. P. (1992). The Balanced Scorecard--Measures That Drive Performance. *Harvard Business Review*, *70*(1), 71–79.

Kennerly, M. & Neely, A. (2003). "Measuring performance in a changing business environment". *International Journal of Operation and Production Management, Vol. 23(2),* pp.213-229.

Kumar, U., Galar, D., Parida, A., Stenström, C., & Berges, L. (2013). Maintenance performance metrics: a state-of-the-art review. *Journal of Quality in Maintenance Engineering*, *19*(3), 233–277. http://dx.doi.org.librarylink.uncc.edu/10.1108/JQME-05-2013-0029

Lavy, S., Garcia, J., & Dixit, M. (2010). Establishment of KPIs for facility performance measurement: review of literature. *Facilities*, *28*(9/10), 440–464. https://doi.org/10.1108/02632771011057189

Lavy, S., Garcia, J. A., & Dixit, M. K. (2014a). KPIs for facility's performance assessment, Part I: identification and categorization of core indicators. *Facilities*, *32*(5/6), 256–274. http://dx.doi.org.librarylink.uncc.edu/10.1108/F-09-2012-0066

Lavy, S., Garcia, J. A., & Dixit, M. K. (2014b). KPIs for facility's performance assessment, Part II: identification of variables and deriving expressions for core indicators. *Facilities*, *32*(5/6), 275–294. http://dx.doi.org.librarylink.uncc.edu/10.1108/F-09-2012-0067

Lavy, S., Garcia, J. A., Scinto, P., & Dixit, M. K. (2014). Key performance indicators for facility performance assessment: simulation of core indicators. *Construction*

Management and Economics, *32*(12), 1183–1204. https://doi.org/10.1080/01446193.2014.970208

Li, Z., Han, Y., & Xu, P. (2014). Methods for benchmarking building energy consumption against its past or intended performance: An overview. *Applied Energy*, *124*, 325–334. https://doi.org/10.1016/j.apenergy.2014.03.020

Lingle, J.H. & Schiemann, W.A. (1996). "From balanced scorecard to strategy gauge: is measurement worth it?" *Management Review*, March, pp.56-62.

Loosemore, M., & Hsin, Y.Y. (2001). "Customer-focused benchmarking for facilities management". *Facilities*, *(19)*, *Issue 13/14*, pp. 464-476.

Massheder, K.& Finch, E. (1998) "Benchmarking methodologies applied to UK facilities management", *Facilities*, *Vol. 16 Issue: 3/4*, pp.99-106, https://doi.org/10.1108/02632779810205639

Meng, X. & Minogue, M. (2011). Performance measurement models in facility management: a comparative study. *Facilities*, *29*(11/12), 472–484. https://doi.org/10.1108/02632771111157141

Palmer, K. & Walls, P. (2015). "Does Information Provision Shrink the Energy Efficiency Gap? A Cross-City Comparison of Commercial Building Benchmarking and Disclosure Laws". Resources for the Future. Washington, D.C. www.rff.org.

Rani, N. A. A., Baharum, M. R., Akbar, A. R. N., & Nawawi, A. H. (2015). Perception of Maintenance Management Strategy on Healthcare Facilities. *Procedia - Social and Behavioral Sciences*, *170*, 272–281. https://doi.org/10.1016/j.sbspro.2015.01.037

Rasila, H., Alho, J., & Nenonen, S. (2010). Using balanced scorecard in operationalising FM strategies. *Journal of Corporate Real Estate*, *12*(4), 279–288. http://dx.doi.org.librarylink.uncc.edu/10.1108/14630011011094694

Kärnä, S. & Junnonen, J. (2016). Benchmarking construction industry, company and project performance by participants' evaluation. *Benchmarking: An International Journal*. https://doi.org/10.1108/BIJ-05-2015-0050

Rodier, M.M. (2000). "A quest for best practices". *IIE Solutions*, *Vol 32*, *No. 2*, pp.36-39.

Sedgwick, S. (1995). "Benchmarking and best practice: promise and performance". *Australian Journal of Public Administration*, *Vol. 54*, *No. 3*, pp. 401-7.

Shetty, Y. K. (1993). "Aiming high: competitive benchmarking for superior performance". *Long Range Planning, Vol. 26, No. 1*, pp. 39-44.

Simões, J.M., Gomes, C.F., & Yasin, M.M. (2011). A literature review of maintenance performance measurement: A conceptual framework and directions for future research. *Journal of Quality in Maintenance Engineering*, *17*(2), 116–137. https://doi.org/10.1108/13552511111134565

Spendolini, J.M. (1992). The Benchmarking Book. American Management Association, New York.

Stauffer, D. (2003). Is Your Benchmarking Doing the Right Work? *Harvard Management Update*, *8*(9), 3

Tucker, M., & Pitt, M. (2010). Improving service provision through better management and measurement of customer satisfaction in facilities management. *Journal of Corporate Real Estate*, *12*(4), 220–233. http://dx.doi.org.librarylink.uncc.edu/10.1108/14630011011094667

Tucker, M. & Smith, A. (2008). "User perceptions in workplace productivity and strategic FM delivery". *Facilities, Vol. 26 (5/6),* pp. 196-212.

Wall, T. D., Michie, J., Patterson, M., Wood, S. J., Sheehan, M., Clegg, C. W., & West, M. (2004). On the Validity of Subjective Measures of Company Performance. *Personnel Psychology*, *57*(1), 95–118. https://doi.org/10.1111/j.1744-6570.2004.tb02485.x

Walters, M. (1999). "Performance measurement systems – a study of customer satisfaction". *Facilities, Vol. 17, (3/4),* pp. 97-104.

Watson, G.H. (1993). Strategic Benchmarking. Wiley, New York, NY.

Wong, P. Y. L., Leung, S. C. H., & Gilleard, J. D. (2013). Portfolio Performance Benchmarking with Data Envelopment Analysis. *Asia-Pacific Journal of Operational Research*, *30*(5), 1. https://doi.org/10.1142/S0217595913500115

Yasin, M. M. (2002). The theory and practice of benchmarking: Then and now. *Benchmarking*, *9*(3), 217–243

APPENDIX A: INDEPENDENT VARIABLE SURVEY QUESTIONS

How do you plan on using the benchmarking data from this survey? (select all that apply)

- Identify performance targets (gauging company performance)
- Identification of best-in-class performance / best practices
- Incorporate Metrics into a performance model (KPI, balanced scorecard, etc.)
- Uncertain of how the data will be used
- NO action will be taken
- Other:_____

How often do you conduct a general satisfaction survey of FM customers / general occupants?

- Never - we do not conduct satisfaction surveys
- Quarterly
- Twice per year
- Every year
- Other:_____

How do you implement corrective / remedial actions (if any) based on the results of the customer survey?

APPENDIX B: PILOT SURVEY

FRONT-PAGE 1

IFMA'S O&M Benchmarking Organizational Snapshot Survey

Your responses will be used to supplement IFMA's Operations & Maintenance Benchmarking survey. If you are unsure of an answer, please leave it blank. Please answer the questions based on the current organization you work for (or that of your "typical" client if you are a services provider). Your individual responses will remain confidential.
Please answer the questions thinking about the past 12 months.

DEMOGRAPHICS

1. Are you a facility manager or a services provider?
   - ○ Facility Manager
   - ○ Service Provider
   - ○ Other: _____
2. What is your primary **ROLE**?
   - ○ C-suite (Executive Management)
   - ○ Director of Real Estate (Director, VP, SVP)
   - ○ Facility Management Director (Director, VP, SVP)
   - ○ Facility Manager
   - ○ Knowledge Worker
   - ○ Project / Program Manager
   - ○ Support Functions
   - ○ Other: _____
3. About **HOW MANY (#)** buildings do you manage? _____
4. Is FM responsible for building / site **SECURITY** operations and management? YES ☐ NO ☐
5. Does your organization use some type of FM **SOFTWARE** solution (CMMS, CAFM, FMS, etc.)? YES ☐ NO ☐

O&M BACKGROUND

Please answer Questions 6 – 14 thinking about the LARGEST and MOST ACTIVE building you manage.

6. What is the approximate **AGE** of this building? _____ years
7. What is the approximate total **INTERIOR AREA** of this building? _____ square ☐ feet ☐ meters
8. What is the **ZIP OR POSTAL CODE** of this building? _____ *(i.e., 28223 or T7X 0A1)*

JANITORIAL

9. What is the total estimated annual cost of janitorial services for this building?
   - ○ *$7,500 or less*
   - ○ *$7,501 – $15,000*
   - ○ *$15,001 – $30,000*
   - ○ *$30,001 – $75,000*
   - ○ *$75,001 – $150,000*
   - ○ *More than $150,000*
10. In general, how satisfied are you with the performance of your janitorial services?

Very dissatisfied *Dissatisfied* *Neutral* *Satisfied* *Very satisfied*

UTILITIES

Utility costs are costs associated with providing electrical power, potable water, and central heating and cooling and sewage service to the facility. They include the purchase cost of oil, gas, water, electricity, and all associated transmission costs. Utility costs also include sewage service and central steam and cooling.

11. What is the total estimated annual utility cost for this building?
    - ○ *$10,000 or less*
    - ○ *$10,001 – $30,000*
    - ○ *$30,001 – $75,000*
    - ○ *$75,001 – $200,000*
    - ○ *$200,001 – $500,000*
    - ○ *More than $500,000*
12. In general, how satisfied are you with your organization's energy management / conservation efforts?

Very dissatisfied *Dissatisfied* *Neutral* *Satisfied* *Very satisfied*

→ *continued on back* →

BACKSIDE – PAGE 2

MAINTENANCE

Maintenance costs are costs associated with the external building (roof, windows, etc.), interior systems (electrical, mechanical, admin support / help desk, etc.), roads and grounds, utility / central system maintenance, and environmental systems.

