MAXIMIZING BENCHMARKING INITIATIVES IN THE BUILT ENVIRONMENT FOR SUSTAINED CONTINUOUS IMPROVEMENT

by

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ABSTRACT

JUSTIN R. DODD. Maximizing Benchmarking Initiatives in the Built Environment for Sustained Continuous Improvement. (Under the direction of DR. JAKE SMITHWICK)

While continuous improvement initiatives such as benchmarking have a history of utilization for core business objectives, their successful utilization in the built environment industries, such as construction and facilities management is not nearly as well documented or researched. This study identifies how the built environment fields are using continual improvement initiatives, evaluates how effectively these initiatives are being utilized, and identifies critical success factors for improving and leveraging these techniques to achieve the sustained continuous improvement initiatives that will be necessary to meet long -term sustainability goals in relation to the operations of the built environment. This study takes place in three parts; a case study of a novel way to benchmark and identify areas for improvement in an existing construction manufacturer's performance management system, a large-scale (N = 585) multi-national, multi-sector survey of how facility managers are using benchmarking and their involvement in benchmarking networks, and an analysis of the relationship of organizational learning culture and the role that it plays in facilitating and supporting benchmarking initiatives with a quantitative analysis and four case studies. The results of this research suggests that the field of facilities management is engaging in benchmarking at a rate similar to general industry, however there are some noted differences in how practitioners are engaging in the process. Most notably, there is a lack of involvement in benchmarking networks and an underutilization of process benchmarking. This research provides the first-of its-kind survey and assessment of how practitioners in the built environment are utilizing benchmarking compared to their counterparts in general industry. The results of this project serve to assist facility practitioners in developing, leveraging, and strengthening their

continuous improvement initiatives to sustain ongoing change critical for the success of long-term organizational goals related to the built environment lifecycle. This is accomplished through the provision of practitioner and researcher-oriented quantitative and qualitative data that can be used to leverage critical success factors and develop and sustain continuous improvement.

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First and foremost, I would like to thank my Advisor and mentor, Dr. Jake Smithwick, for guidance and support. It has been a privilege to work with you for the past five years. Thank you for your tireless agency in preparing me for the next phase of my academic career. I would also like to thank my committee, Dr. Tara Cavalline, Dr. Glenda Mayo, Dr. Brian Lines, and Dr. Arun Ravindran for their support and insight as well. I would also like to thank my lovely and accommodating wife, Katie, who has been so untiring in her support of my education and the long hours and years I have put into the pursuit of these goals. I am also grateful for the support of IFMA and the many opportunities I have been given by the organization. I look forward to giving back to the greater Facilities Management community with the unique insights generated by this research in hopes that it may further the field in its quest for continuous improvement. I would also like to thank my mother, Ann Dodd, and my in-laws, William & Lynn Jenkins for their unending support for this journey. I could not have completed this project without each and everyone of you.

DEDICATION

This dissertation is dedicated to the loving memory of my father, Rev. Robert V. Dodd (1945-2018): A devoted and beloved father, husband, author, orator, minister, and friend who would say, “I never had a doubt” in reference to this accomplishment. Though you did not live to see this day, you live on in me in the man that I have become and continue to be.

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LIST OF ABBREVIATIONS

ANSI – American National Standards Institute

APPA – "Leadership in Educational Facilities" (formerly Association of Physical Plant Administrators)

ASHE – Association of Healthcare Engineers

ASTM – Association of Testing and Materials International

BIFM – British Institute of Facility Management

BOMA – Building Owners and Managers Association International

CCI – Council for Continuous Improvement

CII – Construction Industry Institute

CII BM& M – Construction Industry Institute Benchmarking & Metrics Program

CISA – Cyberstructure & Infrastructure Security Agency

DLOQ – Dimensions of the Learning Organization Questionnaire

EUI – Energy Use Intensity

FM – Facilities Management

GPS – Geographic Positioning System

IFMA – International Facilities Management Association

KPI – Key Performance Indicator

NASEM – National Academies of Sciences, Engineering, & Medicine

OLC – Organizational Learning Culture

SF – Square Feet

SME – Subject Matter Experts

TQM – Total Quality Management

CHAPTER 1: INTRODUCTION

Benchmarking has been a regularly utilized tool for continual improvement initiatives for at least the past 30 years (Adebanjo et al., 2010; Camp, 1989; Hinton et al., 2000; Korpela & Tuominen, 1996). An early survey of Fortune 1000 companies found that 65% of the organizations were using benchmarking (Korpela & Tuominen, 1996), while another survey found only 45% of organizations were using it (Hinton et al., 2000). A later survey on benchmarking use found that 69% of organizations report using benchmarking (Adebanjo et al., 2010). While the results from many of these surveys are limited in detailed analysis of benchmarking modes and strategies, what is made clear from these surveys over several decades is that benchmarking is not a management fad, but rather a regularly utilized tool for seeking continual improvement in a competitive environment. Its continued use over time is demonstrative of its success, however, not all benchmarking is created equal and not every company is able to successfully utilize the technique (Adebanjo et al., 2010).

While there are numerous case studies on benchmarking in the research literature, there are a limited number of quantitative research efforts devoted to understanding how industries at large are utilizing or if they are utilizing the techniques (Longbottom, 2000). Both methods of analysis are equally important to understanding how the process is being used to achieve results (Camp, 1989). Despite the large volume of research publications on benchmarking for general industry, the research on the use of benchmarking in the built environment industries is far less common (El-Mashaleh et al., 2007; Loosemore & Hsin, 2001; Wong et al., 2013). El-Mashaleh et al. (2007) note that benchmarking was just recently embraced in the construction field. Multiple researchers have discussed the field of facilities management as a new field that began to evolve and define itself around the same time as the emergence of benchmarking (Loosemore

& Hsin, 1001; Pitt & Tucker, 2008; Tay & Ooi, 2001; Ventovouri et al., 2007). It has been suggested the field of facilities management was slow to adopt benchmarking as the field faced an increase in outsourcing (Loosemore & Hsin, 2001) and was in the process of resolving a paradox in its evolutionary identity in redefining itself from a technical field primarily reactive in nature to a strategic field aligned with core organizational objectives (Barrett, 2000; Grimshaw, 1999; Loosemore & Hsin, 2001; Ventovuori et al., 2007). As a result of this delay in the utilization of benchmarking for strategic purposes, there exists a knowledge gap in the research literature on quantitative assessments of how the benchmarking is being used by practitioners and case studies illustrating how the practitioner are using the technique to sustain continuous improvement.

This dissertation helps to close the knowledge gap on applied benchmarking in the built environment as it relates to both the field of facilities management (FM) and the construction. The research is presented in the form of three individual papers (Chapters Two, Three and Four) that are all fundamentally related to the use of benchmarking initiatives in the built environment and how these initiatives can be maximized for optimal outcome in sustaining continuous improvement. The continuous improvement process will be necessary to support long-term organizational and municipal objectives related to sustainability and maintaining superior performance in an increasingly competitive and fast-changing field.

Chapter Two is a case study presenting a novel way of benchmarking and controlling the customer satisfaction process of a construction roofing manufacturer. The project examines seven years of post-occupancy project satisfaction evaluations to assess and benchmark the rate of low satisfaction scores using the “fraction defective”. This study provides a unique example of a means for internal benchmarking and provides an analysis of the satisfaction process with

identified areas for continuous improvement opportunities for the manufacturer. It provides a case study of how a high performing manufacturer can use an existing performance management system to identify areas for formal benchmarking initiatives to sustain their competitive edge continuously.

Chapter Three is a research study on how facility management practitioners are using benchmarking. A survey was distributed to practicing facility managers that serves as the first large-scale multi-national, multi-sector survey on how facility managers are using benchmarking for facility-oriented functions. This study serves as the first of its kind assessment of benchmarking use in the field of facilities management and using the results of previous industry studies, it provides a comparison of how the field's use of benchmarking compares to general industry. This study serves to provide practitioners with an understanding of the various techniques used to benchmark in their field and identify opportunities to improve their benchmarking initiatives for maximum strategic effect.

Chapter Four is a research study that analyzes the role of organizational learning culture and benchmarking in facilities management. Though the importance of organizational learning to benchmarking has been thoroughly discussed in the research literature, this study serves to quantify that relationship through connecting benchmarking use to strength of organizational learning culture as measured by the Dimension of the Learning Organization Questionnaire (DLOQ) (Marsick & Watkins, 2003). This study also reviews four case studies on facility management practitioners on how they have utilized benchmarking to achieve organizational change and the critical success factors for their benchmarking initiatives. The results of this study serve to highlight the importance of organizational culture to the success of benchmarking

initiatives and provide practitioners insights on how to leverage cultural change to provide an environment capable of nurturing benchmarking for true continuous improvement.

Together these studies provide a wealth of resources for practitioners and academics in the field of the built environment. They serve to provide both quantitative and qualitative data that can be used to advance benchmarking efforts in their respective fields and identify the path forward in advancing their continual improvement initiatives for maximum organizational impact.

CHAPTER 2: IDENTIFICATION OF CONTINUOUS IMPROVEMENT OPPORTUNITIES FOR A CONSTRUCTION MANUFACTURER'S WARRANTY SATISFACTION PROGRAM

2.1 ABSTRACT

Customer satisfaction is an important element of quality assurance across industries. A high-end construction roofing manufacturer implemented a warranty quality management program to address customer's perceptions regarding quality and warranty length. Using seven years of customer satisfaction ratings, the research team was tasked with identifying whether the process was being controlled. The team identified the largest source of low satisfaction scores and applied Statistical Process Control to the selected data to determine if the process was being controlled. The control charts indicated that the satisfaction process was not being controlled and a binary logistic regression was performed to determine the project characteristics that were contributing to low satisfaction scores. This analysis revealed several project characteristics that were contributing to variability in the customer satisfaction process. For example, customers with longer warranty periods on their products were much more likely to be dissatisfied with their contractors than those with shorter warranty lengths. This research provides a case study of the use of the fraction defective and process control techniques for the purpose of identifying opportunities for continual improvement with customer satisfaction in the construction industry.

2.2 INTRODUCTION

The U.S roofing industry is a rapidly expanding segment of the greater construction industry. It has grown from an estimated $23 billion in 2002 (Coffelt & Hendrickson, 2010) to over $40 billion in 2017 (U.S Census Bureau, 2017) and is anticipated to exceed $50 billion by 2025 (Allied Market Research, 2017). This rapid growth has occurred despite several decades of

poor construction performance documentation (Gajjar et al., 2016) that has relied upon warranties to manage the lifecycle quality of the roofing installations (Coffelt & Hendrickson, 2010). The length of the warranties has become associated with the quality of the components for facility managers (FMs) who manage roofing system replacement decisions based upon the fixed intervals associated with the length of the warranties. As a result, they have begun to associate the performance of the roofing system with the length of the warranty (Gajjar et al., 2016).

Consequently, facility managers rely upon the roofing warranty (offered by the product manufacturer) to provide them with protection during the product's warranty period.
One of the consequences of participating in a quickly growing market is the need to be competitive and seek continual improvement to stay ahead of the competition. In this ever increasingly competitive environment, quality management is becoming a top priority for the construction industry (Han et al., 2008; Sullivan, 2011). Quality control in manufacturing is typically a forward-looking process that acts directly upon the production process as it occurs. Construction, however, typically approaches quality control by looking backwards to identify the source of the problem after it occurs (Sullivan, 2011). This is achieved through inspections and post-completion surveys to manage quality to the customer's level of satisfaction (Han et al., 2008: Sullivan, 2011). Poor quality control and quality assurance during execution has led to the use of warranties provided upon completion to compensate (Gajjar et al., 2016).

In 2012 a U.S.-based commercial roofing product manufacturer sought to track their warranties by assessing customer feedback once the warranty was issued at project completion. The goal of this program is to identify customer dissatisfaction after project completion to mitigate any long-term risks to their warranty program. The program uses a Post-Occupancy-Evaluation (POE) method that was previously established in the construction literature that

consists of an owner satisfaction questionnaire (Wicks & Roethlein, 2011). The satisfaction questionnaires are administered by a research team who contacts the customers, and then notifies the manufacturer. The manufacturer follows up with customers who rate their satisfaction as 7 or less on a 10-point Likert scale with 1 being completely dissatisfied and 10 being completely satisfied (Gajjar et al., 2016).

The warranty program has been in place for seven years now and the mean satisfaction ratings have remained relatively stable during this time-period. To determine if the process was being controlled, a variety of Lean Six Sigma (LSS) techniques were employed to evaluate the warranty program. A Pareto analysis of defects, statistical process control charts, and a logistic regression model for identifying project characteristics contributing to decreased customer satisfaction were used to evaluate the program. Customer satisfaction data and project demographics were collected on more than 5,000 roofing projects completed by over 500 contractors (the project applicators) using the products from one construction manufacturer.

Problem Statement

A U.S based construction coating manufacturer has been implementing a warranty tracking program utilizing customer satisfaction since 2012. Though this warranty tracking program has helped to manage quality through customer satisfaction after project completion, it is unknown whether this process is being controlled. The mean satisfaction ratings have stayed relatively stable since the program's inception in 2012 with a mean of 9.6 out of 10. There remain very few applications of process control to construction projects and this case study serves as an illustration of how this technique can be used to identify means for continual improvement in post-occupancy customer satisfaction.

Research Objectives

The purpose of this research is to evaluate the effectiveness of a warranty program based upon post-occupancy satisfaction evaluations for a construction product manufacturer and to determine if that process is being controlled. This research will be guided by a data-driven problem-solving technique utilized by six sigma initiatives, the D.M.A.I.C. process of Define, Measure, Analyze, Improve and Control (Douglas et al., 2015; Shirey et al., 2017. It should be noted, however, that this paper will not address the improve and control phase, which are currently being addressed by the manufacturer. This research process has the following objectives:

1. To identify the sources of low satisfaction scores.
2. To determine if the customer satisfaction process is being controlled.

2.3 LITERATURE REVIEW

Quality in Construction

Quality management has been a significant focus of the construction industry research for the past four decades (Ahire & Golhar, 1996). Techniques, tools, and systems that were initially developed for use in the highly competitive manufacturing industry have shown promise for applications in a wide variety of sectors (Ahire & Golhar, 1996; Sreedharan & Raju, 2016). Benchmarking (Park et al., 2005), performance management (Bassioni et. al. 2004; Yang et. al. 2010), key performance indicators (KPIs) (Lin et al., 2011, Lavy, 2011), Total Quality Management (TQM) (Pheng & Teo, 2004), Best-Value Method (BMV) (Sullivan, 2011), Six-Sigma (; Han et al., 2008; Peng & Hui, 2004), and Lean Construction (Koskela et al., 2019;

Salem et al., 2006), are just some of the recent quality management endeavors adapted to improve quality in the construction industry.

Lean Six Sigma (LSS) is the result of the merging of Lean Production with the Six Sigma process which allows the application of Lean production concepts with the D.M.A.I.C. process championed by Six Sigma (Bhat et al., 2016; Douglas et al., 2015; Shirey et al., 2017), leading to improvements in efficiency and accuracy. LSS has been widely embraced and utilized in the manufacturing sector (Sreedharan & Raju, 2015) and due to its success has been widely adopted to become an inter-industry standard of business and industry continuous improvement (Timans et al., 2012).