13. What is the total estimated annual maintenance cost for this building?

- ○ *$5,000 or less*
- ○ *$5,001 – $12,500*
- ○ *$12,501 – $50,000*
- ○ *$50,001 – $100,000*
- ○ *$100,001 – $500,000*
- ○ *More than $500,000*

14. What type of maintenance are the majority your maintenance expenses used for? [circle one]

Preventive (time / meter readings) | *Reactive (repair / breakdown)* | *Predictive (equipment condition)*

ORGANIZATIONAL QUESTIONS

15. Indicate your level of agreement with the following statements by circling the appropriate number on the scale.
(1 = strongly disagree; 7 = strongly agree)

	Strongly Disagree						Strongly Agree
Sharing of information between departments is encouraged.	1	2	3	4	5	6	7
My organization emphasizes building cohesive, committed teams of people.	1	2	3	4	5	6	7
My organization values the ideas of employees at every level.	1	2	3	4	5	6	7
Performance of employees is adequately recognized and rewarded.	1	2	3	4	5	6	7
My organization makes its lessons learned available to all employees.	1	2	3	4	5	6	7
My organization develops a culture of change among employees.	1	2	3	4	5	6	7

BACKGROUND INFORMATION

16. What's the highest level of education you've attained? [check one]

- ○ *Less than a high school diploma*
- ○ *High school graduate, not college*
- ○ *Some college, no degree*
- ○ *Vocational school*
- ○ *Associate's degree*
- ○ *Bachelor's degree*
- ○ *Master's degree*
- ○ *PhD or other Doctorate*

17. How many years of facility management experience do you have? _____ years

IFMA is considering using a new approach on the full O&M benchmarking survey, where you would have the option to provide answers as ranges (i.e., $1,000 – $5,000) instead of specific numbers (i.e., $3,187).

18. How would you personally prefer to respond to the full O&M benchmarking survey? [circle one]

Ranges | *Specific Numbers* | *Both Ranges and Specific Numbers* | *No Preference*

Would you like a FREE copy of the summary results? YES ☐ NO ☐

Would you like to participate in the full O&M benchmarking survey? YES ☐ NO ☐

If yes, please provide your name and email address below:

Name: _____

Email: _____

Questions or Comments? Email Nick at Nickalos.Rocha@ifma.org

APPENDIX C: INDUSTRY WIDE O & M SURVEY

GENERAL INFORMATION

1. Please select the currency and unit of measure in which you will be providing responses:
__ U.S dollars / English (sq. feet)
__ Canadian dollars / Metric (sq. meters)
__ EURO dollars / Metric (sq. meters)
__ Other (please specify currency and units of measure): _____

Please note: *In order to guarantee the validity of the data for this survey, it is important that you consistently use the currency and units of measurement that you selected above throughout the survey (unless otherwise stated on a specific question). Example: If you selected "Canadian Dollar," all currency entries should be in Canadian dollars and all units of measure will be Metric. Throughout the survey, "$" will be used as a common symbol to represent currency.*

Option to print out and fill out by hand to gather data (and then input into survey).

Option to do ranges versus specific values

1. Will you be providing responses in:
   _ English (sq. feet) _ U.S. dollars
   _ Metric (sq. meters) _ Canadian dollars

2. Please describe the specific product, service or business activity of your organization or the organization you are contracted to manage:

3. Who will serve as the benchmark contact person for your organization?

(Please complete)
Name: _____ IFMA designation: (CFM, FMP)
_____

4. IFMA member ID #:_____ *(If respondent is not a member of IFMA please enter 9999.)*

Organization:
_____
_____

Address:
_____
_____

City, State, Zip/Postal Code: _____

Country:_____

Province (*if applicable*)

Phone: _____ E-mail:
_____

5. Would you be interested in participating in future benchmarking activities with others? For example, every three years?

_ Yes (If yes, what three topics or areas do you have an interest in benchmarking?)
_ No
Area of interest a) _____ b) _____ c)
_____

6. Do you conduct an annual customer satisfaction survey?

__ Yes

__ No

7. What actions are taken as a result of the survey? Choose all that apply:

__ Actions are limited to funding

__ Life Safety are implemented

__ Review only

__ Results reviewed by a board, and actions selected by priority setting process

__ Other

Organizational Information

8. Which one of the following departments does your FM department report to or reside within organizationally? Select as many responses which apply in each column.

Organizational Structure	Reports to	Resides in
Board or Board Committee		
CAO/Administration		
CEO/President/Owner/Executive Director		
CFO/Finance		

COO/Operations/Shared Services		
Facilities		
Human Resources		
CIO/Information Technology		
GM/business Unit		
Chief Risk or Legal Officer/Risk/Legal/General Counsel		
Other (Please specify): _____		

9. Approximately, how many employees are you responsible for <u>overall</u> in your organization?

_____ (Please enter only whole numbers and not ranges).

_____ Responsible for direct staff

_____ Responsible for indirect staff

FACILITY DESCRIPTION

10. What industry does this facility serve?

(Choose one from the categories listed below that best fits):

SERVICES

__ Banking (Consumer, Commercial, Savings, Credit Unions)

__ Health Care

__ Hospitality (Hotel, Restaurants, Hospitality-Related)

__ Information Services (Data Processing, Information Services, E-Commerce)

__ Insurance (Health, Life, Auto, Mutual, Casualty, Flood)

__ Investment Services (Securities and Investment Services)

__ Media (Broadcasting, Entertainment, Gaming, Media, Publishing)

__ Professional Services (Legal, Accounting, Consulting, Engineering, Architecture)

__ Telecommunications (Telecommunication, Internet Services/Products)

__ Trade (Wholesale, Retail)

__ Transportation (Transportation, Freight)

__ Utilities (Water, Gas, Electric, Energy Management)

__Other Services: _____

MANUFACTURING/PRODUCTION

__ Aircraft/Industrial (Industrial Equipment, Aerospace)

__ Building/Construction (Building, Construction Materials)

__ Chemical/Pharmaceutical (Chemical, Pharmaceutical, Biotech)

__ Consumer Products (Food, Paper or related)

__ Computer (Computer Hardware or Software)

__ Electronics (Electronics, Telecommunications Equipment)

__ Energy (Energy related, Mining or Distribution)

__ Medical Equipment

__ Motor Vehicles

__ Other Manufacturing: _____

OTHER INSTITUTIONS

__ Association (Association, Federation, Non-Profit Foundation, Society)

__ Charitable, Foundation

__ Corrections (private, state, federal, city, county)

__ Cultural (Cultural Institutions)

__ Educational (Training Center, K – 12, ~~Higher Education~~)

__ Educational – University, College, Technical Institute

__ Federal Government

__ State/Provincial Government

__ City/County Government (Law Enforcement, Library)

__ Special District/Quasi-Government (Special Districts, Transportation Authorities, School Boards)

__ Military

__ Religious

__ Research

__ Other institutions: _____

11. Check the description that best represents the facility on which you are reporting data:

__ Space within a building

__ A single building

__ Multiple buildings in one location. Specify number of buildings _____

__ Multiple buildings in multiple locations.

__ Specify number of buildings and locations

_____

12. Which of the following best describes the facility that you are reporting on?

__ Own and occupy

__ Own and lease to others

__ Lease as a tenant

__ Please specify the _____% Leased, _____% owned (% Leased + % Owned = 100%)

13. Check the predominant use of this facility (check the one category that best fits).

ASSEMBLY

__ Community/Recreation Center

__ Convention Center/Exhibit Hall

__ Religious

__ Stadium/Arena/Auditorium

__ Other, please specify:

_____

INDUSTRIAL

__ Manufacturing

__ Warehouse

__ Other, please specify:

_____

Office

__ Headquarter

__ Branch/Regional Office

__ Medical office

__Mixed Use (office is dominant component)

__Other, please specify:

_____

Other

__ Bank branch

__ Big Box/Department Store

__ Data Center (Data/Computer Center/Switch Facility)ity Description

__ Education (Education/Training/Classrooms)

__ Embassy

__ Health Care (Acute Care/Clinic/Behavioral Care/Medical Center/Rehab)

__ Library

__ Lodging and Hospitality

__ Military

__ Multi-family (Condominium/Student Housing)

__ Multi-use (no single type of space dominate more than 50%)

__Museum (Gallery/Zoo/Arboretum)

__ Research Center (Research)

__ Senior Housing (Assisted Living/Skilled Nursing)

__Sports and Entertainment (Aquatic/Gaming/Golf Course)

__ Transportation (Airport/Rail/Bus Station)

__ Other, please specify:

_____

Judicial

__ Courthouse

__ Correctional

Laboratories

__ R & D

__ Biosciences

14. Check the description that best fits the setting of your facility in the city listed above.

__ Central business district

__ Secondary downtown location (uptown, midtown, etc.)

__ Suburban area

__ Industrial park

__ Business park

__ Rural area

15. What is the age of this facility? (To be calculated from the year it was built)
_____ years

16. What is the zip or postal code of this facility? _____

17. In what year was the last major renovation of any type performed at this facility?
_____

a. **What type of renovation was this? (roofing, HVAC, windows, etc.)_____**

18. This facility operates and is heated and cooled for occupant standard use:

Days / week _____ (1-7)

Hours / day _____ (1-24)

19. Does this facility have a central mechanical plant that serves multiple buildings? (electricity, steam, chilled water)

__ Yes

__ No

20. Which of the following best describes the status of your current buildings with respect to green certification?

__ Manage or occupy at least one green certified building

__ Manage or occupy building(s) with green elements but no certification

__ Manage or occupy building(s) with no green elements

21. **What is the total number of full- and part-time employees, contract workers or tenants that occupy space at this facility? _____**

22. **What is the average annual vacancy rate at this facility? _____** %

23. **_____ IFMA Exterior Gross Area (ASTM E1836-08)**

    The area of the floor measured to the outside face of the walls that enclose the floor(s) of the

    building. This includes interior areas, exterior gross to dominant portion, interior parking, excluded,

    interstitial and restricted headroom areas.

24. **_____ Plannable Gross Area (ASTM E1836-08)**

    The gross area minus exterior walls, major vertical penetrations and interior parking spaces

    Plannable Gross Area – the portion of a floor that is totally enclosed within the interior face of

    perimeter encroachments at the floor plane and where there are no perimeter encroachments

    enclosed at the inside finished surface of the exterior walls.

    a. **If another floor area measurement is used, please specify:**
       _____

25. **Developed land (built, paved, or landscaped) on facility site _____**

__ Acres

__ Hectares

(Include “natural” or “native” areas only if actively maintained.)

JANITORIAL COSTS

26. Please select the method your facility is cleaned:

____ team cleaning (Several specialized (bathroom tech, duster cleaner, etc.) personnel cleaning a specific areas

____ area cleaning (single personnel responsible for all duties i.e., dusting, bathroom etc.)

27. Janitorial costs are costs associated with the cleaning of offices, other work areas, restrooms and common support space. These include wages, benefits, staff support, supervision, administration, supplies, paper goods and non-capital equipment (e.g., brooms, floor polishers). Please include service providers’ costs and/or any supplemental cleaning services provided by landlord.

Total annual Janitorial Costs $ _____ .00

Non-Capital equipment *is defined as tangible, non-consumable property with an acquisition cost of </=* **$2,000.00***. Non-Capital equipment has a normal useful life of at least one year, is not permanently attached to or incorporated in buildings and grounds, and is used to conduct business. The cost of equipment includes the purchase price plus all cost to acquire (tax, shipping and handling), install and prepare equipment for its intended use.*

28. Please estimate how your janitorial costs provided in Q27 are divided among the following categories:

_____ % In-House Staff (to include wages & benefits)
_____ % Contracted labor [DEFINE CONTRACTED LABOR HERE]
_____ % Supplies (including paper goods, Cleaning supplies, Non capital equipment)
= 100%

29. Does this facility require specialized cleaning or labor for clean rooms, secured areas (labs, data centers, etc.) or any other specific areas?

Yes, Please Specify Total Cost _____ Total Plannable Gross Area _____
No

30. Are specialized cleaning services contracted out (outsourced)?

___ Yes.
___ No

JANITORIAL PRACTICES

31. **Number of FTEs allocated to janitorial function:**
    _____ Janitors
    _____ Janitorial Supervisors
    _____ Project cleaners/special cleaning/floor crew

For contracted services:

32. **Number of in-house employees supervising contract: _____**

33. **Number of years existing contractor has been in place: _____**

34. **When your janitorial contract comes up for renewal, are you likely to:**
    __ Renew the contract with the same provider
    __ Re-bid the contract
    __ Move janitorial back to an in-house function

35. **What percentage of your janitorial contract is based upon:**
    _____ % Performance
    _____ % Tasks and frequency
    = 100%

36. **Does contractor provide: (Check all that apply)**
    __Supplies
    __Paper products
    __Equipment
    __Background checks
    __Training

37. **When is your primary cleaning done?**
    __Normal work hours
    __Before/After work hours

38. **Please indicate how often the following janitorial tasks are performed:**

1 = More than once a day	5 = Bi-weekly	9 = Annually
2 = Once a day	6 = Monthly	10 = As required
3 = Semi-weekly	7 = Quarterly	11 = Not performed

4 = Weekly 8 = Semi-annually

___ Trash removal
____Sweep/mop tile/composition flooring
____ Upholstery vacuuming
____ Recyclables collected (should this be in the sustainability section?)
____ Carpet vacuuming
____ Spot clean glass/entrance doors
____ Spot carpet cleaning
____ Spot clean walls/switch plates
____ Entire carpet cleaning
____ Interior window/window blind cleaning
____ Restroom cleaning
____ Exterior window washing/cleaning (high-rise)
____ Steam cleaning of ceramic walls
____ Clean light fixture/ventilation grilles
____ High dusting (60" or higher)
____ Low dusting (lower than 60", includes furniture)
____ Dust /clean desk equipment (phones/keyboards)
____ Data center cleaning
____ Sanitize telephones and/or keyboards
___ Kitchen/breakroom cleaning and/or Workroom cleaning

39. **Please specify the floor area cleaned (if different from Plannable Area)**
_____

MAINTENANCE PRACTICES

40. What type of system are you using for maintenance management? (Check all that apply)
__ Building Information Modeling (BIM)
__ Computer Aided Facility Management (CAFM) system with maintenance module
__ Computerized Maintenance Management System (CMMS)
__ Integrated Workplace Management System (IWMS)
__ Manual spreadsheets
__ Excel spreadsheets
__ Other:
_____
__

41. Is your maintenance management program managed:
__ In-house
__ Contracted Out

__ Combination of In-house and Contracted out

42. What type of maintenance productivity metrics do you collect? (Check all that apply)

__ Cost/ft_2 or m_2
__ FTE/ ft_2 or m_2
__ Response time for work requests
__ Utility and/or equipment downtime
__ Percentage of work orders closed on time
__ Number of service complaints
__ Percentage of budget spent on breakdown (unplanned) maintenance [
__ Corrective backlog maintenance completion
__ Planned (or preventative) maintenance completion DEFINE THIS]
__ Other, please specify
_____

43. For work requests, do your customers: (Check all that apply)

__ Fill out a paper request
__ Send request electronically
__ Contact a call center or help desk, i.e., a centralized location for all services
__ Contact the individual FM function or service needed
__ Personally tell maintenance personnel
__ Other
_____
___

44. Which of the following electronic hand held devices do Service staff use for documentation of work orders, PMs? (Check all that apply)

__ PDA
__ Smart phone
__ Tablet
__ Other

The next five entries pertain to maintenance costs. For each of the following five categories, please include all repair, preventive, materials, direct labor and contract costs. For those who manage leased facilities, in both sole-occupant and multi-tenant spaces, some of these costs may appear in common area maintenance (CAM) charges or building operating expenses from the landlord or property manager.

45. Annual cost of external building maintenance $_____.00 (% _____)

- *Roof*
- *Skin (siding, masonry, sash, glazing, window washing, external doors)*
- *Exterior signage*

46. Annual cost of interior systems maintenance $_____.00 (% _____)

- *Electrical systems (primary and secondary systems, emergency electrical systems, UPS, lighting systems,*
- *egress signage, master clocks, fire/life safety systems and alarms and remote monitoring, elevator*
- *maintenance/repair)*

- *Mechanical systems (HVAC, chillers, boilers, plumbing, extinguishing systems, back flow prevention,*
- *compressed air refrigeration and non-process related pumps)*
- *Building and general maintenance (interior walls, doors, ceilings, partitions and interior finishes, pest control)*
- *Interior signage*
- *Admin support services – trouble desks*

47. Annual cost of roads and grounds maintenance $_____.00 (% _____)

- *Roadways, sidewalks, parking lots (paving repairs, sealing, striping, parking, roadway lighting, power*
- *washing), snow removal, de-icing*
- *Landscaping (planting, mowing, irrigation)*
- *Parking structures (surface repairs, sealing, striping, lighting and drainage systems)*
- *Storm sewers (catch basins, manholes, sub-surface drainage systems)*
- *Underground fire systems and hydrants*

The following two maintenance categories apply primarily to facilities with central plants and/or large manufacturing plants. Please provide your expenses not already included in line items above if your facility incurs these maintenance costs

48. Annual cost of utility/central system maintenance $_____.00 (% _____)

- *Electrical (generation/distribution)*
- *Mechanical (steam, hot & cold water systems)*

49. Annual cost of process treatment and environmental systems $_____.00 (%_____)

- *Process cooling water systems*
- *Process gas systems*
- *Air discharge scrubbers*
- *Waste water systems*
- *Water treatment plants*
- *Incinerator operation*
- *Solid waste management system (not solid waste costs)*

50. Annual cost of technology $_____.00 (%_____)

- ***ADD IDENTIFIERS WHAT THIS CONSISTS OF***

51. Annual cost of security $_____.00 (%_____)

- ***ADD IDENTIFIERS WHAT THIS CONSISTS OF***

52. Total Annual Maintenance Costs $_____

(this will total automatically – text for programmers)

53. What percentage of your total annual maintenance costs was spent on preventive maintenance versus unplanned repair/breakdown maintenance?

_____ % spent on preventive maintenance
_____ % spent on reactive (repair/breakdown) maintenance
_____ % spent on predictive maintenance
= 100%

CURRENT REPLACEMENT VALUE (CRV)

54. If your facility is owned by your organization, what is the estimated CRV?

55. What is your facility/building area _____ sq ft or M^2

56. 44a. Current Replacement Value $ _____ .00

Current replacement value is defined as the total amount of expenditure in current dollars required to replace the organization's facilities to its optimal condition (excluding auxiliary facilities). It should include the full replacement cost for all buildings, grounds, utility systems, and generating plants. Furthermore, it should meet the current acceptable standards of construction and comply with regulatory requirements. Do not use: Insurance replacement values, book values, cost of contents.

DEFERRED MAINTENANCE

57. What is your current estimated amount of Deferred Maintenance?

Deferred maintenance $ _____ .00

This estimate should not include projected maintenance, replacement or other types of work, such as program improvements or new construction, as these items are considered capital projects.

CAPITAL RENEWAL

58. What is your current budgeted amount for Capital Renewal?

Capital Renewal $ _____ .00

Capital renewal is a systematic management process to plan and budget for known cyclic repair and replacement requirements that extend the life and retain usable condition of facilities and systems and are not normally contained in the annual operating budget. Capital renewal is a planned investment program that ensures that facilities will function at levels commensurate with the academic priorities and missions of an institution. Included are major building and infrastructure systems and components that have a maintenance cycle in excess of one year.

59. Overall Facility Condition Index is _____ %

The facility condition index (FCI) is expressed as a ratio of the cost of remedying existing deficiencies,
plus capital renewal required to bring the building to its original design condition to the current replacement value. FCI is often based on a facility condition assessment provided by a qualified professional assessment team.
(FCI = Deferred Maintenance + Capital Renewal) divided by Current Replacement Value)

MAINTENANCE PLANNING HORIZON

60. Do you have any type of maintenance plan?

__ Yes (If yes, present next group of related questions
__ No (if no skip this section

61. What type of a maintenance plan do you support:
    __ HVAC
    __ Electric
    __ Grounds

__ [List out other types of plans]
__ Other: _____

62. If yes, what is your maintenance planning horizon in general overall?
__ 1 year
__ 5 years
__ 10 years
__ Other

63. How often are your maintenance plans reviewed?
__ 1 year
__ 2 years
__ Other

MAINTENANCE STAFFING

64. How many full-time equivalent (FTE) workers are used for base building operations and maintenance at this facility?

You may use fractional FTEs. For example, if your carpenter does 50% carpentry, 25% painting and 25% locksmith work, please allocate 0.5, 0.25 and 0.25 in the corresponding categories. Use the following definitions in providing worker counts.