The construction industry, however, has had difficulty transferring and adopting all of these principles and techniques (Han et al., 2008; Salem et al., 2006; Sullivan, 2011). This difficulty is due to differences between the construction industry and the manufacturing industry. The construction industry removes defects in the production process after they occur, making it difficult to systematically evaluate defects and their rate of occurrence (Han et al., 2008). (Salem et., 2006) note that there are four primary differences between manufacturing and construction, the inability to transport & distribute the final product due to its size, on-site production, one-of-a-kind projects, and complexity. Sullivan (2011) identified the common problems associated with implementing LSS in the construction industry. These problems include product variability and heterogeneity, lack of clear product definitions and valuation, the adversarial legal environment surrounding contracted built environment work, and the lack of true "production control" as is seen in the manufacturing industry. The overall effect of these differences is that they bring a much greater amount of uncertainty into the production process (Salem et al., 2006).

Importance of customer satisfaction to quality

Achieving high customer satisfaction is a fundamental component of the LSS principles and quality management (Salah et al., 2010). The key to high customer satisfaction levels is the provision of high-quality products free from defects (Han et al, 2008). How the end-users see the product is a great indicator of how well the product was manufactured (Hayes, 1997; Vavra, 2002). Customer satisfaction is one of the most widely utilized KPIs across industries (Dodd et al., 2018), including hospitality (Oh et. al. 2016; Pizam et. al. 2015), retail and consumer services (Kasiri et. al. 2017; Ramanathan et. al. 2015), economics and finance (Ali & Raza, 2015; Ling et. al. 2016), facility management (Dodd et al., 2018; Gajjar et al., 2018) and transportation (Gao et. al., 2012; Lierop & El-Geneirdy, 2016). Recently, the construction industry has been using satisfaction to manage warranties and the perceived value of their product (Gajjar et al., 2016). Customer satisfaction surveys are implemented to identify potential problems or defects in the finished project.

Statistical Process Control

Statistical Process Control is a countermeasure developed by manufacturers to eliminate "noise" in the manufacturing process caused by small variations in machine tolerances. Its purpose is to eliminate waste and inefficiency that produces variation in the production of a product. This process is typically performed and reviewed as a control chart (Devor et. al., 2007). Control charts were developed to identify variation in a process over time and to verify that the process is being controlled or improved (Kennet, Deldossi, & Zappa, 2012; MacCarthy & Wasuri, 2001: Wardell & Candia, 1996). Variation in a process can come from one of two sources, random variation or assignable variation. Random variation can be seen in the range of the chart points and assignable cause variation is typically identified as an out of -control point

that occurs above or below the control limits or varies in a manner consistent with one of the eight runs rules (Shirey et al., 2017; Western Electric Company, 1956).

These charts have been widely used by the manufacturing industry since their development by Shewhart (1931). Though these charts were originally developed as a quality control technique for manufactured products (MacCarthy & Wasuri, 2001), they have since been adopted and utilized by a number of different industries and performed on a wide variety of data. MacCarthy & Wasuri (2001) identified applications such as engineering, industrial, environmental, healthcare, general service sector, and statistical forecasting. While most of the data sources for these applications come from real processes, other sources of data include simulation or modeling, and data from surveys or questionnaires. There has been some research on their use in the construction industry where they have been used to monitor earned value indices for real-time progress tracking (Aliverdi et al., 2013; Leu & Lin, 2008) and evaluating cost overruns in asphalt paving operations (Nassar et al., 2005).

Early research into the use of SPC charts on customer satisfaction data can regularly be seen beginning in the mid 1990's (Jensen & Markland, 1996; MacCarthy & Wasuri, 2001; Piccirillo, 1996). Over time, the use of SPC Charts to evaluate customer satisfaction ratings has become an integral part of managing quality control for numerous organizations (Kennet et al., 2012). This is exemplified by the development of the ISO10004:2010 standard which provides guidelines for the management of customer satisfaction surveys, and the ISO 7870 guidelines which focus specifically on the development of control charts for monitoring customer satisfaction (ISO, 2010). These guidelines specifically address how to develop and calculate control charts for use in customer surveys.

The selection of a control chart is based primarily upon the type of data that is analyzed (Kennet et al., 2012; MacCarthy & Wasuri, 2001). P-Charts are considered to be the appropriate chart to utilize with attribute or categorical data as they monitor whether or not a certain condition occurred, such as a threshold score on a Likert scale used to measure customer satisfaction (DeVor et al., 2007). This type of chart assumes there are only two conditions to analyze. P-charts are constructed based upon the binomial distribution and thus no assumption about the normality of the data is necessary to construct them (Wardell & Candia, 1996). Others have developed improved and specialized charts for examining attribute data. Wardell & Candia (1996) proposed the use of a modified p-chart to evaluate hospital satisfaction data. Modified p-charts allow for control limits to vary with sample size, whereas a standard p-chart utilizes a consistent sample size. Laney (2002) proposed a P' -Chart, also known as the Laney P-Chart to use with large samples that takes a more conservative approach to the calculation of control limits.

All control charts are constructed with the assumption that the data represents a set of continuous observations of a standard product or process over time (Devor et al., 2007; Ding et al., 2006), also known as rational sampling. Though satisfaction scores are being analyzed using SPC charts, there has been very little adoption of the technique in the construction or facilities management industries. One reason for this was noted by Sullivan (2011); construction projects are each inherently unique and thus there is great variability among each product (or project). Furthermore, construction companies do not produce the same number of products (projects) in a year that the manufacturing or service industries produce. Consequently, there are fewer products to sample, meaning that it could be difficult to get the sample sizes necessary to produce reliable control charts.

Defect Modeling (Logistic Regression)

Defect Modeling is the application of a logistic model to predict the outcome of a binary variable, such as whether a product is defective or not. Logistic models rely upon probability rather than a linear relationship to make predictions about the outcome of the binary variable. While these models are not typically employed by researchers in the construction industry, sociologists have worked extensively using logistic regression models (Allison, 1999; Mood, 2010) and it is a regularly used tool in Lean Six Sigma Analyses (Meulen et. al., 2011; Nandkumar & Santosh, 2019), where it has been used to identify sources of defects for quality improvements.

2.4 METHODOLOGY

Problem-Solving Sequence

The data were collected by an independent research team who contacted the project customers to evaluate their satisfaction in five different areas using a Likert scale with 10 representing “completely satisfied” and 1 representing “not at all satisfied”. These areas include contractor (applicator), roofing system, sales representative, value relative to the project cost, and overall project. Additional project characteristics and demographics were also collected. The research team contacted the customers within one month of project completion and asked them the follow-up questions in *Table 1: Satisfaction Survey Questions*. A total of 4,320 consecutive projects from 2012-2018 were identified for this analysis. To achieve the research objectives, a methodology of six steps was employed. These include identification of largest defect type, SPC chart selection, determination of sampling methodology, construction of P-chart, interpretation

of P-chart, and modeling the source of Contractor Defects (See Figure 1*: Research Methodology).*

Table 2.01: Satisfaction Survey Questions

	Survey Questions	**UNIT**
1	How satisfied were you with the roofing system?	(1-10)
2	Would you purchase the roofing solution again?	(Y/N)
3	How satisfied were you with the contractor?	(1-10)
4	How satisfied were you with the sales representative?	(1-10)
5	How satisfied were you with the value relative to overall project cost?	(1-10)
6	How satisfied were you with the overall project?	(1-10)
7	Repeat Customer (For internal use)	(Y/N)
	1-10 scale with 1 being "Not at all Satisfied" and 10 being "Completely Satisfied". (Y/N = “Yes” or “No”.	

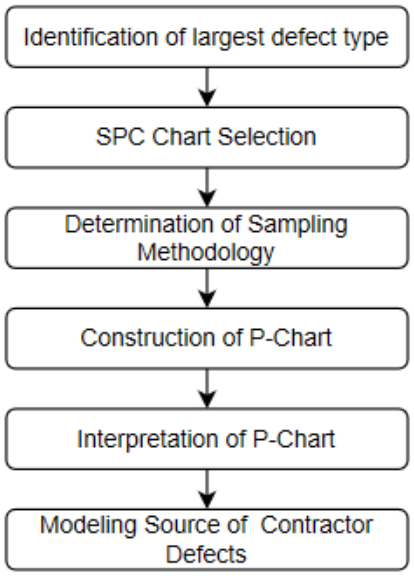

Figure 2.01: Research Methodology

Defining the Problem

The warranty tracking program identifies customers with a score of 7 or less on the customer satisfaction indices to initiate follow-up with a customer service representative for the

manufacturer. Per the manufacturer's specifications, a defect was defined as a score of ≤ 7 on a 10-point Likert scale of satisfaction with 10 representing "completely satisfied" and 1 representing "not at all satisfied". More specifically, as the dependent variable, a Contractor Defect is defined as a score from 1-7 on the contractor satisfaction scale in the customer survey. The term "defect" is used to denote the binary nature of the attribute variable where satisfaction scores are grouped into either satisfactory satisfaction scores (8-10) or defects (<=7). This allows for analysis of the fraction defective (# of defects/sample). The contractor is the applicator of the product.

Measuring the Problem

The first step in the research was to determine where the source of the defects using a Pareto Chart Analysis (See Figure 2*: Pareto Chart of Total Defects per Indices 2012-2018*). All five satisfaction rating scales were analyzed for the total count of defects on each scale. Pareto Charts have been used previously to identify wastes in the construction industry (Ismali & Yusof, 2016) and to determine the largest contributions to work-related accidents on construction sites (Karimi, Arghami, & Behroozi, 2017). P-charts are considered the appropriate SPC procedure for attribute data examining the fraction defective (Wardell & Candia, 1996).

Sample size determination & sampling methodology

Morris & Riddle (2008) reviewed several methodologies for determining the appropriate sample size to detect quality improvements in p-charts. For this study, the rule of thumb methodology (Morris & Riddle, 2008) was employed to determine the sample size (Equation 1). In this equation, p represents the overall percent defect in the population, and the sample size, n,

is being determined to approximate the binomial distribution based upon the odds of zero conforming units occurring in a sample. The value of 6.6 is an empirically derived value based upon the results of their study that provides a value approximately similar to other more complex formula derivations. This ensures that the sample size is sufficient to guarantee that the probability of zero nonconforming units in a fraction defective analysis corresponds to the probability of $z \leq -3$.

Equation 1: $$n \geq \frac{6.6}{p}$$

Using Equation 1 and the observed population percent defect rate as 11.49%, the sample size was determined to be $n \geq 57.44$, and $n = 60$ was selected. Using this sample size, rational samples (DeVor, et al., 2007) were taken using sixty chronologically consecutive projects with contractor satisfaction ratings throughout the available database of records from January 2012-January 2018. Cases with missing values of contractor satisfaction were excluded from the analysis. The number of defects per sample was counted and divided by the sample size to get the fraction defective for use in the SPC Control Chart.

Construction of P-Chart

A total of seventy-two samples of sixty were collected in consecutive order over an 84-month period from January 2012 -January 2018. Each sample was a count of the number of defects divided by the size of the sample, 60. Though the time-period represented by each sample varied, the average sample period was about 1.17 months or about thirty-five days. The p-charts were constructed in Minitab 3.35 using the control charts feature. The Minitab chart diagnostics feature identified a larger than expected variation in the scores and recommended the

use of a Laney P' Chart (Laney, 2002) to prevent false positives. The P' Chart takes that variation into account and conservatively extends the control limit lines further from the mean.

Analyzing the Problem

The results of the p-chart were analyzed according to the 8 runs rules of control chart interpretation (Nelson, 1984; Western Electric Company, 1956). Only a few of the rules are applicable to attribute-based charts, such as the p-chart, and these include (Devor et al., 2007):

- Test 1: Extreme Points (points beyond the control limits)
- Test 4: Runs above or below the centerline (8 points in a row)
- Test 5: Linear Trend Identification (six points in a linear trend)
- Test 6: Oscillatory Trend Identification (14 points up and down successively)

Logistic Regression

A binary logistic regression analysis using SAS 9.4 was conducted to identify causes of customer dissatisfaction. Within the data set, there more than 500 contractors. An analysis of project demographics contributing to the fraction defective was undertaken. The independent variables were warranty length, job area, repeat customers, physical quarter of the year, owner type, and sales district. To compare the differences between Physical Quarters of the Year, Quarter 4 (October-December) was chosen as the quarter of comparison as it represented the quarter closest to the mean number of defects out of the 4 quarters. Owner Group 13 was chosen as the comparison group as it constituted the largest owner group in the sample. Sales District 11 was chosen as the comparison group for Sales Districts as it also represented the largest sales group in the sample. (See Table 2: *Logistic Regression Results.)*

2.5 RESULTS

Independent Variables

Table 2: Project Independent Variables lists the independent variables in this analysis. These include Owner Type. Sales District, Warranty Length, Project Area (sf), Repeat Customer, and Physical Quarter of the Year. Physical Quarters of the year represent 3-month periods beginning on January 1st of each year. Sales Districts are geographic regions in the United States defined by the construction manufacturer. Owner Types are different categories of facilities, such as educational institutions, manufacturing facilities, government buildings, etc. Due to the large range of the Project Area variable (GSF of roofing installation), this variable was log-transformed for use in the logistic regression analysis.

Table 2.02: Project Independent Variables

Project Variables	**Number of sub-group categories**	**Range of values in category**
Owner Type (nominal)	13	1-13
Sales District (nominal)	11	1-11
Warranty length (ordinal)	28	2 years – 30 years
Project Area (continuous)	N/A	400-1,190,000 GSF
Repeat Customer (nominal)	2	Yes or No
Physical Quarter of Year (nominal)	4	1-4

Dependent Variables

Satisfaction rating frequencies on the Likert 10-point scale are heavily skewed to the left favoring the top three ratings. *Table 3: Frequency of Satisfaction Index Ratings* lists each Likert scale and the rating frequencies obtained from the customer satisfaction surveys following project completion.

Table 2.03: Frequency of Satisfaction Index Ratings

Satisfaction Indices	10-point Scale Rating Frequency										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**TOTAL**
Contractor Satisfaction	30	15	21	48	74	69	255	740	1043	2052	4347
Value Relative to Project Cost Satisfaction	3	7	5	20	46	77	322	1050	963	1714	4207
Overall Satisfaction	2	5	9	15	34	44	153	725	1242	3018	5247
Roofing System Satisfaction	2	1	2	9	43	25	112	650	1007	2455	4306
Sales Representative Satisfaction	4	5	2	7	27	24	72	370	787	2951	4249

Pareto Analysis for largest defect source

The Pareto Analysis of defects (Figure 2) indicated that Contractor Satisfaction had the most reported defects, accounting for 31.5% (495/1572*)* of the scores of 7 or less on the Likert satisfaction scales *(See Figure 2: Pareto Chart of Total Defects Per Indices 2012-2018*). The focus of this project was to work with the largest source of defects, contractor satisfaction, though Value Relative to Project Cost Satisfaction was approximately similar.