DEFINITIONS:

Full-time Equivalent (FTE) *– The operational and supervisory "person year" headcount that delivers a facility service on an annual, full-time basis, calculated on a 40-hour work week (2080 hours/year.)*

Maintenance Workforce *– Exclude those who do primarily automotive, grounds or janitorial work in your totals.*

Administrative Support *– Administrative support includes help desk personnel and al other who perform administrative support, including all front office staff, budget, planners, schedulers, receptionists, CMMS administrators, and estimators.*

Maintenance Management *– Group supervisors and salaried managers involved in operation and maintenance of the facility.*

65. Maintenance Workforce	**# of in-house FTEs**	**# of contract FTEs**	**# of shifts per day**	**# of days per week**
Carpenters				
Controls & low voltage				
Electricians				
Generalists				

HVAC & central plant				
Locksmiths				
Mechanics				
Painters				
Plumbers				
Stationery engineers				
Other FTEs (Please specify)				
Maintenance Workforce Totals =				

66. Maintenance Management	**# of in-house FTEs**	**# of contract FTEs**
Group Supervisor *(ex. Foreman) "first line supervision"*		

Operations and Maintenance Manager *"second line* *supervision and above"*		
Other Maintenance Management FTEs		
Maintenance Management Totals =		

67. Administrative Support	**# of in-house FTEs**	**# of contract FTEs**
Help desk		
Administrative assistant		
Other administrative support FTEs		

Administrative Support Totals =		

68. **Total Maintenance Staffing =**

(have programmer calculate result)

Sustainability Section

Definition: Sustainability in Facility Management entails operations and maintenance of the built environment so that organizations thrive and are sustained into the future. Activities are undertaken with consideration of their environmental impact, their cost effectiveness and their contributions to the health and safety of all personnel.

69. Which of the following elements have you incorporated into your janitorial practices? (Check all that apply)

__ Green cleaning certified staff or contracted service
__ Implemented a green cleaning training program for janitorial staff
__ Green cleaning training is tracked and documented
__ Janitorial procedures are audited on a periodical basis
__ Green cleaning procedures are documented
__ A daytime cleaning program has been implemented in the facility

70. Which of the following green cleaning products and equipment have been incorporated into your janitorial practices? (Check all that apply)

__ Use cleaning chemicals that meet green cleaning certified standards
__ Use automatic chemical dispensers to reduce exposure and ensure proper dilution
__ Eliminated all disinfectants and sanitizers, except where specifically required
__Reduced or eliminated plastic trash liners (substituting vegetable-based or re-usable liners)
__ Use janitorial paper products made with recycled content or rapidly renewable resources
__ Replaced multi-fold hand towels with hand dryers

__ Use microfiber wipes and mops instead of traditional dusters, dust mops, and damp mops
__ Have an effective walk-off mat system outside and inside each entry
__Use vacuum cleaners with high-filtration filters
__ Utilize Vacuum cleaners with a decibel level less than 70
__Standup/upright vacuum cleaners are still used

NEW QUESTIONS

71. Are there any local legislative mandates that dictate how your facility operates?
__ Yes
__ No (skip to Q53)

72. If "yes" check all those that apply
__Water
__Electricity
__Carbon reporting
__Waste stream management
__Energy star scores

73. Do you have an environmentally preferred purchasing program?
__ Yes
__ No

74. Is a life cycle assessment conducted for purchases?
__ Yes
__ No

75. Is there a formal measuring and monitoring process in your facility?
__ Yes
__ No

76. Which of the following best describes the status of your current buildings with respect to green certification?
We manage or occupy at least one green certified building
We have plans to undertake green building certification in the next 12 months
We manage or occupy building(s) with green elements but no certification
We manage or occupy buildings with no green elements

77. Does your organization participate in ENERGY STAR or other energy monitoring programs?
Yes

No

78. **Please specify your building's energy star score _____**

Click the following link to sign up to share your facility's ENERGY STAR SCORE with IFMA. **ENERGY STAR Sign Up**

79. Do you have a recycling program in place?

__ Yes
__ No (Skip to Q. XX)

80. Which recycling programs do you currently have in place? (Check all that apply)

__Paper
__Aluminum cans
__Computer parts
__Fluorescent light bulbs
__Carpet
__Batteries
__Plastic
__Ink cartridges
__Cardboard
__Kitchen oil
__Construction debris
__Other, please specify
_____

81. What is your percentage of solid waste diverted from landfill, either through recycling or composting? _____ %

UTILITY HEADER

82. Are water costs combined with sewage?

__ Yes
__ No

83. Utility costs are costs associated with providing electrical power, potable water, and central heating and cooling and sewage service to the facility. Utility costs include the purchase cost of oil, gas, water and electricity and all associated transmission costs. Utility costs also include sewage service, central steam and cooling.

NOTE: To ensure consistency, please continue to report your values (currency and units of
measurement) as you did in previous questions.

Annual Cost and Units Consumed Annually

Energy Line Item	Annual Cost	Unit
Electricity (main grid)	$_____	_____ kWh

Electricity (renewable)	$ _____	_____ kWh
Etc.	Etc.	Etc.

Electricity (main grid) $ _____ .00 _____ kWh
Electricity (renewable) _____ kWh
Fuel Oil $ _____ .00 _____ gallons/liters
Gas $ _____ .00 _____ therms/m3
Steam (per 1000) $ _____ .00 _____ lbs / kgs
Chilled Water $ _____ .00 _____ Day - tons
Water $ _____ .00 _____ gallons/liters
(If purchased)
Sewage $ _____ .00 _____ gallons/liters
(If not included with water)
Other $ _____ .00 Please specify _____
Total Annual Utility Costs $ _____
(this will total automatically)

UTILITY MANAGEMENT PRACTICES

84. Please specify the unit of temperature you use.
___°F
___°C

85. What are your summer and winter space temperature standards?
Summer high: _____ Winter high: _____
Summer low: _____ Winter low: _____

86. Compared to the year prior to the reporting year, by what percentage has your utility consumption changed, if any?
Decreased or Increased
> 10.0% 0.1% – 5.0%
5.1% – 10.0% 5.1% – 10.0%
0.1% – 5.0% > 10%
No change

87. The difference in utility consumption is primarily the result of:
__Expanding total space
__Reducing total space
__Implementing specific energy management/conservation practices
__Net usage reduction
__Increased number of cooling/heating degree days for the year
__Decreased number of cooling/heating degree days for the year
__Other
_____

88. Which of the following energy management practices have you undertaken to reduce utility usage, if any? (Check all that apply)

EQUIPMENT AND CONTROLS
__Recommissioned building systems
__Installed energy-efficient motors

__Installed energy-efficient ventilation equipment
__Installed energy-efficient chillers
__Installed energy-efficient heating equipment
__Set back thermostat
__Installed energy efficient air compressors
__Adjusted operating hours of HVAC
__Repaired compressed air and steam leaks
__Increased the number of items monitored/controlled through building automation systems
__Require the purchase of energy-efficient selections, e.g., Energy Star-rated equipment
__Installed electrical sub-metering for usage tracking of sub-units
__Installed variable speed drives for pumps and motors
__Monitor power quality to balance loads and reduce waste heat
__Implemented smart metering
__Implemented smart or automated demand response
__Asset direct metering eg. Pumps, Motors, etc.
__Change pneumatic controls to digital

BUILDING AND ENVELOPE
__Installed energy-efficient windows
__Improved building shell insulation
__Performed thermal imaging study to detect a building's sources of heat loss, e.g., motors,
electrical panels, and building envelope

WATER
__Installed low flow water fixtures
__Installed waterless urinals
__Implemented cooling tower blowdown recycling
__Implemented rain harvesting
__Planted native/drought tolerant plants
__Installed computerized irrigation controllers
__Reduced or eliminated irrigation
__Use gray (reclaimed) water

LIGHTING
__Replaced existing light fixtures with new light fixtures
__Retrofitted existing light fixtures
__Installed energy management system
__Installed occupancy sensors
__Implemented daylight harvesting
__Selectively reduced the number of lamps in over-lit areas
__Adjusted operating hours of lighting

RENEWABLE
__Installed solar systems for electric use
__Installed solar systems for heat use
__Installed a wind generation system for electricity
__Installed a geo-thermal system
__Purchased green power from an outside source
__Uses alternative or renewable energy (solar, geothermal, wind, biomass, fuel cells)

__Has onsite power generation
__Has electric vehicle charging stations
__Solar power for hot water

EMPLOYEE AND TENANT TRAINING
__Provided training to FM staff to reduce energy use
__Promoted energy use reduction to employees/tenants

STRATEGY PLANNING
__Hired an energy consultant to find ways to improve energy efficiency
__Conducted energy-related due diligence for new real estate
__Conducted an energy audit
__Put into place a strategic energy management plan
__Has a written plan for strategic energy management in place

89. Do you have a dedicated in-house workforce for energy management (procurement, conservation, tracking, net usage reduction)?
__ Yes
__ No (Skip to Q. 70)

90. Please provide the number of In-House FTEs _____

91. Please provide the number of the Outsourced FTE's _____

92. Is your facility's utility management program managed by a Building Automation System (BAS)?
Yes
No (Skip to Q. 41)

93. Does your BAS provide utility use trends and energy management summary reports?
Yes
No

94. Is your BAS system: (Check all that apply)
__Pneumatic
__Direct Digital Control (DDC)
__DDC/Pneumatic retrofit

95. Is your BAS a single integrated system for multiple buildings?
Yes
No

96. Do you use your BAS report output in your decision making or planning process?
Yes
No

Output - From a benchmarking perspective, the type of KPI/metric comparative benchmarking data we would like to see as an output in the report is:

1. Energy Utilization Index (kBtu/SF-year)
2. Data reported in terms of region of the country (e.g. climate region), and facility use type.
3. Ranking of Energy Management Practices from most implemented to least implemented.
4. Cost of energy by source ($/SF)
    a. Grid-purchased electricity
    b. Natural gas
    c. Fuel oil
    d. Purchased steam
    e. Purchased renewable resources (solar, wind, hydro, etc.))

SECURITY SECTION

97. Does your facility provide security operations? (((Need filter question here – so if the facility does not support/have security operations participants can skip section))

__ Yes

__ No (Skip to Q 86)

98. In which of the following areas does your enterprise have security operations (check all that apply):

Region	No Operations	Operations but no Security Services	Operations with Security Services
Northwest (Alberta, British Columbia, Idaho, Manitoba, Oregon, Saskatchewan, Washington)			
West Coast (California, Hawaii)			
Canada East (Ontario, Quebec)			
Northwest (Connecticut, Delaware, Massachusetts, New Jersey, New York, Pennsylvania)			
Midwest (Illinois, Indiana, Kentucky, Michigan, Ohio)			

North Central (Iowa, Minnesota, North Dakota, Nebraska, Wisconsin)			
South Central (Kansas, Louisiana, Missouri, Oklahoma, Texas)			
Southwest (Arizona, Colorado, New Mexico, Nevada, Utah)			
Mid-Atlantic (District of Columbia, Maryland, South Carolina, North Carolina, Virginia)			
South (Florida, Georgia, Tennessee)			
International (Asia Pacific, Caribbean & Latin America, Europe, Africa and Middle East)			

99. Number of FTEs (in-house and/or contracted) allocated to security function:
_____ Security supervisors
_____ Security officers

100. Are security services conducted:

__ In-house

__ Contracted (If contracted skip to 74a)

_ Hybrid (In-house and Contracted)

For contracted services:

a. Number of in-house security employees supervising contract security: _____

b. Number of years existing contractor has been in place: _____

c. When your security contract comes up for renewal, are you likely to:
__ Renew the contract with the same provider
__ Re-bid the contract
__ Move security back to an in-house function

101. Are your security officers armed?

__ Yes

__ No

102. Compared to your 2014 security operating budget how has your budget changed in 2015?

__ Increased

__ Stayed the same

__ Decreased

__ Don't know

103. By what percent has your security operating budget increased in 2015 compared to 2014?

_____% (Please enter only whole numbers and not ranges).

104. By what percent has your security operating budget decreased in 2015 compared to 2014?

_____% (Please enter only whole numbers and not ranges).

105. Approximately, how many employees are in your overall organization?

_____(Please enter only whole numbers and not ranges).

106. What is your organization's 2015 security budget? Please provide organization-wide, global security budget including all security staff, hardware, software and depreciation for security equipment.

_____ Please enter only whole numbers and not ranges.

107. Do you have closed circuit television security?

_ Yes (if yes, ask Q82)

_ No

108. Who controls it?

INSERT OPTIONS

109. Who monitors it?

INSERT OPTIONS

110. Do you use Identification cards for facility access?

_ Yes (If yes, ask Q84a)

_No (if yes, ask Q85)

111. Who controls it?

INSERT OPTIONS

112. Who monitors it?

INSERT OPTIONS

113. Do you use biometrics for facility access?

_ Yes (if yes, ask Q85a)

_ No (if no, ask Q86)

114. Who controls it? _____

(Insert choices here)

115. Who monitors it? _____

(Insert choices here)

TECHNOLOGY HEADER

116. Does your company use **Computer Monitoring Maintenance System (CMMS):**

__ Yes (if yes, check applications used- below)

__ No (Skip to Q88)

Preliminary Key Performance Indicators	Yes	No
Customer Perspective	1111111111111111	44444444444444444444444444
Work Order Response Time		
Percent Rework (Call Backs)		
Customer Satisfaction		
SLA Performance (APPA LOS)		
Process Perspective	1111111111111111	11111111111111111111111111
Craft Utilization/Productivity		
PM to CM Ratio		
PM/PdM Compliance		
Work Order Aging (Trend)		
Employee Perspective	1111111111111111	11111111111111111111111111
Staff Turnover		
Stewardship Perspective	1111111111111111	11111111111111111111111111
Cost/GSF Benchmarks		
Facility Condition (FCI Trend)		
Total Cost of Ownership (TCO)		

117. Does your company currently use **Computer Aided Facility Management (CAFM)?**

__ Yes (if yes, check applications used- below)

__ No (Skip to Q89)

118. [FOR EACH TECHNOLOGY / IT SYSTEM BELOW, CONSIDER ASKING A QUESTION THAT CAPTURES THE VALUE THE FM ACTUALLY GETS FROM THE TOOL. For example, "What value has [the system] brought to your organization? Or maybe, "What is your level of agreement with the following statement: [the system] make my job easier. "Strongly Disagree Disagree, etc. etc."

119. Which of the following does your company use CAFM to measure:

	Yes	No
Asset inventories		
Space utilization		
Personnel and staff levels		
Communication patterns		
Real Estate		
Project Management		
Safety and environmental conditions		

120. Does your company presently use **Facility Management Information System (FMIS):**

__ Yes (if yes, check all applicable options below)

__ No (Skip to Q90)

	Yes	**No**
Asset Management		
Work Management		

Space Management		
Project Management		
Budget Management		

121. Does your company presently use **Integrated Workplace Management System (IWMS**):

__ Yes (if yes, check components/applications used- below)

__ No (Skip to Q92)

	Yes	**No**
Real estate and lease management		
Facilities and space management		
Maintenance management		
Project management		
Environmental sustainability		

122. Does your company presently use **Building Information Management System (BIMS):**

__ Yes (if yes, check applicable items used- below)

__ No (If no, skip to Q93)

	Yes	**No**
3D visualization of buildings		
Change management		
Construction simulation		
Data management		
Operational management		

123. Does your company use **Building Management/Building Automation System (BMS/BAS):**

__ Yes (if yes, check applications used- below)

__ No

	Yes	No
Building Automation		
Energy Utilization Tracking		
Energy Demand Management		
Used with EMS component		

IFMA would like to thank you for participating in this effort. Provided IFMA attains the sample needed to allow for statistical representation to support different industries, this electronic report should be ready for distribution to participants in late December 201

APPENDIX D: SME COMMENTARY

SME 1

O&M Survey

Q22

In intro, say 'will be provided to you' instead of 'participants' to make it more personal.

The suggestion of sources may be confusing, you ask for 2015-2016 budget but not all orgs have that budget year, many will be calendar. So, should ask for last fiscal year (actuals) or the most recent 12 month actuals. I would suggest the last fiscal and ask them what the period is for if necessary.

Q199

Need different questions.

In House FM Manager OR Outsourced FM Manager

Why ask if they are a consultant, they don't manage buildings and this is about the buildings.? If you think a consultant is answering FOR the FM, then add a note and ask whether it is for inhouse or outsourced. [Make clear that they don't have to reply. Option "does not apply"].

Q163

At the bottom suggest they fill In more than one survey for additional buildings. (make sure this will be possible) [note at the end for the end]

Q11 [general industry] + Q10 [service based]+ Q26

I thought we were trying to reduce the #. Did the past responses inform these list? [point of clarification]

Plus, when I indicate Services (banking/hospitality, health care, etc.) in the first Q11, in the next Q (Q10)it then includes media IT, Trade, Transport, Utilities in the next question Seems odd.

Then later it asks me the predominant use of the facility in Q26

This does not make sense and needs to be reconciled. [jd – first line of questioning is on industry that facility serves. Second line of questioning is on the predominant use of facility – this distinction allows for variable use of facilities within industries, such as the office headquarters of a large Healthcare Services company]

Q24

You tell them at the intro to chose ONE building, so why are we asking the multiple buildings question? They were not given the choice of reporting on multiple buildings at the start. [take out # of building question]

Q25

These answers will likely be connected closely with Q23 so put them together. [leave as is]

Own and lease to others my be confusing. A company may own and occupy a building + lease space to thers. This was my situation at Bell Canada…

Q26

See above (Q11, etc.)

Q29

This is the 4th or 5th separate question about the type of building use/occupancy. Lets reconcile and make it easier….Adding Medical Office to this list does not make sense, the others relate to the type of occupancy, not the organization's business function. [leave as is]

Q33

Combine industrial park/business park unless you know you want to analyze/report on these separately. I don't know why you would want to. . [leave as is]

Q40

Since we ask for a single building, how will this question be used for analysis. It isn't clear to me. Why is it asked. If you have to ask it, put the NO answer first, it will be the most common by far. [leave as is]

Q41

Again, you ask for one building, this relates to the portfolio so is highly confusing. And why isn't this Q in the sustainability section? If it is about the portfolio overall, make it clearer in the question directions. [leave as is]

Q42

This will be confusing for some. If they are a tenant, you want the occupancy of the entire building? Yet they won't be reporting the total cost for the entire building. [clarify of just space they are reporting on]

It needs to be reworded.

Q1

Suggest separate out the currency and metric question.

Many Canadians will probably have info by Sq.Ft. since it is still commonly used in facilites in Canada.

And it is not ‘English’ it is ‘Imperial’[make changes]

Q46

Do you mean the total area of the site or the area outside the building (not including the footprint of the building)? [including the footprint of the building]

Cleaning

Q164

Should tell them that the costing will be all asked at the same time at the end of the survey. [clarify at beginning]

Q63

That is sometimes known as ‘Cleanable area’ so perhaps should use that term as well. [add this in]

Q51

How will this question be used for analysis and reporting since we don’t ask how many sq.ft or other details to use for analysis. [leave as is]

Q58

This is not useful unless you ask a question about WHY they are doing that. I.e. contract ending, bad performance, etc. Should consider how and why this information will be used in the analysis / report.

Also, you ask about bringing in-house, but there is no question about moving to outsource. The first two questions don’t do that….[leave as is]

Q60

Clarify about what ‘provides’ means. When I was a contractor for jani, we provided paper products as part of our contract price for some and provided it at an extra cost for others. Clarity is needed. [clarify this]

Why are we asking about background checks? So minor it is not important. .[leave as is]

Maintenance

Q155

Same, tell them $ are asked later.

Q64

BIM is not used for Maintenance Management, remove it from the question. .[leave as is]

For the CMMS question, add the word ‘stand-alone’ in front. .[do this]

Q65

Not a clear question.

Do you mean the actual maintenance work or management of the process? Review this again

Remove Utility from the equipment downtime item.

Should not be #FTE/M, it should be M/FTE

Response is only a small part of the measurement, What about asking if they calculate the time to repair, which is more important? [jd – include]

What is Planned Maintenance (time/meter readings) completion ? This is not clear. Clarify

You ask for ‘corrective backlog maintenance completion’ which is a confusing statement, but you don’t ask for the preventive maintenance backlog, which is as important. [jd-include]

Q67

A common term is ‘occupant’, not just customer, so might want to add. [jd-include]

Does ‘send request electronically’ mean by email or a sophisticated web interface or on a mobile app? There is a difference so suggest you ask different questions.