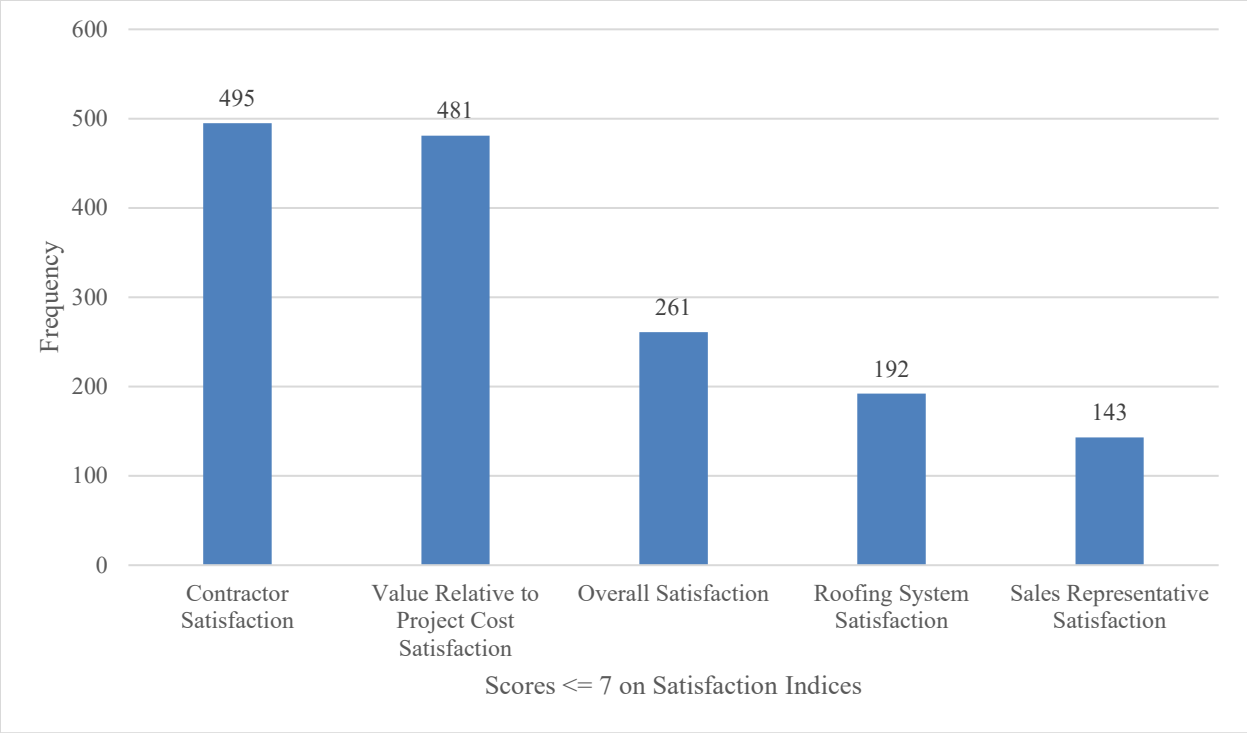

Figure 2.02: Pareto Chart of Total Defects Per Indices 2012-2018

Data Analysis

Figure 3 shows the results of the control chart construction. The outer lines on the chart (*See Figure 3: Minitab 3.3.5: Laney P' Chart for Contractor Satisfaction Defects*) represent the control limits, which are approximately three standard deviations from the mean or centerline of the chart. Though the lower limit is set at zero, the sample size was selected such that the probability of zero defects should be equivalent to the corresponding probability that occurs at three standard deviations from the mean. The values represent the percent defective (or fraction defective) in each of the 71 samples. The high level of random variation can be seen in the blue line. The circled run of eight lines represents a special variation cause and the red dot outside of the upper control limit represents a sample with an out-of-control data point.

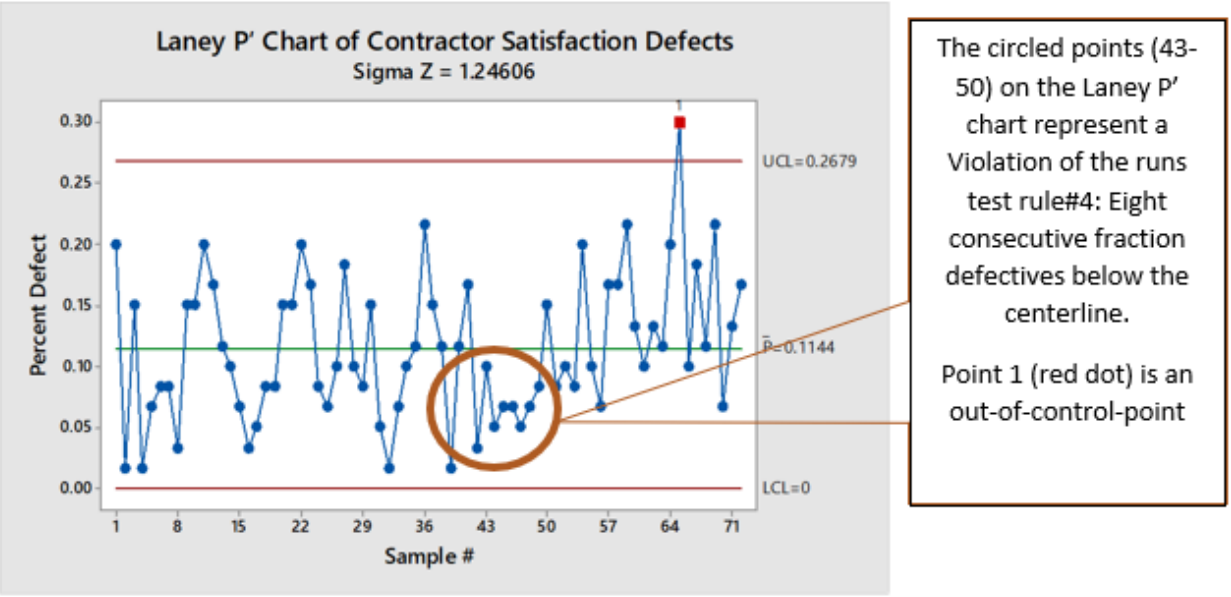

Figure 2.03: Minitab 3.3.5: Laney P' Chart for Contractor Satisfaction Defects

The results of the logistic regression indicate that the model successfully converged. The results of the model are summarized in Table 3, which indicates that Warranty Length, Repeat Customer, and Physical Quarter all meet the α=.05 threshold.

Table 2.04: SAS Logistic Regression Results

Model Convergence Status			
Convergence criterion (GCONV=1E-8) satisfied			
Model Fit Statistics			
Criterion	**Intercept Only**	**Intercept and Covariates**	
AIC	1959.785	1936.678	
SC	1965.675	2107.483	
-2 Log L	1957.785	1878.678	
Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	79.1073	28	< 0.0001
Score	78.5439	28	< 0.0001
Wald	74.6334	28	< 0.0001

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
Warranty length	1	4.7576	0.0292
Job area (log)	1	0.4824	0.4873
Repeat Customer	1	6.1012	0.0135
Physical Quarter	*3*	*27.2253*	*< 0.0001*
Owner Type	*12*	*17.2973*	*0.1388*
Sales District	*10*	*18.0844*	*0.0536*

The significant results from the logistic regression and their Odd Ratio Estimates are summarized in Table 4: *Binary Logit Significant Findings and Odds Ratio Estimates*. While Owner Type and Sales District did not meet the alpha criterion for significance in the model, significant relationships were found with certain Owners and Sales Districts.

Table 2.05: Binary Logit Significant Findings and Odds Ratio Estimates

		Odds Ratio Estimates		
Significant Predictors	**Alpha level**	**Point Estimate**	**95% Wald Confidence Limits**	
Intercept	<.0001			
Warranty Length	.0292	1.031	1.003	1.060
Repeat Customer	.0135	0.637	0.446	0.911
Physical Quarter 2 vs. 4	.0118	1.066	.767	1.481
Physical Quarter 3 vs. 4	<.0001	0.472	0.345	0.646
Owner 7 vs. 13	.0499	1.193	0.839	1.697
Owner 11 vs. 13	.0004	1.988	1.181	3.348
Sales District 5 vs. 11	.0031	1.971	1.227	3.168

2.6 DISCUSSION

Customer Satisfaction Process Control

The Laney P' Chart (Figure 3) indicates that quality as measured by contractor satisfaction is not being controlled nor has the process improved over time. A process is out-of-

control when samples of the fraction defective exist outside of the control limits. Further, samples 43 through 50 show a pattern of eight consecutive samples of fraction defectives below the centerline. This is a violation of the runs test rule #4: “Runs above or below the centerline” (Western Electric Company, 1956: Devor et al., 2007). This is indicative of a small but sustained special cause which suggests that the process shifted to an above average performance over a period of approximately 9 months. Immediately following this trend, the fraction defective appears to show a trend of shifting upwards. This indicates that the high performance was immediately followed by a period of low performance along with an out-of-control data point indicating a fraction defective greater than three standard deviations from the mean. This out-of-control point #1 is indicative of a special cause as well (Shewart, 1931)

The results of the P-Chart analysis informed the research team that there were factors that were contributing to elevated patterns of increased satisfaction defects over the 7 years of customer satisfaction data. Ordinarily, a P-Chart would be constructed on a singular product, however, in the construction industry, almost every product (project) is unique. As a result, this p-chart should be interpreted with some caution and recognition that there exists an increased variability in the statistical control process that can be attributed to the heterogeneity of the samples. While this control chart was constructed to meet technical requirements for control chart construction, the utility of this technique for comparing across projects may be limited. The chart does, however, highlight the fact that there are some noticeable shifting patterns and an apparent trend towards increased defects that are consistent with decreasing mean satisfaction ratings across the same time-period.

Sources of Satisfaction Defects

The results of this analysis suggest that there are multiple project characteristics and business cycle patterns that are contributing to the likelihood of contractor dissatisfaction.

- All other things being equal, warranty length is associated with an additional 3% chance of defect per year of warranty length. The range of warranty lengths runs from 2 years to 30 years, meaning that the 10-year warranties are 1.15 times more likely to be a Contractor Defect than the 5-year warranties, and the 30-year warranties are 1.75 times more likely to be rated as a Contractor Defect. This suggests there is a customer perception that longer warranty periods demand higher initial project quality.
- All other things being equal, returning customers are 36.3% less likely than first time customers to report a Contractor Defect.
- All other things being equal, when compared to Quarter 4 (Oct.-Dec.), Quarter 2 (April – June) is 1.066 times more likely to have contractor defects, and Quarter 3 (July-Sept.) is 53.8% less likely to have a contractor defect. This is evidence that suggests seasonal cycles or certain times of year have an effect on perceived customer quality.
- Though the type of owner did not quite meet the alpha level for significance as a class of predictors, there are some significant differences amongst several owner types. All else being equal, when compared to the largest owner type, Schools, Government Districts were found to be 1.193 times more likely to have a contractor defect, and Manufacturing Facilities were found to be 1.988 times more likely to have a contractor defect. These results are consistent with the known technical requirements for roofing in manufacturing buildings as manufacturing facilities require multiple vents and roof penetrations to perform their business operations.

- While sales districts just barely missed the alpha level for significance as a class of predictors, there is one notable sales district that has a high probability of contractor defects. All other things being equal, when compared to the largest Sales District, 11, District 5 is 1.971 times more likely to have a contractor defect. This may be evidence that a particular Sales District has been having trouble with the quality of their contractors or due to other regional issues.

The analysis suggests that there are identifiable project characteristics contributing to poor customer satisfaction. The identification of these trends effectively provides the manufacturer with known probabilistic risks to contractor satisfaction. Design of quality assurance plans to provide additional checks and quality standards for these sources of poor customer satisfaction can provide the manufacturer with opportunities to improve customer satisfaction for the purpose of controlling the satisfaction process. For example, knowing that the roofs of manufacturing facilities are 99% more likely to have a problem with customer satisfaction, additional quality assurance checklists and procedures can be implemented to minimize the potential risks to quality.

2.7 CONCLUSION AND RECOMMENDATIONS

This research project was an application of lean six sigma driven principles for the purpose of identifying if the customer satisfaction process is being controlled and identifying the sources of customer dissatisfaction. In this analysis, customer satisfaction scores below an identified threshold were identified and modeled as defects to identify how well the process was being controlled, and potential project characteristics that were contributing to poor customer satisfaction. A Pareto Analysis, SPC Charts, and Logistic Regression were utilized for analysis.

The process in this paper represents the first 3 phases of the D.M.A.I.C. process, as the "Implement" and "Control" phases must be implemented by the construction manufacturer for the purpose of controlling the customer satisfaction process and decreasing the frequency of low scores.

The value in this research is that a construction manufacturer (of any product) can use the concepts and process delineated in this paper to design a product performance tool through a simple measure obtained through a brief survey (customer satisfaction). This provides evidence that simple tools (surveys of warranty holders) are capable of generating highly useful insights into complex business processes without relying upon more difficult to collect technical data. While the collection of more technical empirical data on the quality of the roof might be more accurate, it is highly difficult to collect and analyze, requiring extensive manpower and expertise to complete. Satisfaction surveys can serve as potential indicators of the overall quality of the product, the manufacturer's ability to service the customer, or the skill of the applicator. Using a customer satisfaction survey and the fraction defective as a benchmark, this research was able to find seasonal fluctuations, repeat customer favoritism, higher expectations concerning longer warranty periods, differences in facility (owner) expectations, and geographical differences in sales regions. Implementation of proactive interventions to address these defects, and further control the satisfaction process should allow the construction manufacturer to further improve their customer perceived value.

In summary, the traditional application of SPC is more challenging in construction due to the heterogeneity of the project as a product. In this case study, though, the value of the process when used as a simplistic tool, served to identify trends and concerns that were capable of being addressed in a logistic regression analysis, thereby, providing the means to identify problems and

seek continuous improvement. This research provides a case study in how LSS principles and philosophies and statistical process control can be applied to the construction industry to implement the continuous improvement process as a quality management initiative. Future research should focus on identifying further demographic variables that can be used to create more similar comparisons for use in project comparisons, such as type of produce utilized, and the incorporation of qualitative data relating to the customer's reasoning for their specific satisfaction rating.

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CHAPTER THREE: THE CURRENT STATE OF BENCHMARKING USE AND NETWORKS IN FACILITIES MANAGEMENT

3.1 ABSTRACT

As a relatively new field, facilities management has been defining its scope of operations for the past 40 years. The field has shifted from what was once thought of as "the price of doing business" to becoming a strategic partner for support of overall business objectives. As such, practitioners are increasingly utilizing management techniques championed by other industries such as benchmarking. Benchmarking has been a widely utilized benchmarking technique for at least the past 30 years, but the majority of research publications on benchmarking are case studies. Only a handful of multi-industry benchmarking use surveys exists in the research literature and there exists no information on how the facilities management field is utilizing benchmarking as a management technique. To address this knowledge-gap an online survey on benchmarking use was distributed to practicing facility managers. A total of 585 responses were recorded and the results of the survey were compared to a previous survey on benchmarking use. This paper marks the first multi-national, multi-sector benchmarking use survey specifically on facility benchmarking. Using comparisons from previous benchmarking use surveys, this paper serves as an assessment of how well the facilities management field has adopted this management technique and how it can be improved to sustain continuous improvement. While the field has adopted the technique at rates similar to general industry, there are some noted differences in how facility managers go about benchmarking, as well as an underutilization of process benchmarking and benchmarking network opportunities.

3.2 INTRODUCTION

Benchmarking was defined by informally by Robert Camp as the title of his book, *The Search for Best Practices That Lead to Superior Performance* (Camp, 1989). Since the publication of his book and his work at Xerox being acknowledged with a Malcolm Baldridge Quality award, benchmarking has been embraced by the business community as a valid and sought after means of achieving continual improvement (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. These initiatives were able to provide valuable insights into their production efficiency, design, and logistics, 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).

Fundamentally, benchmarking is the linking of metrics and practices to effect organizational change. As Camp (1989) noted, metrics are the measurements and practices are the means of achieving change. The two must be linked such that by changing practices, the effect on the metrics can be observed and quantified for the purpose of achieving a goal, the paragon of which is the adoption of an identified best-practice.

Thousands of articles on benchmarking have been published in both academic and practitioner-based journals (Yasin, 2002). Watson (1993) noted that benchmarking has evolved since its inception in the 1980's leading to many different formulations, definitions, and models on how to approach the practitioner led management technique (Anand & Kodali, 2008). Since benchmarking is a practitioner lead activity often conducted between private organizations for

unique purposes decided by the participants, the published research evidence for its effectiveness is limited. Longbottom (2000) notes that most of the evidence for the effectiveness of benchmarking exists in case studies, and there exists very few surveys or more quantitative research efforts demonstrating the effectiveness of this organizational learning tool in achieving incremental change.