Q68

You need to ask about whether they : use a paper process OR update on a desktop/laptop.

Q84

Do you mean a preventive maintenance plan? If they answerd CMMS/IWMS/CAFM in an earlier question, then the question is likely yes. Perhaps reword and put this with the system question. [jd-review this again – he may have point in using the word preventative – also 85 & 86]

Q85

I don’t understand what this question is. If filling it in, I would not know what to answer.

And grounds is very different from HVAC/Electrical.

Q86

What is this question? Again, I would not know how to answer. A Preventive maintenance plan is an annual plan with some periodic items up to about 5 years. That is common.

Do you mean capital replacement?

Q87

Why ask this? Why only 1 or 2 years?

Sustainability

Q90

You ask in the cleaning section about daytime cleaning, don't ask again.

You ask more about documentation than practices.

Auditing jani processes is not about sustainability.

Needs to be reconciled.

For cleaning questions, should put in the cleaning section..(applies to Q90 and Q91)

Q91

There is some overlap wht the previous question.

Not all these things are about sustainability. Move to jani section.

Q200

Not clear about the formal measuring / monitoring answer – you mean for sustainability likely so add that.

Q97

Is a repeat from a previous question. Reconcile.

Utilities

Q164

If you are going to ask about the % change later, mention that. If you don't, then ask for the% change here. Otherwise it is not helpful for benchmarking. [jd- leave as is comes up in cost section]

Q111

Wording could be better. 'Do you use a BAS to help you manage energy conservation' – [jd-change wording]

Security

Q117

Why the definition? Don't have one anywhere else. It is most often simply called security or security services, not security operations.

In the question, don't ask is Facility Management responsible'

Ask 'Are you responsible' or 'is your FM department responsible' – [jd-already changed]

Technology

Q184

I recommend eliminating the neutral answer in the middle but adding a 'not applicable' answer. [jd-leave as is]

Q185

I have a hard time understanding this. By software/it, do you mean CMMS/CAFM? If so, how can the answers include multiple times over the past 2 year.

If you are assuming they are involved in IT projects (beyond MACs) then that needs to be clear. But hardly any are….

Q186

Same issue with intent/purpose.

And why the details here when you don't ask anything like this for other services?

Q186

Same issue.

Q170

We don't 'partner' they are supplers. So please change question.[jd- this may need changing]

One answer is 'we don't use' a FM software yet we ask them this exact question further up. Should be skipped. Or ask this question when you ask about FM – [jd -add skip logic based on 0 answer from 185]

In any case, we should not be naming suppliers in an IFMA questionnaire so this shold be removed. There are many, many other software providers who are not listed and it may look bad as a result. [jd- trying to gather software solution providers, others will be listed in report as they are reported]

Organizational

Q188

Some of these are very similar or essentially the same things.

(performance model, KPI, balanced scorecard) [jd – they are similar and may overlap: working on reviewing research for specifics to help, may need to revise slightly to help with validity of question for thesis topic – we can discuss]

Q193

Should clarify that you mean a general occupant survey. They may do other things (post occupancy, transaction) that are very different. [jd-include "or general occupants"]

Q194

This is a long form answer, the first (and only?) but the purpose of the survey is to get metrics that can be analysed. Should have choices. [jd – will be easier to categorize, interpret – but would need to generate list of likely actions – will review research]

Q23

One answer is that the FM department reports to Facilities. That is circular and should not be an answer.

Do you mean Corporate Real Estate department instead? (which may include]leasing/sales/development not part of the fm department) [jd – second person who has mentioned this?]

Q204

Nobody will understand the difference between this question and the previous one.

Q9.

Change question. What if an admin or an FM coordinator or technician is responding?

Do you mean the total FM organization?

Do you mean the FM staff at the building that is being reported on?

What if the fm is regional, won't apply to the building or the portfolio.

Change this question to be clearer.[jd-could use some clarity]

Costs and Staff Levels

Q173

I strongly disagree with this approach.

If an FM does not have the numbers, they should not be filling in the survey or be an FM! If they don't have an account code for something specific that needs to be reported, they should estimate, not provide a range.

If you must do this, then don't tell them that ranges will save them time.

Tell them they can use ranges only if they don't have the actual numbers to report.

Q174

Change wording, nobody downloads a 'paper form'

Same on Q190 to download.

I really hope this will be an excel spreadsheet. IF so, tell them….

Q192

Upload a scanned copy? Clarify

What about just uploading the file itself? (i.e. a completed excel form.

Why would they scan it?

SME 2

1. What are the Q numbers? They are random in isolation (Q22, Q3, etc) at first, but seem to be more or less sequential later.
2. The first underlined part ("2015-16 FM Budget…") needs a carriage return in the middle to create a second line.
3. Q12 doesn't have an obvious business/industry choice – where does, say AMEX's FM click? I guess "other", but it seems companies would be a big source of data for this survey – that's what IFMA members should most be anyway.
4. The running commentary at the top of each new page is good – it makes me smile when I'm taking the survey. Not because they're accurate, but because you know they're purposely overly enthusiastic.
5. Q23 is a single choice question. It might be that someone has a dual reporting line though.
6. Q's 50, 59, 79 let you move on even if the total is not 100%
7. Q71 second bullet (mechanical) needs a comma after "prevention" and optionally after "refrigeration". The list starts with HVAC, but lists chillers and boilers separately, which are technically part of HVAC. That might be modified a little: "HVAC/chillers/boilers", something like that. It would look ok with "HVAC (including chillers, boilers, etc)" except it's already all in brackets. It's a fine point, but some FMs will look at that and think we don't know what our terminology means, while other won't even notice (or understand themselves possibly). Better to be exacting, I think.
8. Q72 second bullet "de-icing" is capitalized but doesn't need to be.
9. On maintenance cost questions which have the final option of "exact cost", how will they be coded? Will they be lumped in with the pre-defined buckets? If so, what is the purpose of the added detail?
10. Q82 talks about the "academic priorities and missions of an institution". Did I misunderstand the audience for this survey? I thought it was for all IFMA members, most of which will be with companies.
11. Q104 asks for the data in $, but earlier we had them specify which currency they were going to use.

SME 2 Responses

1. The Q numbers refer to the order in which the questions were entered into the survey. They only show to internal reviewers and are not present for the respondents taking the survey
2. That change has been made. Thank you for catching this.
3. Q12 is a follow up question to question 11. It is meant to further clarify when respondents pick "Other institution" in question 11 and only displays to respondents that make that selection. Business modalities are reflected in other follow up questions that follow question11.
4. Thank you. Hopefully it keeps it light and people motivated to complete it.
5. Thank you. The question is meant to be a single choice. We agree that the possibility could exist, however, even in such an arrangement, there is likely to be a primary department that they formally report to.
6. Thank you for catching this. I will update/revise the validation logic for this question.
7. Thank you for feedback. The changes have been made.
8. The change has been made.
9. The intent of the cost questions is to get the exact cost if they have them and to use the range values if they are uncertain. These values will be analyzed separately using the exact cost. We are in the process of clarifying this issue in the survey.

10. Agreed. We have replaced academic with business. Thank you.
11. We are checking on how the data displays and will make the revision.

APPENDIX E: SURVEY REVISIONS & CHANGES

November 5, 2016
O&M Detailed Survey Update

General Comments

- All of the major cost sections & detailed FTE counts have been moved to the END of the survey (grouped by custodial, maintenance, and utilities).
- The respondents will have the opportunity to print off a form that lists out the requested cost and FTE information. They can then use this form to input results on the online survey (or just simply upload a scanned copy of their survey – the results will then manually be inputted into the results for that respondent).

Questions for SMEs.

- (my suggestion is for the largest most active building) Can most FMs provide cost data for individual buildings, or is it easier to provide just a single lump sum for all of their buildings? Instruction states "All responses in this survey should be about the largest, most active facility you manage" – is this about the facility overall, or just a single building? Either way will work, just need to be clear.

Suggested Removals *("Q#" refers to the Qualtrics-created question number. The numbers have no specific meaning or relation to question order).*

- Q2. Please describe the specific product, service or business activity of your organization or the organization you are contracted to manage
- (reinclude-unless this is covered elsewhere in the survey. We are making a push to include more universities and pharmaceutical companies on this effort) Q51. Does this facility require specialized cleaning or labor for clean rooms, secured areas (labs, data centers, etc.) or any other specific areas
- (This is one of the more asked about sections of the report, prized information. Although, some of these questions are now standard within the industry i.e.,

expected to have within buildings, I would highly suggest keeping this).The ENTIRE sustainability section:

  - Q90. Which of the following elements have you incorporated into your janitorial practices? (Check all that apply)
  - Q91. Which of the following green cleaning products and equipment have been incorporated into your janitorial practices? (Check all that apply)
  - Q93. Which legislative mandates dictate how your facility operates (if any)?
  - Q94. Do you have an environmentally preferred purchasing program?
  - Q95. Is a life cycle assessment conducted for purchases?
  - Q96. Is there a formal measuring and monitoring process in your facility?
  - Q97. Which of the following best describes the status of your current buildings with respect to green certification
  - Q98. Does your organization participate in ENERGY STAR or other energy monitoring programs?
  - Q101. Which recycling programs do you currently have in place? (Check all that apply)
  - Q102. What is your percentage (%) of solid waste diverted from landfill, either through recycling or composting?

- (Ok to remove) The Building Automation System (BAS) system details:
  - Q113. Does your BAS provide utility use trends and energy management summary reports?
  - Q112. Is your BAS system?
  - Q114. Is your BAS a single integrated system for multiple buildings?
  - Q115. Do you use your BAS report output in your decision making or planning process?

- (My question/statement is – this is not information the FM would have to find, it would be existing knowledge since s/he provides support for the building unless s/he is a new FM at that location – correct? The survey asks "Q152 which of the following energy management practices have you undertaken" and then lists Equipment and Controls, Building and Envelope, etc. etc. It then proceeds to ask the specific measures that were undertaken for each area selected to reduce energy usage. This detailed section is ***quite*** extensive (depending on which options they selected, the user might be asked to evaluate a maximum of 60 activities). Suggested to keep the main areas of energy reduction, but considering removing the details for each of these areas.

- Q110. Do you have a dedicated in-house workforce for energy management (procurement, conservation, tracking, net usage reduction)?

- (Question that comes to mind here is – is it common practice that one building supports multiple buildings? My assumption is yes, its good to know how many buildings support other buildings?) Does this facility have a central mechanical plant that serves multiple buildings? (electricity, steam, chilled water)

- (We should keep this in the survey. Although industry standard has changed from nine years ago, how many buildings still do not have "green certification"?) Which of the following best describes the status of your current buildings with respect to green certification?

- In the utility section, for steam it says "Steam (per 1000)"… what does the "per 1000" mean? Per 1000 _____ ?

Other Revisions / Information Needed

- (this will already be conducted by engaging via the bi-monthly meetings and other communication emails). FM Organization will take care of this. In addition to the normal distribution channels John identified, I think direct personal contact with each FM Organization chapter would help a lot. I would like to personally contact each chapter directly, on behalf of FM Organization. Could you please send me a list that contains the following:

    - FM chapter name

    - Chapter administrator name, email, & phone #

  - Chapter president name, email, & phone #
  - City
  - State
  - # of members in the chapter

- Please define “security operations.” (request made from professional development)
- (Should be only about the current building) Is the security operations budget just about the building / facility they are reporting on, or for their ENTIRE organization?
- (No) Can any of the following activities be removed from custodial?
  - Trash removal
  - Sweep/mop tile/composition flooring
  - Upholstery vacuuming
  - Recyclables collected
  - Carpet vacuuming
  - Spot clean glass/entrance doors
  - Spot carpet cleaning
  - Spot clean walls/switch plates
  - Entire carpet cleaning
  - Interior window/window blind cleaning
  - Restroom cleaning
  - Exterior window washing/cleaning (high-rise)
  - Steam cleaning of ceramic walls
  - Clean light fixture/ventilation grilles
  - High dusting (60" or higher)

- Low dusting (60" or lower, includes furniture)
- Dust/clean desk equipment (phones/keyboards)
- Data center cleaning
- Sanitize telephones and/or keyboards
- Kitchen/breakroom cleaning and/or workroom cleaning

New Questions Added (I'm ok with the new questions)

Q184. In general, how satisfied are you with the implementation and use of FM software / technology solutions in your current organization?

Extremely dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Extremely satisfied

Q185

Over the past 24 months, about how many software / technology projects have you been involved with that were specific to FM?

0 (none)	1-3 projects	4 - 10 projects	11 - 50 projects	More than 50 projects

Q186. Based on your IT project experiences over the past 24 months, please provide your **level of agreement** with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Software vendors assigned their most highly trained, highly qualified people to your contracts.	○	○	○	○	○
Software vendors partnered with the best subcontractors, suppliers, sub-consultants, etc.	○	○	○	○	○
Before the contract was signed, your software Vendors provided a complete operational plan detailing the schedule, risks, metrics, and client responsibilities.	○	○	○	○	○
After the contract was signed, but before the major work activities commenced, your software Vendors provided a complete operational plan detailing the schedule, risks, metrics, and client responsibilities.	○	○	○	○	○

Q187. Based on your IT project experiences over the past 24 months, **how satisfied do you think your VENDORS are with your organization as a client** (how easy or difficult is it to work for your organization)?

Vendors think we are very difficult to work with	Vendors think we are somewhat difficult to work with	Unsure	Vendors think we are somewhat easy to work with	Vendors think we are very easy to work with

Q170. Which of the following software companies do you partner with (if any)? [NICK - IS THIS ALONG THE LINES OF WHAT YOU WERE THINKING? [IF YES, WE WILL GENERATE LARGER LIST OF COMPANIES]

Trimble	Plannon	Oracle
Other:	N/A - we don't use a FM software solution	

(This should be a two part question at minimum. A) does the FM use integrated workplace management systems software– yes or no. If YES, which company(ies) do they purchase the software from? The approach from the company perspective vs

specific software is that it would be easier to determine the company and look at the different software's vs listing all the different software's out per company – what do you think?

The focus of this question is to get a feel about usage, as FM organization has not ever asked about this in a benchmarking aspect and

Q188. **How do you plan on using the benchmarking data from this survey? (select all that apply)**

Identify performance targets (gauging company performance)	Incorporate metrics into a Performance Model	Incorporate metrics into a Balanced Scorecard
Establish Key Performance Indicators (KPIs)	Identification of best-in-class performance / best practices	Uncertain
NO action will be taken	Other:	

Q193. How often do you conduct a satisfaction survey of FM customers?

- Never - do not conduct customer surveys
- Quaterly
- Twice per year
- Every year
- Other:

Q194. How do you implement corrective / remedial actions based on the results of the survey (if any)?

<u>Questions Already Removed</u> (can be added back in if wanted)

- **(Reinclude this question) Please specify the _____% Leased, _____% owned (% Leased + % Owned = 100%)**
- **(Would this not be good to know, so the respondent can know what is the average renovation for facilities of XXXXX thousands of square feet?) In what year was the last major renovation of any type performed at this facility?**
- **(Lets include the latter part of your response of this question in the summary). The percentage allocation (%)for each maintenance area. The current survey structure does not easily allow for the inclusion of this. Plus, it appears to complicate the survey layout? We can include a percentage calculate as part of the final summary report if needed.**
- **Administrative support and related functions (in-house FTEs, contract FTEs)**
- **(Reinclude this question) Energy Star rating. If they even have the result, it will be almost useless because the rating must be in exact same location, reporting time frame as the rest of the survey. It's almost like an apples vs. oranges comparison.**

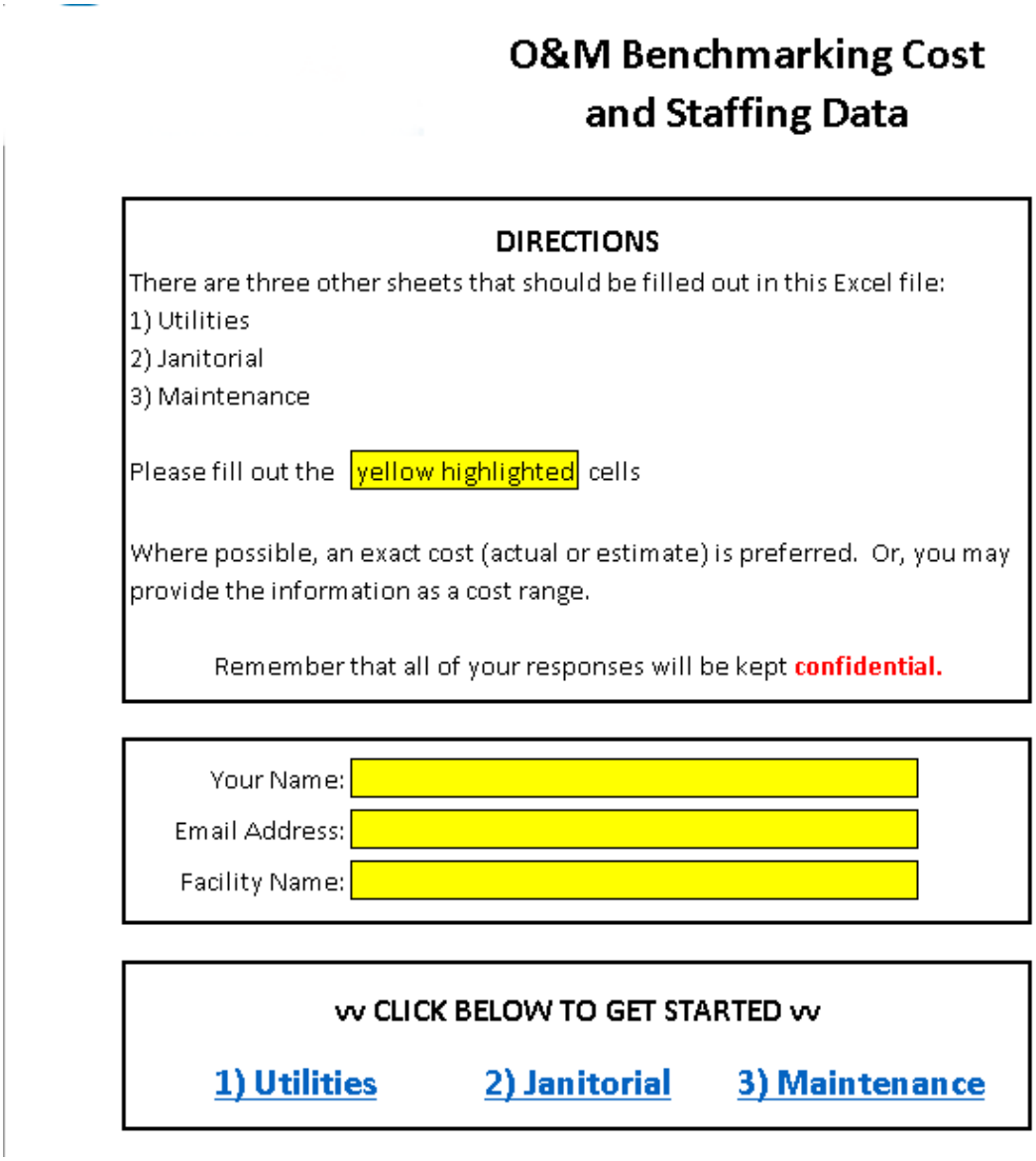
IFMA O&M Survey Changes
Feb 4, 2017

- Q210 – changed date to May 2017
- Q216 – purpose of this question is just to identify the actual building or space being report on. I know some organizations have the same address for all buildings, where as others might have something different. I imagine the responses would be something like "Corporate Headquarters" or "Tenant space – floors 1-3"
- Q24 - The largest most active "**facility**" the user's manages could include multiple buildings. Certain parts of FM costs are step functions, so having the number of buildings (for example) might be useful in interpreting the data. Regardless, we are collecting the total square footage of the site (which will be used to calculate $/SF). Also, the intro states (Q163): "if you are unable to provide data about a single facility, you may elect to report data on multiple facilities."
- Q108 – added "earlier"
- Q170 – recommend to keep this as a single question for the sake of brevity.
- [multiple questions] – moved "EXACT COST" to be the first option on all cost-related questions. The reason it was at the end was formatting. The input box adds in some extra space when it's listed first. We'll contact Qualtrics about potentially adjusting this issue.
- Q44 & Q45 – clarified that the number should be for "the facility you are reporting on", which may include either a single building, or multiple buildings.
- Q104 – clarified steam ($ / 1000 lbs)
- Q185 – reduced # of projects. Clarified question wording.
- Q60 – added "/ pay for" to clarify who pays / brings the products
- Q85 – changed "support" to "have"
- Q85 & Q86 – reduced time scale, changed options to be in month units
- Q90 – change green cleaning training to say "regularly provided and documented"
- Q90 – added text box to allow for users to provide other details on their green janitorial practices.
- Q204 & Q23 – still some confusion / merit of the report to vs. reside questions.
- O&M Sampling of ranges: The use of cost ranges acknowledges that the quality of data in exact values might not be as accurate as "+/- 5%". An analysis of the 2012 O&M survey showed that 40% of all respondents rounded their answers (with almost half of these rounding by $10,000 or more). These ranges fall far outside of a +/- 5% accuracy. Instead, we are looking at the costs as categorical distributions. The expected result is that we will drastically increase the number of responses (and therefore getting a more accurate estimate of actual costs). If the detailed data from those who provide "exact costs" suggest that the costs are trending higher or lower within each range, the average estimates will be adjusted accordingly. The research team will also compare results from this study with the 2009 published report (#32). Any major discrepancies

will be subject to additional analysis and investigation. The goal is to have a +/- 5% range on the categorical costs (this is dependent on how many responses are received).