While there exists a large amount of literature on benchmarking, studies on benchmarking for facilities management functions are less common (Wong et al., 2013). Loosemore & Hsin (2001) suggests that the field was slow to embrace benchmarking as a general management tool as it was still in the process of defining itself and how it was perceived. As outsourcing became more common in the 1990s and the field began to move from a technically reactive field to a proactive strategic organizational partner, techniques like benchmarking became more common (Grimshaw, 1999; Loosemore & Hsin, 2001; Ventovuori et al., 2007).

Since the emergence of the first academic facilities management research in the 1990s (Loosemore & Hsin, 2001), there is evidence of an increasing demand for benchmarking resources for facility management practitioners. This can be seen in an increasing amount of academic benchmarking research, but also in the activities of facilities management-oriented associations for practitioners. Some of these include:

1. Industry Associations like the International Facilities Management Association (IFMA) and the Building Owners and Managers Association International (BOMA) have worked to define and support the field through setting standards in space definitions and management. This has helped to ensure that accurate area benchmarks can be obtained for comparison. (ASTM E 1836) (ANSI/BOMA Z65)

2. These same associations have also repeatedly conducted benchmarking surveys in the form of reports and databases that can assist facility managers in identifying appropriate benchmarks (IFMA, BOMA).
3. These same organizations regularly highlight and distribute best practices within their field (IFMA, BOMA).
4. Growth in mandatory municipal and regional benchmarking requirements for building energy management (Hsu, 2014) (Buildingrating.org, 2021).

There, however, exists very little research on how or if practitioners are using the techniques and what modes of benchmarking they are using. A previous survey of how FM practitioners were using the information from these benchmarking reports suggests that not all practitioners understand how to or are using the data to seek continual improvement in a true formal benchmarking exercise (Dodd, 2018). There also exists very little evidence of facility management practitioners engaging in benchmarking networks, use of benchmarking partners or process benchmarking within the research literature. For this reason, this study was conducted, and it serves as the first multi-industry, multi-national benchmarking use survey specifically for the facilities management field.

3.3 LITERATURE REVIEW

This literature review will address the pertinent research information relevant to the theoretical background and content of the benchmarking use survey for this study. To address this information, a large volume of previous research will be summarized. The content of the literature review is as follows:

1. Benchmarking
2. Critiques of benchmarking
3. Surveys and self-report measures
4. Benchmarking networks
5. Problems with networks, clubs, and groups
6. Facilities management benchmarking
7. Critiques of FM benchmarking
8. Facility Management industry networks
9. FM benchmarking data sources

Benchmarking

Benchmarking is a tool developed by practitioners concerned with end results rather than theory. As a result, there are numerous opinions regarding what benchmarking is, its modes, and how to approach it. Camp (1989) described four types of benchmarking, while some academic scholars suggests that it has evolved into seven (Bhutta & Huq, 1999). Appleby (1999) discussed benchmarking broadly in terms of metric, diagnostic, and process modes. This approach is used by numerous researchers (Pemberton et al., 2001; Yarrow & Prabhu, 1999). Metric benchmarking is simply comparison of performance based upon metrics and is considered the most widely utilized, yet least effective form of benchmarking. Diagnostic benchmarking is the use of benchmarking for identification of problems and is considered a precursor to the final and most involved form of benchmarking, process benchmarking. Process benchmarking is also known as best practice benchmarking and it is the formal process of benchmarking an entire business process, identification of a best practice, and implementation of that best practice

(Camp, 1989; Pemberton et al, 2001). Research has demonstrated that the more intensive the benchmarking project, the greater the costs and the larger the potential for organizational benefit and superior performance (Yarrow & Prabhu, 1999). (See Figure 3.01).

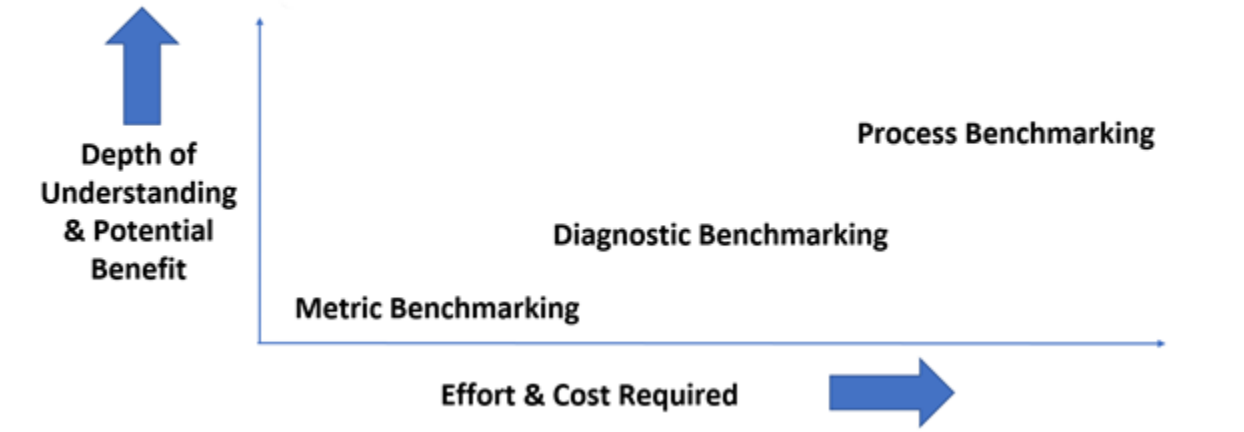

Figure 3.01: Costs vs. Benefits of Benchmarking Modes (As adapted from Yarrrow & Prabhu, 1999)

Camp's (1989) benchmarking work at Xerox was originally designed to be an exercise among a small group of organizations at a time prior to the existence of big data and comprehensive databases. The development of large benchmarking networks for the advancement of benchmarking to meet industry needs is a more recent development (Saunders et al., 2007).

Regardless of the benchmarking model utilized in a project, the identification of benchmarking partners is a crucial step in the benchmarking process. Camp's (1989) second step in his benchmarking model is the identification of comparative companies (partners). Spendolini's (1992) third step in Spendolini's five-step benchmarking model is the solicitation of benchmarking partners. Spendolini's definition of benchmarking partners is "…any person or organization that supplies you with information related to your benchmarking investigation"

(Spendolini, 1992, p. 105). He notes that "A direct person-to-person approach when dealing with functional counterparts has yielded dividends in the form of improved levels of information quantity and quality" (p. 105). The goal of solidifying partners in a benchmarking project is the formation of an individualized benchmarking information network.

Benchmarking networks are the inter and intraorganizational structures that facilitate the benchmarking process within and across organizations to ensure strategic buy-in and comparison groups for the purpose of continual improvement (Camp, 1995). While there exists no formal definition for benchmarking networks, Camp states, "It is often desirable to coordinate benchmarking activities through an operational network that meets at regular intervals to update activities, reduce redundancies, and produce work" (Camp, 1995, p. 228). An organization can have both an internal network and an external network depending on whether they are engaging in internal or external benchmarking comparisons. The intention of the term "network" is simply to represent the participants and resources involved in a formal benchmarking process (Camp, 1989). Still others use the term "benchmarking club" (Costa et al., 2006; Longbottom, 2000; Yarrow & Prabhu, 1999) or even "partnerships" (Yarrow & Prabhu, 1999) to represent the intra or interorganizational members of a long-term benchmarking initiative.

While it is possible to engage in some modes of benchmarking without direct participation in a benchmarking network (Pemberton et al., 2001; Yarrow & Prabhu, 1999), process benchmarking or "best-practice" benchmarking is only achievable through a direct participation in a benchmarking network (Camp, 1995; Longbottom, 2000; Yarrow & Prabhu, 1999). Process benchmarking "…involves two or more organizations comparing their practices in a specific area of activity, in depth, to learn how better results can be achieved" (Yarrow & Prabhu, 1999, p. 794). Camp elaborates on this topic at some depth to further emphasize that

process benchmarking involves the identification, adaptation, and implementation of another organizations “best-practice” to achieve continual improvement in a specific area or process (Camp, 1995).

Process benchmarking, however, is not without its difficulties. While the potential for organizational learning and depth of understanding is greatly increased by engaging in process benchmarking, the time and cost required to implement the ongoing benchmarking process is also substantially more than what is involved in engaging in simple metric or diagnostic benchmarking (Yarrow & Prabhu, 1999).

Since benchmarking is a practitioner lead activity often conducted between private organizations for unique purposes decided by the participants, the published research evidence for its effectiveness is limited. Longbottom (2000) notes that most of the evidence for the effectiveness of benchmarking exists in case studies, and there exists very few surveys or more quantitative research efforts demonstrating the effectiveness of this organizational learning tool in achieving incremental change.

Large scale studies of benchmarking use among practitioners provide understanding regarding how benchmarking is being used by the business community. Longbottom (2000) reviewed more than 460 papers on benchmarking as it is being applied by practitioners in real world projects. The results suggest that negotiating benchmarking partnerships, internal company resistance, and a heavy reliance on basic metric style benchmarking are some of the greatest barriers to successful external benchmarking projects. Only 12 % (n = 560) of respondents to a benchmarking use survey indicated that they had been a member of a benchmarking group, club, or network with the majority (87%) of those clubs being industry specific. Out of those participating in the groups, only 38% considered their membership to be successful. As a result,

the authors recommend that further research is devoted to linking benchmarking to strategic planning and processes, and that further attention needs to be given to the adoption of best practices through process benchmarking.

Adebanjo et al. (2010) also conduct a survey on benchmarking use (n = 453). The survey provides norms on benchmarking use, size of benchmarking teams, composition of benchmarking teams, frequency of benchmarking projects, length of benchmarking projects, reasons for undertaking or not using benchmarking, frequency of data collection, and additional demographics. The results of the survey indicated that informal benchmarking was being increasingly used, while diagnostic and best-practice benchmarking were not as widely used. Although best-practice benchmarking was not as widely adopted as the other modes of benchmarking, it was also perceived by practitioners as the most effective form of benchmarking. The lower levels of adoption of the more effective modes of benchmarking may be indicative of the higher time, effort, and costs associated with these forms of benchmarking as noted by other researchers (Yarrow & Prabhu, 1999).

Critiques of benchmarking

Benchmarking, however, is not without its difficulties and critics. Longbottom (2000) conducted a survey on benchmarking where respondents reported problems in finding suitable external benchmarking partners, as well as internal reluctance to share information with individuals outside of the organization. While Camp (1989) considered the adoption of a best practice as the purpose of benchmarking, as little as 5% of these initiatives may result in the transfer of a best practice (CCI, 1993).

Benchmarking is a frequently misunderstood process. Following the publication of Robert Camp's (1989) book on benchmarking, the process, as well as the lexicon became increasingly embraced and utilized by the general business community and the public alike (Alstete, 2008). Over time, this had led to the adoption of the term "benchmark" in referring to a specified performance metric that is analyzed, which is often confused with the term, "benchmarking", which is a structured and defined process. The emphasis in the term, "benchmarking" is that it is a continuous process rather than performance management measurement. With the adoption of the management practice into various industries, it has come to mean different things to different people. It has become known as a "fuzzy, all-encompassing phrase that can mean all things to all people" (Tarricone, 1998, p. 50). Prior research indicates that confusion surrounding these issues and usage of the term still exists (Alstete, 2008).

Surveys and Self-Report Measures

Benchmarking surveys often utilize a self-report methodology. When this is not a mandated reporting methodology, self-reporting does decrease the odds of intentional misreporting, however, this approach is susceptible to mistakes in data entry and errors originating from the understanding and knowledge of the individual reporting the data (Hsu, 2014). Simple misunderstandings of area measurements, numbers of employees or even differences in accounting methods can cause error in the self-report benchmarking process that can often obscure the true differences in the benchmarking comparisons being made. More involved benchmarking modes, such as process benchmarking, or participation with organizational partners and benchmarking networks are more likely to utilize verified data, which offers a much greater potential for benchmarking success due to the accuracy of the data.

Benchmarking Networks

There exists a significant amount of research on benchmarking networks and their outcomes. These networks are groups of varying sizes and purposes who regularly meet over long periods of time (years) to benchmark, identify best practices, and support one another in the quest for continual improvement. Despite the global availability of benchmarking opportunities, there exists little to no research on whether the facilities management field is participating in and benefitting from these intraorganizational comparisons (Camp, 1989; Ogden & Wilson, 2001; Petri & Kuhne, 2013). Table 3.01 provides a summary of the research literature on benchmarking networks, topics, and size.

Table 3.01: Previous studies on benchmarking networks and their outcomes

	Benchmarking Network Sector	**Network Topics**	**Network Size**	**Research Papers**
1	government municipalities	various efficiency measures	(7-15) organizations	Ammons & Rivenbark (2008)
		efficiency and quality measures	190 organizations	Knuttson et al. (2012)
		land development review process	17 organizations	Ammons & Roenigk (2015)
		multiple networks/ various performance management topics	313 municipalities in 25 local networks	Askim et al. (2007)
2	construction industry	Key Performance Indicators (KPIs)	a few hundred organizations	Costa et al. (2006)
		construction project performance	39 companies, 247 projects	Costa et al. (2006)
		construction project performance	1,240 projects	Costa et al. (2006)
3	manufacturing & service organizations	Multiple topics	700 organizations	Yarrow & Prabhu (1999)
4	mixed industry networks	customer focus & strategy deployment	15 organizations	Adebanjo & Mann (2008), Saunders et al (2007)

		various performance concerns	14 organizations	Adebanjo & Mann (2008)
5	food & drink industry	demand management, customer satisfaction	13 organizations	Adebanjo & Mann (2008)
6	utility municipalities	water consumption/treatment	25 municipalities	Tillema (2007)
7	laboratory facilities	productivity, maintenance, energy efficiency	284 buildings	Petri & Kuhne (2013)
8	public leisure/recreation	Facility performance	9 municipalities	Ogden & Wilson (2001)
9	New York commercial office buildings	energy consumption/performance	24,071 buildings	Hsu (2014)

Adebanjo & Mann (2008) documented case studies of three benchmarking networks to determine potential challenges with their long-term management and upkeep. Their paper summarizes the long-term results achieved by the Benchmarking Club for the Food and Drinks Industry, The New Zealand Benchmarking Club, and The Benchmarking Institute. They found that while these networks often benefitted the participating members, there was difficulty in getting the organizations to sustain the long-term buy-in required to achieve long lasting change and that membership in these networks varied over time due to attrition. Based upon their case studies, the researchers recommend network members should be advised of the time, effort, and costs associated with memberships and that the networks should be designed with flexibility in mind, as their membership base is likely to change over time.

Ammons and Rivenbark (2008) note that in publicly mandated municipal benchmarking networks, participants are all reporting data but there are very few who are effectively able to use the data to achieve performance improvements. As a result, they recommend that future research needs to be detail oriented for the purpose of understanding how the organizational dynamics,

cultures, and treatment of performance improvement in these interacting organizations determine the capacity for improvement.

Problems with Networks, Clubs, and Groups

While participation in a benchmarking network, club, or group offers the greatest potential for learning, savings, and adoption of a genuine best-practice (Yarrow & Prabhu, 1999), these groups are not without their long-term difficulties. Adebanjo & Mann (2008) studied three benchmarking networks over their operational lifetime (4-8 years) and found long-term performance to vary substantially. The researchers found that while most organizations reported benefits from participation in the groups, many organizations struggled to secure their organizational buy-in necessary to achieve sustained continuous improvement. The long-term performance of these networks was impacted by membership costs vs. practical value, the types and purposes of the networks, and the rate of internal employee change within the organizations participating. Additional problems included membership turnover and commitment to network meetings and events.

Facilities Management Benchmarking

Facilities management been rapidly growing and defining itself as a field since the 1980s but is still considered a fairly new profession (Loosemore & Hsin, 2001; Pitt & Tucker, 2008; Tay & Ooi, 2001; Ventovuori et al., 2007). A large part of this growth in the field and its emergence as a defined discipline is due in large part to the establishment of professional associations such as IFMA in North America (Tay & Ooi, 2001; Ventovuori et al., 2007), as well as international counterparts in other regions (Tay & Ooi, 2001).

The growth of outsourcing and the further definition of this field in the 90's helped to articulate this profession into the host of services that it is known for today (Loosemore & Hsin, 2001). FM focused benchmarking began during this same time when IFMA began to collect building performance data and to work with the industry to develop KPIs. Other organizations such as the British Institute of Facility Management (BIFM) and BOMA were quick to add to this growing trend of developing performance measures specifically for the built environment. While the facility-oriented literature on benchmarking is not as pervasive as business oriented literature there exists a good amount of literature on performance measurement and management (Meng & Minogue, 2011; Pitt & Tucker, 2008; Tucker & Pitt, 2010; Simões et al., 2011), holistic industry wide key performance indicators (KPIs) (Lavy, Garcia, & Dixit, 2014a, 2014b; Lavy, Garcia, Scinto, & Dixit, 2014; Lavy S., 2011), and customer satisfaction (Pitt et al., 2016; Tucker & Pitt, 2009). FM performance studies (which include benchmarking) are the third most common type of academic research in the field (Ventovuori et al., 2007). These research efforts, however, seem to highlight the use of metric benchmarking, rather than the more involved diagnostic and process benchmarking (Yarrow & Prabhu, 1999). In fact, there exists little to no evidence that facility managers are getting the most out of their benchmarking activities. Case studies of continual improvement are scarce and surveys examining the types and modes of benchmarking used by FM practitioners are absent from the research literature.

Critiques of FM Benchmarking

While the distinction between performance management and true benchmarking has been noted for at least the past 20 years in facilities management (Tarricone, 1998), there still appears to be a disconnect on how to use benchmarking for continual improvement in the FM literature.

The known confusion around performance management and benchmarking (Alstete, 2008) has been noted in the literature. Thought the two techniques are distinct, they are complimentary. Simoes et al. (2011) noted that only 11% of articles in a review of 251 articles on maintenance performance management even mentioned benchmarking, suggesting a professional and academic disconnect on the complimentary nature of the techniques. To date there remains little research on how well practitioners currently understand the distinctions in regard to the facilities management discipline. The presence of this confusion, however, suggests that this may be an important concept to test for in surveying facility management practitioners on their benchmarking initiatives.

Other difficulties in FM-oriented benchmarking have also been noted in the research literature. Wong et al. (2013) noted that FM benchmarking has traditionally been relatively simplistic in its analytical approach, which may be limiting the field's capacity for continuous improvement. Rodier (2001) suggests that a lack of uniform analysis and statistical methods can make the determination of "best-in-class" performance difficult. Hinton et al. (2000) discussed how determination of best practices are limited by tendencies to look for similar data, organizational size, and resource constraints that may result in a continuous cycle of catching up, rather than leaping ahead in performance capacity. In a review of FM benchmarking literature, Yasin (2002) identified several knowledge gaps in the literature that include a lack of proper or uniform benchmarking models, lack of a systemic approach to benchmarking, insufficient methodologies for cost-benefit analysis, and a disparity of benchmarking use between various industry sectors.

Facility Management Industry Networks

There exists very little evidence for the use of formal benchmarking initiatives in directly addressing facilities management processes or services. One example of an early benchmarking network focused on facilities management is a study conducted by the U.S Department of Energy (DOE) (Engebretson & Skokan, 1997). The researchers followed a four-phase benchmarking model to determine the best way to reduce energy costs for government buildings. The results of the benchmarking project concluded that the process was successful in reducing costs and that benchmarking facilities management and maintenance activities were the keys to "leveraging cost improvements" (p. B&PM/A.02.5) and facilitating continual improvement.

Petri & Kuhne (2013) may arguably provide the most detailed and thorough example of a formal process or best-practice benchmarking initiative and network in the academic literature on facilities management. The network was formed to specifically focus on the comparison of facility efficiency of laboratory and office buildings in the pharmaceutical industry. The research group worked with a network of 15 organizations managing 284 office and laboratory buildings over an eight-year period. The benchmarking itself was carried out in an anonymous manner but all organizations were given the means to communicate and exchange information through the project coordinator, program structure, and regular best-practice workshops. Numerous efficiency related building details were compared across demographically similar buildings and organizations. Buildings were compared in terms of their productivity per unit area, life-cycle oriented maintenance, and energy supply and waste disposal. Using best-practice workshops details and discussion of practices and techniques for optimization were exchanged and best practices identified based upon consensus opinion. One of the most significant findings of this network was that type of building had very little impact on the energy use of the laboratory

buildings. Rather, air exchange rate (AER) was found to be the most influential factor regarding energy consumption.

FM Benchmarking Data Sources

One of the most critical elements of successfully benchmarking is the data. Petri & Kuhne (2013) note that in their study of a facility benchmarking network, benchmarking reports served to identify both the benchmarks and the potential for performance optimization. The researchers note, however, that the intention of the group was to move beyond a simple comparison of figures, as metric benchmarking is performed too frequently with minimal results. Modern benchmarking frequently involves the use of benchmarking reports and databases, which were not available in the 1980s and 90s when benchmarking was being developed as a standard business tool. This section will review some of the most regularly utilized sources of benchmarking data for the building sector. These include IFMA, BOMA, the Construction Industry Institute (CII), Leadership in Educational Facilities (APPA), and the Association of Healthcare Engineers (ASHE).

IFMA

The International Facilities Management Association (IFMA) was formed as a non-profit in 1980 shortly after the emergence of Facilities Management as a discipline (Ventovuori et al., 2007). It was formed by a group of practicing facility professionals who wanted to improve and advance their profession. As of 2019, IFMA has over 24,000 members in more than 100 countries (IFMA.org, n.d.).

Since its inception IFMA has published on ongoing and growing series of facility benchmarking reports constituting a wide array of facilities and subjects. IFMA has released a North American series of benchmarking reports on Facility Operations and Maintenance and Healthcare facilities. More recently IFMA has expanded its benchmarking research to begin benchmarking studies in Europe, Asia, the Middle East, and the Caribbean (IFMA.org, n.d.).

The content of the benchmarking studies is determined through a collaborative effort between IFMA, identified Subject Matter Experts (SMEs), and academic researchers. The data from the studies is analyzed by the research team and the reports are published by IFMA and available for purchase at both member and non-member rates. The content in the reports contains overall trends, means, and range of metrics studied and broken down by various facility demographics such as industry served, facility, use, geographic region, facility size, age, climate zone, setting, and many others.

These reports, however, do not specifically identify best practices. IFMA tends to provide reports on best practices and trends as determined by SMEs, but there is a lack of connection to specific benchmarking data. This means that the data in these reports is only capable of supporting metric benchmarking, leaving diagnostic benchmarking and process benchmarking to be handled solely by the practitioners using these reports. This gap between benchmarking data and benchmarking use is an issue of paramount importance of the facilities management industry, as diagnostic and process benchmarking offer the largest chance of adoption of best practices and sustaining a continuous improvement initiative (Yarrow & Prabhu, 1999). Further, these reports do not enable specific facilities or organizations to identify each other for partnerships as the data is only reported in aggregate form.

BOMA

The Building Owners and Managers Association International (BOMA) was originally founded in 1907, giving it a much longer history than IFMA (BOMA.org, n.d.). Whereas IFMA's focus tends to be on the practitioners managing the facilities, BOMA's focus tends to be geared to commercial real estate professionals. BOMA has a long history of advocating for building owners and developing standards for floor measurements in buildings (Anonymous, 2007). Recently, IFMA and BOMA worked together to help define floor measurement area terms and merged the ANSI/BOMA Z65. standards with the ASTM E 1836 standards used by IFMA. This paved the way for standardization in space comparisons, which are essential in benchmarking the management of building space.

BOMA has regularly produced benchmarking reports for a variety of building sectors. These reports are a summary of the metrics considered by practitioners to be crucial to the operating lifecycle of buildings. This data is gathered through self-report surveys and compiled into published reports where the overall trends, means, and range of measures are reported for interpretation by commercial real estate professionals.

In addition to the publication of building oriented metrics, BOMA, like IFMA, produces ongoing qualitative research and gathers practitioner wisdom through the utilization of Subject Matter Experts. BOMA regularly releases reports and articles that identify best practices. These best practices, however, are often determined by professional opinion and are not necessarily linked to the benchmarking reports and data. As is this case with IFMA's benchmarking reports, this benchmarking data is only capable of supporting metric benchmarking, leaving diagnostic and process benchmarking undocumented and up to the individual practitioners. Like IFMA,

BOMA's reports also only report the data in aggregate form. This means these benchmarking efforts do not identify specific partners, as is required in formal benchmarking activities.

APPA

APPA has gone through several name changes throughout its 100+ year history but has maintained its focus on the physical management of higher education facilities. The acronym itself originated as the Association of Physical Plant Administrators, but as of 2007, it is known by its tagline, "Leadership in Educational Facilities" (APPA, n.d.). Like IFMA and BOMA, APPA also provides benchmarking surveys and reports for facility managers (APPA, 2019). The reports survey educational facilities regarding key performance indicators and provide facility managers with metrics by which to compare the performance of their buildings. The importance of specialty building associations, such as APPA, is that they focus on the particular operating constraints of facility use, thereby providing a similarity of data that makes it more feasible to make "apples to apples" comparisons (Camp, 1989).

ASHE

The Association of Healthcare Engineers (ASHE) is another facilities management association directly focusing on the management of healthcare facilities. ASHE has also conducted benchmarking surveys and reports on healthcare facilities and partnered with IFMA for a previous benchmarking report (IFMA/ASHE, 2010). Healthcare facilities are well-known for having unique operating needs that must include 24/7 reliable operational performance during emergency and disaster events as critical infrastructure (CISA, 2020), and demand urgent and timely service, as well as an increased regulatory accreditation and code compliance (NASEM,

2020). Since the operation of these facilities has unique demands, ASHE specializes in compiling data and reports that have a greater relevance to hospital facility management departments.

Construction Industry Benchmarking

The construction industry has also been slow to adopt peer or competitive benchmarking (Lee et al., 2005). Academic research on construction benchmarking tends to be scarce, as standard performance metrics have not been widely identified, adopted, or collected by construction companies (Costa et al., 2006). (El-Mashaleh et al., 2007, p.) noted that "…rigorous benchmarking in the construction industry still remains an embryonic field" (p. 10). Aa a result, there exists very little evidence of formal benchmarking initiatives for the construction industry.

Costa et al. (2006) outlined and reviewed four major international benchmarking initiatives for the construction industry. These include the Key Performance Indicators (KPI) initiative in the United Kingdom, The National Benchmarking System (NBS) out of Chile, the Construction Industry Institute Benchmarking & Metrics (CII-BM& M) in the United States, and the Performance Measurement for Benchmarking in the Brazilian construction industry (SSIND-NET Project). The authors noted that each of these initiatives is geared towards providing data, resources, and tools for construction project evaluation and improvement, and each have the option of participating in a benchmarking club for a true benchmarking network experience. No information, however, is provided about the specific content and results of the benchmarking clubs.

The Construction Industry Institute (CII) was first formed in 1983 (Lee et al., 2005). Unlike the non-profits of IFMA and BOMA, the CII is a privately funded research institute

headquartered at the University of Texas at Austin. CII membership includes owner, contractor, and vendor organizations. This organization is arguably the largest source of project-oriented benchmarks in North America.

Like IFMA, CII has an ongoing benchmarking program entitled the CII Benchmarking & Metrics (BM&M) program. This program has been collected benchmarks and produced reports on project delivery and performance since 1996. In 2005, they amassed their data and created a benchmarking database for practitioners to use for more sophisticated analyses not included in their standard benchmarking reports. Like IFMA and BOMA alike, this data is made available for "self-analysis" (Lee et al., 2005, p. 791). Costa et al. (2006) noted that CII offers benchmarking "clubs", but most of the tools and resources are provided for self-use. (Castillo et al., 2018) reported that CII has collected best practices for the construction community since the 1990s, however, the extent to which these are connected to organizational data is unknown. This aspect of the benchmarking process is up to the individual organization and like IFMA and BOMA, there is no evidence that construction or owner organizations are using this data to engage in the more productive diagnostic and/or process benchmarking modes. Participants in this program report that the most common problem they encounter in utilizing data is the lack of organizational resources for implementation (Costa et al., 2006).

Usage and Prevalence Summary

IFMA, BOMA, APPA, ASHE, and the CII all represent Industry Associations or Networks of professionals involved in the lifecycle of buildings and infrastructure. These organizations sponsor and deliver ongoing industry relevant benchmarks, benchmarking studies, and opportunities for networking. Their continued presence and the ongoing and increasing

demand for benchmarking data demonstrates that the field of facilities management and construction are utilizing the data and benchmarks made available by these organizations. The nature of the data in these reports can support metric benchmarking but is short of the detail and individual attention necessary for diagnostic or process benchmarking. One of the critical steps in benchmarking is the identification of benchmarking partners to benchmark against. Reports and databases that report benchmarking studies in aggregate form offer significant potential to be representatively large samples, but they do not allow for the identification of sufficiently similar organizations or facilities for the purpose of completing a formal benchmarking project. Though these organizations offer exceptional networking opportunities and single point data sources, effective benchmarking need to take place at the organizational or unit level.

3.4 RESEARCH OBJECTIVES

The overall objective of this study was to carry out an international study on the utilization of benchmarking by facility professionals. While there exist previous studies on benchmarking adoption and implementation, there exists no data on how the FM field is utilizing the technique to manage the operation of constructed facilities. Assessment of the current state of benchmarking use in the field is necessary to identify opportunities for improvement and the creation of resources available for practitioner use. The objectives for this study are as follows:

1. To assess the frequency of benchmarking use in facilities management.
2. To assess the benchmarking process as used by FM practitioners.
3. To identify sources of FM benchmarking data and information.
4. To assess FM involvement with benchmarking networks, clubs, or groups.

5. To identify areas for improvement and educational opportunities for practitioners.

Research Questions

Given the results of the literature review, there are several important questions that need to be answered regarding how facility management professionals are utilizing benchmarking techniques. The answers to these questions can help guide academics and practitioners to develop resources for improving the FM benchmarking process for the purpose of achieving the sustained continuous improvement that will be necessary to meet long term regional and municipal goals pertaining to the operation of buildings.

RQ1: To what extent are organizations utilizing benchmarking to optimize facility management functions?

RQ2: How is the benchmarking process typically approached by facility management professionals?

RQ3: What are the barriers to FM-focused benchmarking in organizations that do not use the technique?

RQ4: What is the incidence of participation in benchmarking networks, groups, or clubs for facility management functions?

RQ5: How does the use of benchmarking for FM functions compare to previous studies on benchmarking use?