- Q66 – all of the piped text has been added in.
- Q128 – year changed to 2016.
- Q170 – recommend to keep this as a single question. Brevity.
- Q211 – recommend to keep this question as is. The survey allows users to enter data whether they have it as single numbers for their entire organization, or if they want to do it by individual buildings. This question appears if they say up front they are reporting on multiple buildings.
- Q198, Q59, Q79 – the reason why I did not "force" these to add up to 100 was that it would force the user to answer the question. If they selected "lease and own" (for example), but they don't know what the percentages are, the survey will not let them move forward. However, I don't mind forcing them. My recommendation: don't force them to answer.
- Q1 & Q213 – all questions updated to reflect the currency symbol where appropriate.
- Q133 – added question at very end for how they heard about the survey
- Q134 – added consent to participate on the first page. OR, I can make this on its own page.
- Q170 – I'm still a bit uncomfortable with the software question. It could be off-putting?

APPENDIX F: MANUAL EXCEL COSTS FILE



O&M Benchmarking Cost and Staffing Data

DIRECTIONS

There are three other sheets that should be filled out in this Excel file:
1) Utilities
2) Janitorial
3) Maintenance

Please fill out the yellow highlighted cells

Where possible, an exact cost (actual or estimate) is preferred. Or, you may provide the information as a cost range.

Remember that all of your responses will be kept **confidential.**

Your Name:
Email Address:
Facility Name:

vv CLICK BELOW TO GET STARTED vv

1) Utilities 2) Janitorial 3) Maintenance

O&M Costs and Staffing Worksheet

1) Utilities 2) Janitorial 3) Maintenance

you are here

Are water costs combined with sewage for this facility?

Utility costs are costs associated with providing electrical power, potable water, and central heating and cooling and sewage service to the facility. Utility costs include the purchase cost of oil, gas, water and electricity and all associated transmission costs. Utility costs also include sewage service, central steam, and cooling.

NOTE: Report your values (currency and units of measurement) as you did in previous questions!

	Annual Cost $	Annual Consumption	
Main Grid Electricity (kWh)			
Renewable Electricity (kWh)			
Fuel Oil Annual Cost (gallons)			
Gas Annual Cost (therms)			
Steam ($/1000 lbs.)			
Chilled Water (Day-tons)			
Water (Gallons)			
Sewage (Gallons)			*unit (e.g., kWh)*
Other cost:			
Other cost:			
Other cost:			

Total Annual Utility Cost = $ -

Did your utility consumption change prior to the reporting year?

O&M Costs and Staffing Worksheet

1) Utilities | **2) Janitorial** | 3) Maintenance

you are here

Please indicate how often the following janitorial tasks are performed.

	Trash removal
	Sweep/mop tile/composition flooring
	Upholstery vacuuming
	Recyclables collected
	Carpet vacuuming
	Spot clean glass/entrance doors
	Spot carpet cleaning
	Spot clean walls/switchplates
	Entire carpet cleaning
	Interior window/window blind cleaning
	Restroom cleaning
	Exterior window washing/cleaning (high-rise)
	Clean light fixture/ventilation grilles
	High dusting (60° or higher)
	Low dusting (lower than 60°, includes furniture)
	Dust/clean desk equipment (phones/keyboards)
	Data center cleaning
	Sanitize telephone and/or keyboards
	Kitchen/breakroom cleaning and/or Workroom cleaning

What is the total annual janitorial cost for this facility?

Janitorial costs are costs associated with the cleaning of offices, other work areas, restrooms and common support space. These include wages, benefits, staff support, supervision, administration, supplies, paper goods and non-capital equipment (e.g., brooms, floor polishers). Please include service provider's costs and/or any supplemental cleaning services provided by the landlord.

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

What percentage (%) of these janitorial costs are divided among the following categories?

	In-House Staff (to include wages and benefits)
	Contracted Labor
	Supplies (including paper goods, cleaning supplies, and non-capital equipment)
0%	**TOTAL** *(should = 100%)*

How many FTEs are allocated to janitorial function?

	Janitors (#)
	Janitorial Supervisors (#)
	Project cleaners/special cleaning/floor crew (#)
0	**TOTAL # of Janitorial FTEs**

O&M Costs and Staffing Worksheet

1) Utilities | 2) Janitorial | **3) Maintenance** *you are here*

The next set of questions pertain to maintenance costs. For each of the categories, include all repair, preventive, materials, direct labor, and contract costs. For those who manage leased facilities (both sole-occupant and multi-tenant spaces), some of these costs may appear in common area maintenance (CAM) charges or building operating expenses from the landlord or property manager.

Annual cost of external building maintenance:

- Roof
- Skin (siding, masonry, sash, glazing, window washing, external doors)
- Exterior signage

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

Annual Cost of interior systems maintenance:

- Electrical systems (primary and secondary systems, emergency electrical systems, UPS,
- lighting systems, egress signage, master clocks, fire/life safety systems and alarms and remote monitoring, elevator maintenance/repair)
- Mechanical systems (HVAC, chillers, boilers, plumbing, extinguishing systems, back flow prevention, compressed air refrigeration and non-process related pumps)
- Building and general maintenance (interior walls, doors, ceilings, partitions and interior finishes, pest control)
- Interior signage
- Call center - help desk

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

Annual Cost of roads and grounds maintenance:

- Roadways, sidewalks, parking lots (paving repairs, sealing, striping, parking, roadway lighting, and power washing)
- Landscaping (planting, mowing, irrigation) or snow removal, de-icing
- Parking structures (surface repairs, sealing, striping, lighting and drainage systems)
- Storm sewers (catch basins, manholes, sub-surface drainage systems)
- Underground fire systems and hydrants

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

Annual cost of utility/central system maintenance:

- Electrical (generation/distribution)
- Mechanical (steam, hot & cold water systems)

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

Annual cost of process treatment and environmental systems:

- Process cooling water systems
- Process gas systems
- Air discharge scrubbers
- Waste water systems
- Water treatment plants
- Incinerator operation
- Solid waste management system (not solid waste costs)

Approximate Cost: _____ *...OR...* **Exact Cost:** _____

Annual cost of ALL other maintenance items not included above:

Approximate Cost: ____ ...OR... **Exact Cost:** ____

What percentage of your maintenance costs are allocated between the categories below:

____ spent on preventative maintenance (%)
____ spent on reactive (repair/breakdown) maintenance (%)
____ spent of predictive maintenance (%)
0% **TOTAL** *(should = 100%)*

If your facility is owned by your organization, what is the estimated CRV?

Current replacement value is defined as the total amount of expenditure in current dollars required to replace the organization's facilities to its optimal condition (excluding auxiliary facilities). It should include the full replacement cost for all buildings, grounds, utility systems, and generating plants. Furthermore, it should meet the current acceptable standards of construction and comply with regulatory requirements. Do NOT use: Insurance replacement values, book values, cost of contents.

Approximate Cost: ____ ...OR... **Exact Cost:** ____

What was the amount of Deferred Maintenance on the year that you are reporting on?

This estimate should not include projected maintenance, replacement or other types of work, such as program improvements or new construction, as these items are considered capital projects.

Approximate Cost: ____ ...OR... **Exact Cost:** ____

What was the budgeted amount for Capital Renewal for the year that you are reporting on ?

Approximate Cost: ____ ...OR... **Exact Cost:** ____

How many full-time equivalent (FTE) workers are used for base building operations and maintenance at this facility (in-house and contractual)?

You may use fractional FTEs. For example, if your carpenter does 50% carpentry, 25% painting and 25% locksmith work, please allocate 0.5, 0.25 and 0.25 in the corresponding categories. Use the following definitions in providing worker counts.

	# of in-house FTEs	# of contract FTEs	# of shifts per day	# of days per week
Carpenters				
Controls & Low voltage				
Electricians				
Generalists				
HVAC & Central Plant				
Locksmiths				
Mechanics				
Painters				
Plumbers				
Stationary engineers				
Other FTEs				

How Many Full-Time-Equivalent Workers are used for Maintenance Management at this facility (in-house and contractual)?

	# of in-house FTEs	# of contract FTEs
Group Supervisor *first line supervision*		
Operations & Maintenance Manager *second line supervision & above*		
Other Maintenance FTEs		

How Many Full-Time-Equivalent Workers are used for Administrative Support at this facility (in-house and contractual)?

	# of in-house FTEs	# of contract FTEs
Help Desk		
Administrative Assistant		
Other administrative support FTEs		

APPENDIX G: MULTI-FACILITY COSTS FILE

Multi-Facility Spreadsheet

General Information							Utility costs		
Facility Name or Identifier	Year built	Exterior Gross Area	Rentable Gross Area	Primary Use of facility	zip or postal code of facility	Facility Setting	Are Utility - Water and Sewage costs combined	Main grid cost	Main g consump (kwH
				Assembly Building			Yes		