3.5 METHODS

Survey Development

The benchmarking modes used in this survey include metric, diagnostic, and process benchmarking as utilized by numerous researchers (Appleby, 1999; Pemberton et al., 2001; Yarrow & Prabhu, 1999). The survey also used the internal and external benchmarking mode distinction as utilized by Camp (1989). Using this broad perspective of benchmarking modes allows for a simple assessment of approaches to benchmarking in the field of FM that can easily be compared to other industries and fields. These benchmarking modes were defined for all participants in the survey. The definitions for these modes were specifically applied to the facilities management field and can be found in the survey content in APPENDIX A: Benchmarking Modes & Networks Survey.

The question content for the survey was developed from an extensive literature review on benchmarking networks and organizational learning both external to and within the facilities management and construction fields. A total of 46 questions were developed for the survey. Not every respondent was asked every question using within survey logic to present follow-up questions relevant to their choices. See Figure 3.02 for an illustration of the survey logic. Someone with very little benchmarking experience could complete the survey in as little as 5 minutes, while more experienced respondents (who were queried for more detail) could complete the survey in 10-15 minutes. Many of the questions specific to benchmarking practices were taken from Adebanjo et al.'s (2010) benchmarking survey, for which norms exists and can be compared to the results of this survey. Some of these questions were modified to fit the FM industry. Other questions were developed specifically for the FM industry based upon previous

research experience and a literature review. The topics are listed below. See the APPENDIX A: Benchmarking Modes & Networks Survey for full survey.

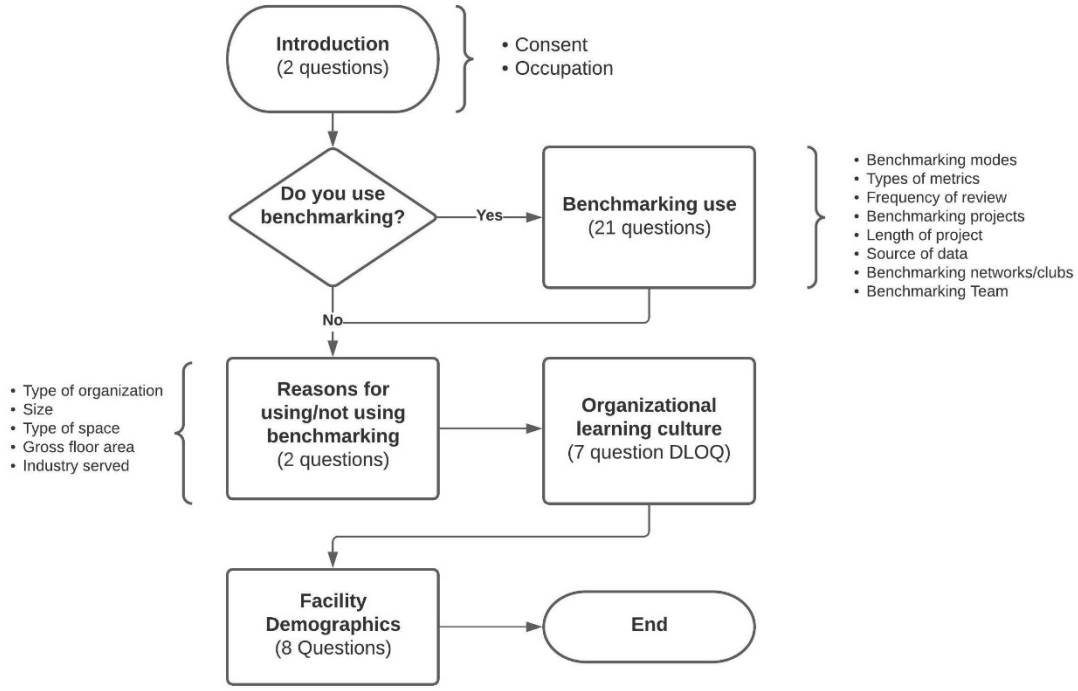

Figure 3.02: Benchmarking survey logic and content

Survey Platform

The survey was developed and administered through the Qualtrics survey service. Upon completion of the survey, the results of the survey were downloaded in the form of an SPSSS file.

Survey Distribution

1. The respondents for this survey were identified through previous participation in FM focused webinars given by the research group.
2. Pilot survey was sent to 200 FM contacts. An email invitation was sent from Qualtrics Survey Service on 02/17/21. On 2/23/21 responses were reviewed. A total of 15 responses were recorded, indicating a 7.5% response rate. Responses were checked in detail and no problems with survey logic or incomplete surveys were noted.
3. Survey was sent out to 3,566 contacts through Qualtrics on 02/24/21.
4. A reminder was sent on 03/03/21 and 03/10/21 to respondents who had not completed or taken the survey. Reminders were sent out at varying times of the day to ensure that the time at which the email was delivered did not limit the chances of the invitation being seen. See APPENDIX B: Email Invitation Examples for additional information.
5. The survey was closed on 03/17/21.
6. A total of 585 responses were recorded out of 3463 emails sent indicating a response rate of 17%.

Data Analysis

A descriptive analysis utilizing frequency tables, charts and cross-tabulations was the primary form of analysis. An SPSS file format was downloaded from Qualtrics and the descriptive analysis was conducted in SPSS 26. The data were cleaned by removing responses that abandoned the survey within the first five questions. Numerical data were checked for form and were converted into a purely numerical form if they utilized letters or abbreviations in the answers. For example, “1M” was converted to “1,000,000”.

While the respondents were not asked to give their location, Qualtrics logs IP addresses of the physical locations of the respondents to each survey in the form of GPS coordinates. The GPS coordinates were used to identify the country of origin for respondents. All other demographic information was provided by the respondents.

3.6 RESULTS

Respondent Locations

The geographic region of the respondents is reported in Table 3.02. The majority of the respondents (73%) were from North America. Responses were recorded from 50 countries and territories. The regions of the respondents are summarized below along with the percentage of respondents who report using benchmarking.

Table 3.02: Geographic Regions of respondents

Region	N	Percent of sample	Percent Using Benchmarking
North America	334	73%	61%
USA	280	61%	60%
Canada	39	9%	67%
Mexico	3	1%	100%
Caribbean	12	3%	33%
South America	5	1%	60%
Europe	19	4%	68%
Middle East	31	7%	55%
Africa	42	9%	67%
South-Pacific	4	1%	75%
India	12	3%	83%
Asia	11	2%	64%
Total	458		64%

Demographics

Table 3.03 summarizes the demographics of these respondents to this survey. Column 1 lists the sample size and the Column 2 lists the overall proportion of the demographics in the survey. The respondents to this survey were primarily facility managers. 73% of the respondents identified as in-house facility managers, 10% as outsourced facility managers, and 11% as FM consultants. The remaining 6% identified as various job titles including vendor, project manager, professor, property manager, and energy manager. Most facility managers in this survey were responsible for portfolios of buildings (multiple buildings in multiple locations) (66%), while 19% reported being responsible for a campus of buildings (multiple buildings in one location, and the remaining 15% were responsible for a single building or a space within a building. 44% of 480 respondents reported that the organization was private, 37% reported that it was a public organization, and 15% reported being a Not-for-Profit organization. The remaining 4% reported as other, which included mixed forms of the other organization types. The industries represented in this survey include 14% from the manufacturing sector, 43% from the service sector (Banking, Insurance, etc.), and 43% from the Institutional Sector (Education, Government, Cultural Institutions, etc.). Various organizational sizes were well represented in this survey with 32% reporting as small, 27% as medium, 21% as large, and 21% as enterprise (See Table 1 for definitions of size ranges).

Benchmarking Use

Sixty-four percent of all respondents reported using benchmarking to evaluate and improve facility operations. These results are similar to the general industry results of Adebanjo et al.'s (2010) survey that found that 69% of businesses use informal benchmarking. Table 3.03 Column 3 lists the percent of respondents that use benchmarking in relation to the demographics

collected for this survey. The trends in this table suggest that the use of benchmarking is related to organizational size in that larger organizations are more likely to use benchmarking than smaller ones. This trend is also somewhat evident in the type of space that facility mangers reported being responsible for. Of further note is that Not-for Profit organizations report less facility-focused benchmarking use (50%) compared to their private (65%) and public organizational peers (64%). Respondents who indicated that they did not use benchmarking (36%) were not asked any further questions pertaining to benchmarking use.

Table 3.03: FM Demographic and Benchmarking Use Summary Table

1	2	3	4
	N	Percent of Sample	Respondents that use Benchmarking (%)
Organizational Size			
Small: Less than 500 employees	153	32%	57%
Medium: 500-2,000 employees	127	27%	61%
Large: 2,001-10,000 employees	98	21%	63%
Enterprise: More than 10,000 employees	100	21%	71%
Sector			
Manufacturing	64	14%	61%
Service	199	43%	66%
Institutional	195	43%	57%
Type of Organization			
Private	210	44%	65%
Public	177	37%	64%
Not For Profit	72	15%	50%
Other	21	4%	53%
Respondent Type			

In-house Facility Manager	401	73%	61%
Outsourced Facility Manager	56	10%	71%
Consultant	58	11%	72%
Other	32	6%	63%
Type of Facility Space			
Space within a building	34	7%	38%
A Single Building	39	8%	51%
Multiple Buildings in One Location	91	19%	64%
Multiple Buildings in Multiple Locations	316	66%	66%
Overall Use of FM Benchmarking			64%

FMs That Don't Use Benchmarking

Thirty-six percent of Facility Managers do not use benchmarking in the management of their facility operations. These non-benchmarking facility professionals were asked to give the top three reasons that they do not use benchmarking. The results in in Table 2 indicate the percentage of non-benchmarking facility professional's reasons for not benchmarking. Lack of understanding, resources, and technical knowledge were the most common reasons given for not benchmarking. This question utilized answers given to Adebanjo et al.'s (2010) general industry benchmarking survey (N = 485). While the results are similar to Adebanjo et al.'s (2010) survey, facility managers noted a lack of understanding of benchmarking as their primary reason and a lack of knowledge in planning benchmarking as their third most common reason. Adebanjo et al.'s 92010) top three reasons in order were lack of resources, lack of partners, and lack of technical knowledge. This top-three pattern begins to change when the reasons are grouped by organizational size. Table 3.04 highlights the top three reasons in red underlined text and shows

as organizations get larger their reasons for not utilizing benchmarking shift from lack of knowledge to lack of top management commitment and FM not being seen as a strategic partner in the parent organization.

Table 3.04: Reasons for not Using Benchmarking by Organizational Size

Reasons for NOT Benchmarking	Small: Less than 500 employees	Medium: 500-2,000 employees	Large: 2,001-10,000 employees	Enterprise: More than 10,000 employees	Overall % of Respondents
Lack of understanding of benchmarking	20%	14%	14%	11%	39%
Lack of resources	12%	15%	16%	12%	35%
Lack of technical knowledge in planning benchmarking project	14%	18%	8%	11%	33%
Lack of top management commitment	8%	10%	15%	13%	27%
Lack of benchmarking partners	11%	9%	10%	11%	25%
FM is not perceived as an organizational strategic partner	9%	6%	7%	12%	20%
No clear benefit from benchmarking	10%	7%	7%	5%	19%
Lack of organizational authority	5%	6%	9%	11%	17%
Other reasons	3%	4%	2%	8%	10%
High costs (outweighs potential benefits)	4%	4%	5%	1%	9%
Long time frame to complete the project	3%	3%	4%	4%	9%
Fear of sharing information	0%	5%	6%	1%	8%
Total Sample Size	171	142	103	75	201

Types of Benchmarking

Figure 3.03 displays the results of the survey indicating the percentage of facility managers who use the various modes of benchmarking. About half of all facility managers have

used internal, external, metric, and diagnostic benchmarking, however, less than 27% have utilized process benchmarking in the management of their facilities. Adebanjo et al. (2010) found that 49% of business used performance or diagnostic benchmarking compared to 53% of facility managers in this survey. The researchers also found that 39% of businesses use process or best-practice benchmarking, compared to 27% of facility managers who reported using the benchmarking mode in this survey.

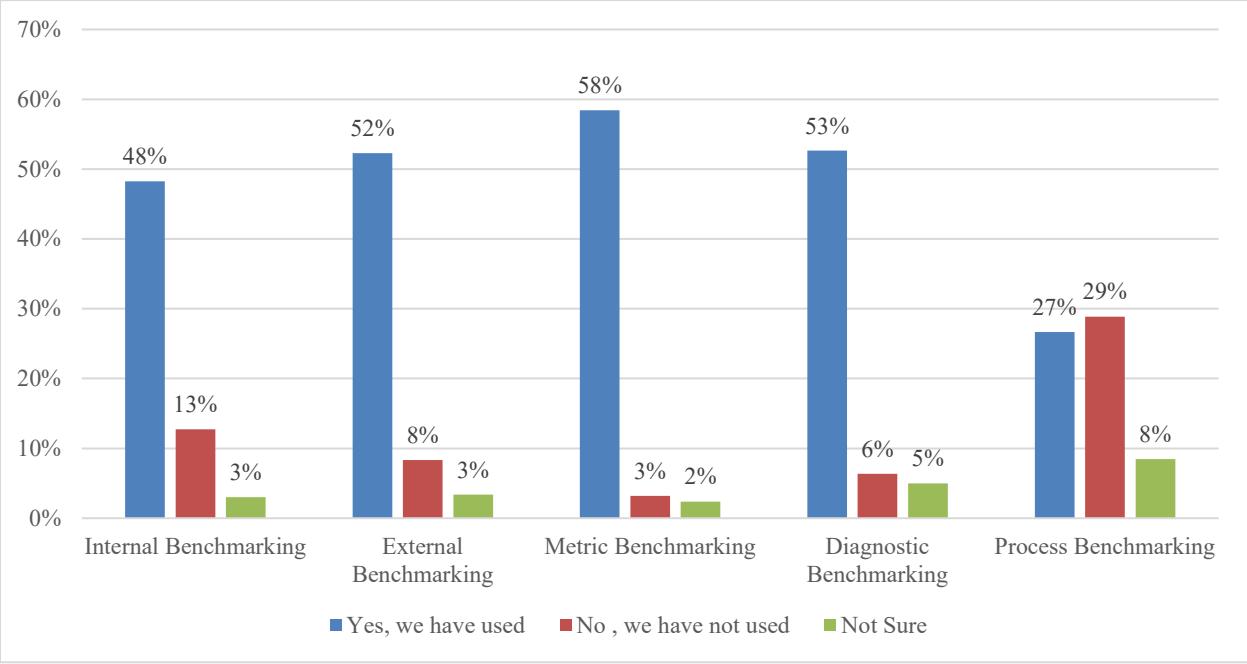

Figure 3.03: FM Use of Benchmarking Modes (N = 556)

Metric Benchmarking/Performance Management

Table 3.05 shoes that the most widely used metrics in facilities management are financial metrics with 96% of respondents who use benchmarking reporting that these metrics are regularly used to assess and modify performance. The least widely used are spatial metrics with only 57% of respondents reporting their use on a regular basis.

Table 5: Percent of Facility Managers Who Regularly Use Metric Types

	Financial	Satisfaction	Productivity	Environmental	Service Quality	Spatial
Overall Use	96%	85%	83%	80%	72%	57%
N	241	212	206	197	177	142

Figure 3.04 shows the percent of respondents who review performance metrics at regular intervals. The most often reviewed metrics are financial with 64% of facility managers reviewing those at least once a month. Spatial metrics appear to be reviewed much less regularly than the other types of metrics with 83% of facility managers reviewing those metrics less than once a quarter.

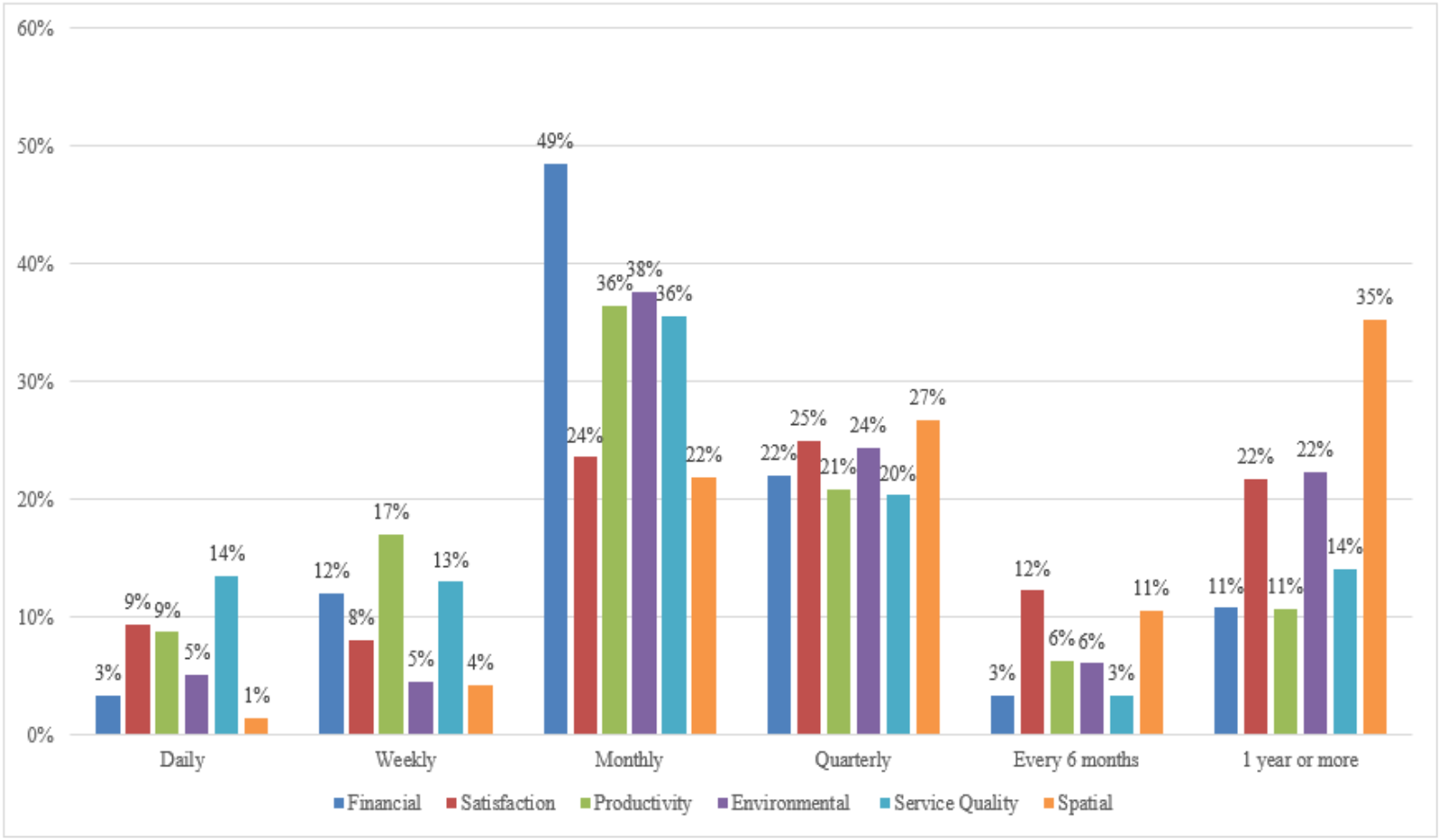

Figure 3.04: Percent of Respondents and Frequency of Review of Metric Types (N = 254)

Benchmarking Projects

Figure 3.05 shows that the majority of FM departments (73%) engage in fewer than five benchmarking projects for FM functions in a three-year period. Although all these respondents reported using benchmarking, 10% report not having been involved in a benchmarking project in the last three years. These results suggest Facility Managers are engaging in fewer FM oriented benchmarking projects than is reported by general industry over a three-year period (Adebanjo et al., 2010).

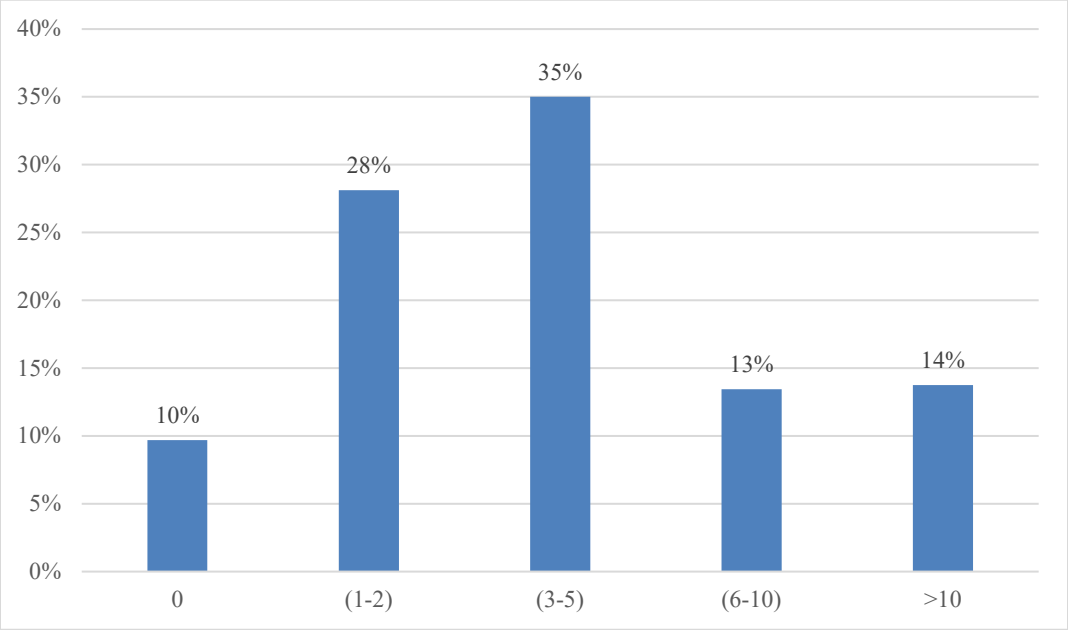

Figure 3.05: Number of FM Benchmarking Projects in the past three years (N = 320)

Figure 3.06 shows a comparison of the length of FM benchmarking projects compared with Adebanjo et al.'s (2010) general industry results. The comparison demonstrates that FM benchmarking projects are similar to general industry in length but may take slightly longer on average.

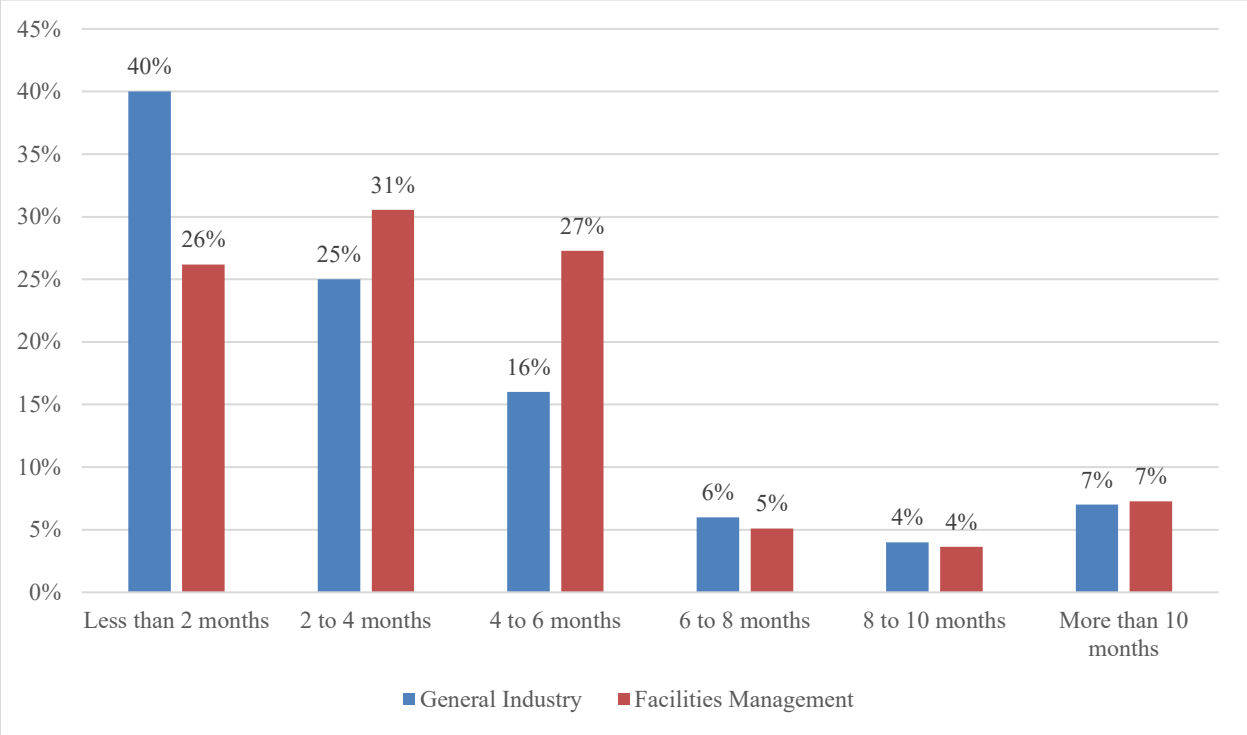

Figure 3.06: Comparison of Benchmarking Project Length Between General Industry and Facilities Management (N = 275)

Benchmarking Teams

Respondents were asked if their current organization ever had an identified benchmarking team assigned to a benchmarking project or initiative. Of the 64% of facility managers who use benchmarking, only 42% of them have identified benchmarking teams (Approximately 27% of all facility managers). The mean number of benchmarking team members reported by facility practitioners is 8.00. The range of answers was from 2 to 25. Figure 3.07 shows the results of benchmarking team size reported in this survey compared to the results reported by Adebanjo et al. (2010). Adebanjo reported that 62% of benchmarking teams consist of 4 or less people, but the results of this survey are that only 24% of FMs have benchmarking

teams of 4 or less people. Facility Management oriented benchmarking teams appear to be significantly larger than those reported by general industry.

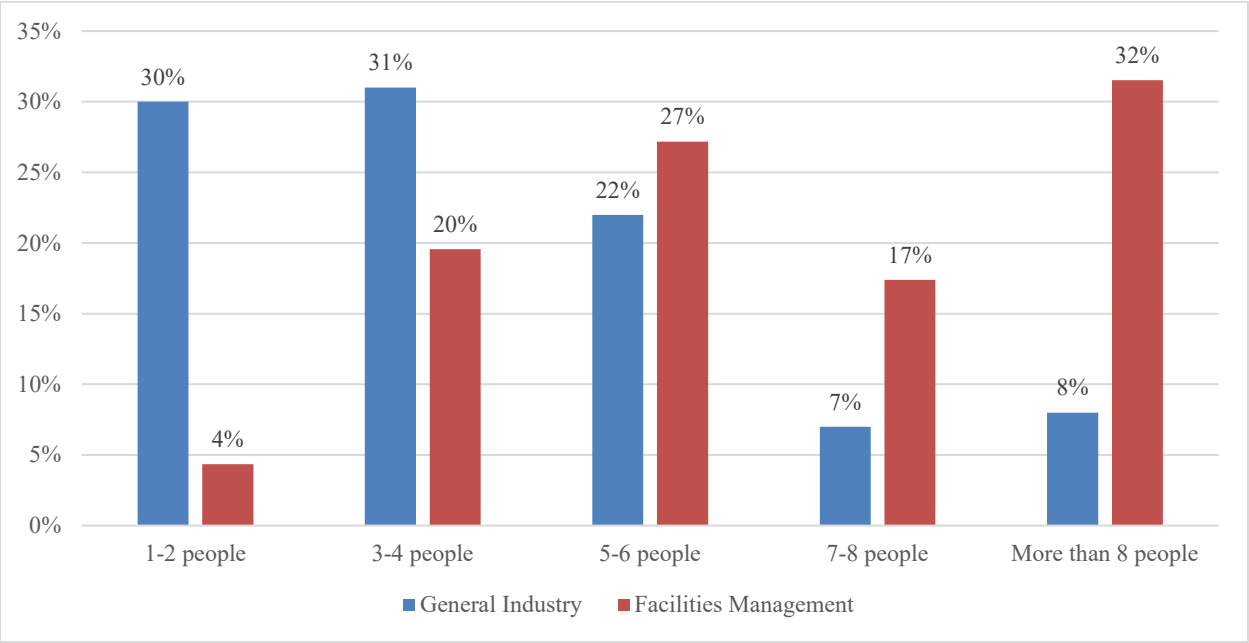

Figure 3.07: Size Comparison of Benchmarking Teams (N = 92)

Figure 3.08 lists the types of employees that are typically utilized in FM oriented benchmarking teams. While the composition of this teams can vary substantially depending upon the type of benchmarking project undertaken, the majority of respondents indicate that facility manager are parts of the team (87%), followed by senior management (58%), and data analysts (52%). The recognition of data analysts as a regular participant in benchmarking teams is a departure from the results obtained by Adebanjo et al. (2010) and may be reflective of the growing trend of big data and data analytics that is current being embraced by the FM industry.

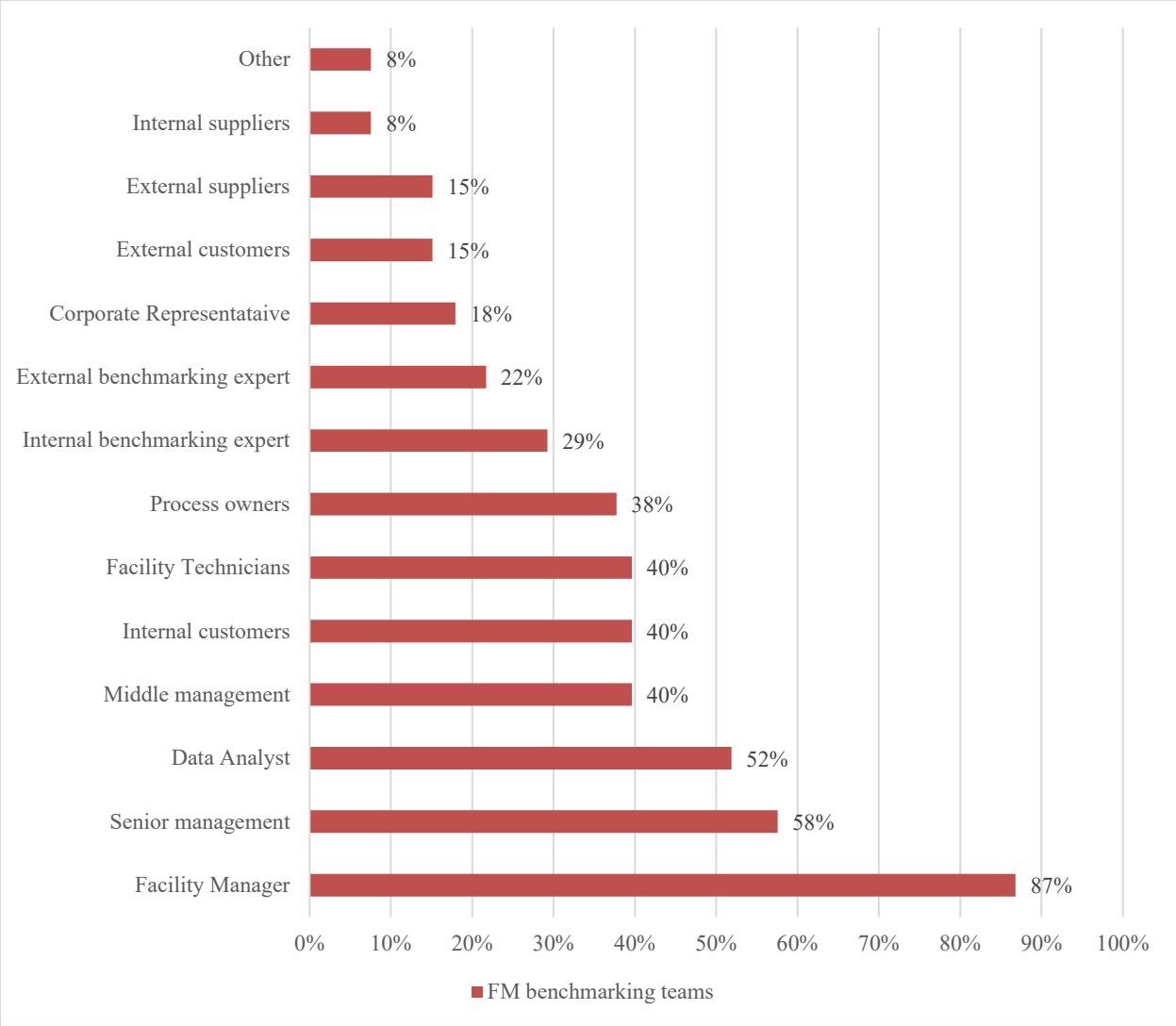

Figure 3.08: Types of employees in FM Benchmarking Teams (N = 106)

Figure 3.09 details the frequency of benchmarking team meetings during the course of FM benchmarking projects. The majority of FM benchmarking team meetings (58%) occur at least once a month during the course of the benchmarking project.

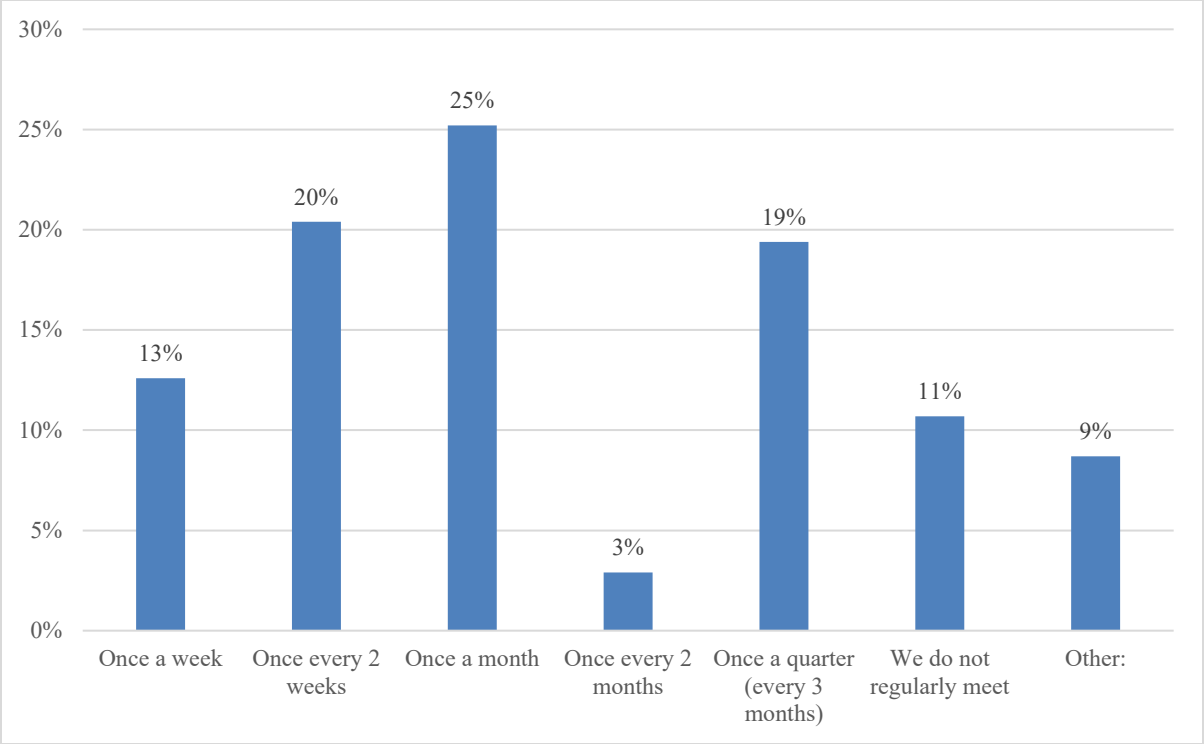

Figure 3.09: Frequency of FM Benchmarking Team Meetings (N = 103)

Benchmarking Success

Eighty-five percent of facility managers who use benchmarking report that their initiatives have produced quantifiable change. Twelve percent reported they were still waiting on results, and only 2% said that their benchmarking efforts had not produced any change.

Data Sources

Figure 3.10 indicates the sources of external benchmarking data used by respondents. The top three sources of benchmarking data reported by facility managers were IFMA (63%), Outside Consultants/Subject Matter Experts (49%) and direct from organizational partners (37%). Only 11% of respondents reported receiving benchmarking data directly from a benchmarking network (7% of all survey respondents).

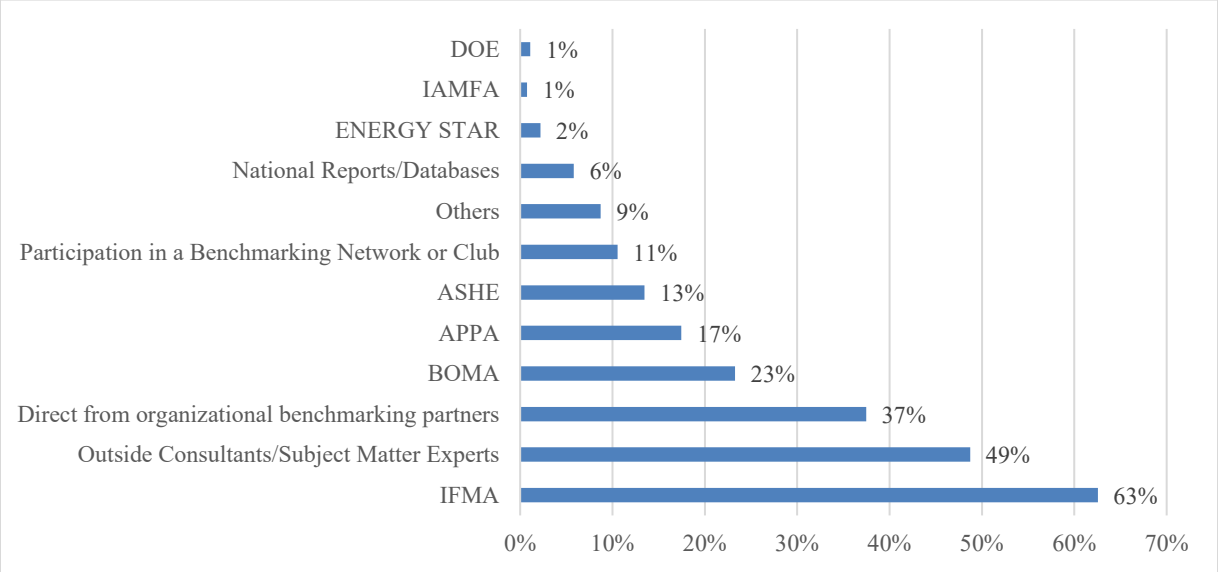

Figure 3.10: Sources of External FM Benchmarking Data (N = 275)

Benchmarking Networks

Figure 3.11 lists the topics of the benchmarking networks reported by the 7% of facility managers who had obtained data through participation in a network. Energy Consumption & Savings was the most common benchmarking network topic reported by 7/21 respondents (33%). Figure 10 indicates that half (13/26) facility managers were still participating in their benchmarking networks. 35% reported being involved with a network for less than a year, while the remaining 16% reported being involved for 1-4 years.

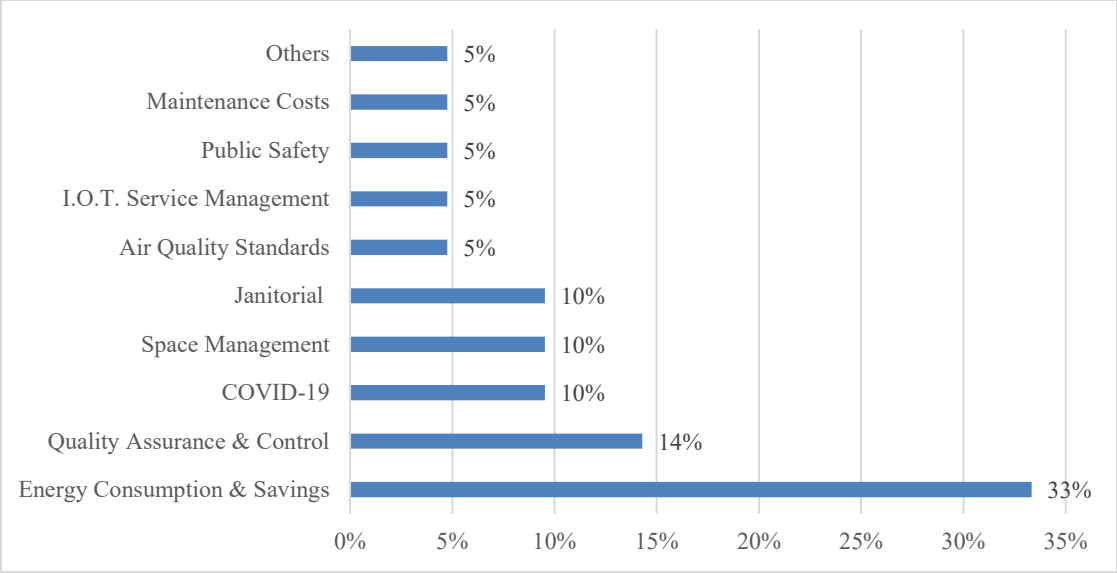

Figure 3.11: Topics of FM Benchmarking Networks (N=21)

Figure 3.12 indicates that the respondents participated in their benchmarking networks for varying amounts of time from less than six months (12%) to more than four years (8%). Interestingly, 50% of the 26 respondents indicated that they were still participating in the networks, suggesting that benchmarking is still actively being pursued and that facility managers are finding value in continued participation.

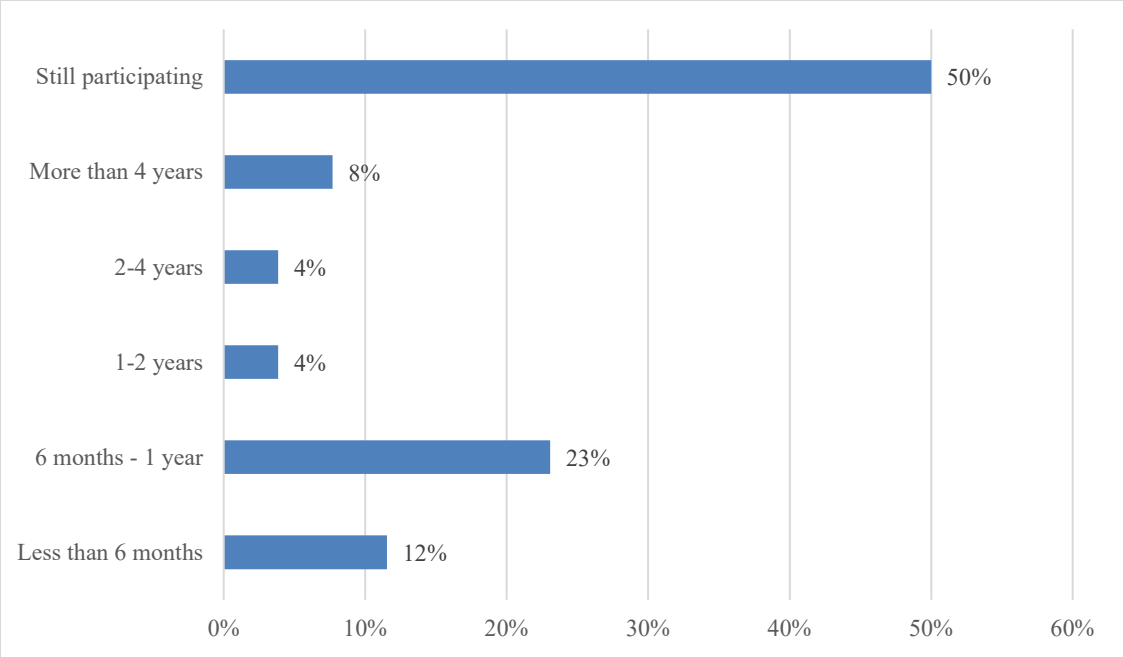

Figure 3.12: Length of Time Participating in Benchmarking Network (N = 26)

The facility management benchmarking networks vary substantially in size with 60% of reported networks consisting of 10 or fewer organizations and 27% consisting of greater than 30 organizations (Figure 3.13). 19% of respondents were uncertain of the number of organizations in their network, suggesting a lack of engagement or dispersion of knowledge in those particular networks.

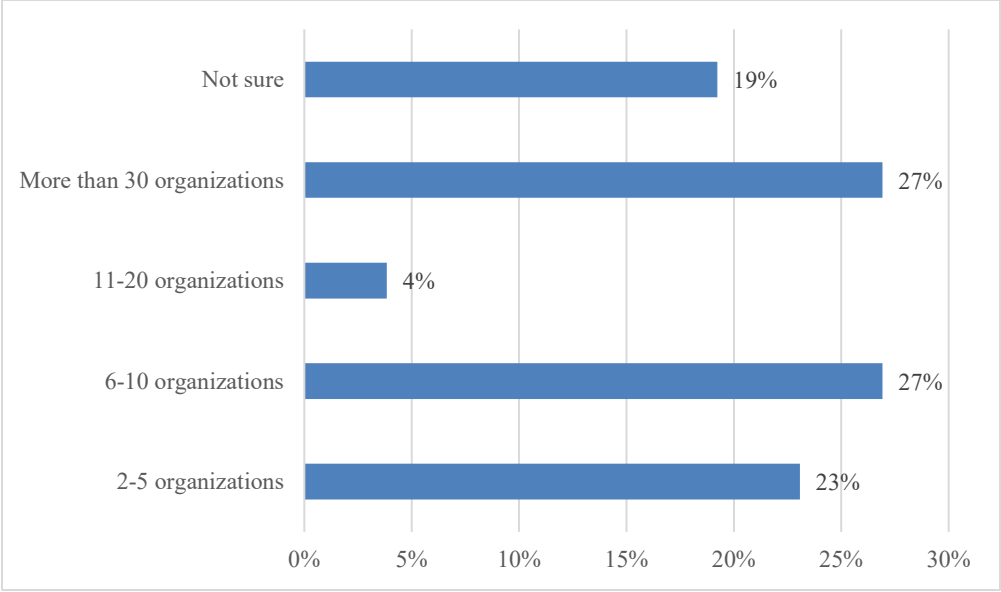

Figure 3.13: Number of FM organizations participating in the Benchmarking Network (N=26)

Figure 3.14 indicates that the most common method for determining best practices in benchmarking networks was research and data review/analysis (57%), followed by company interviews (18%), and memberships votes (11%). 17 of 18 respondents indicated that they were able to implement a best practice identified in their benchmarking network.

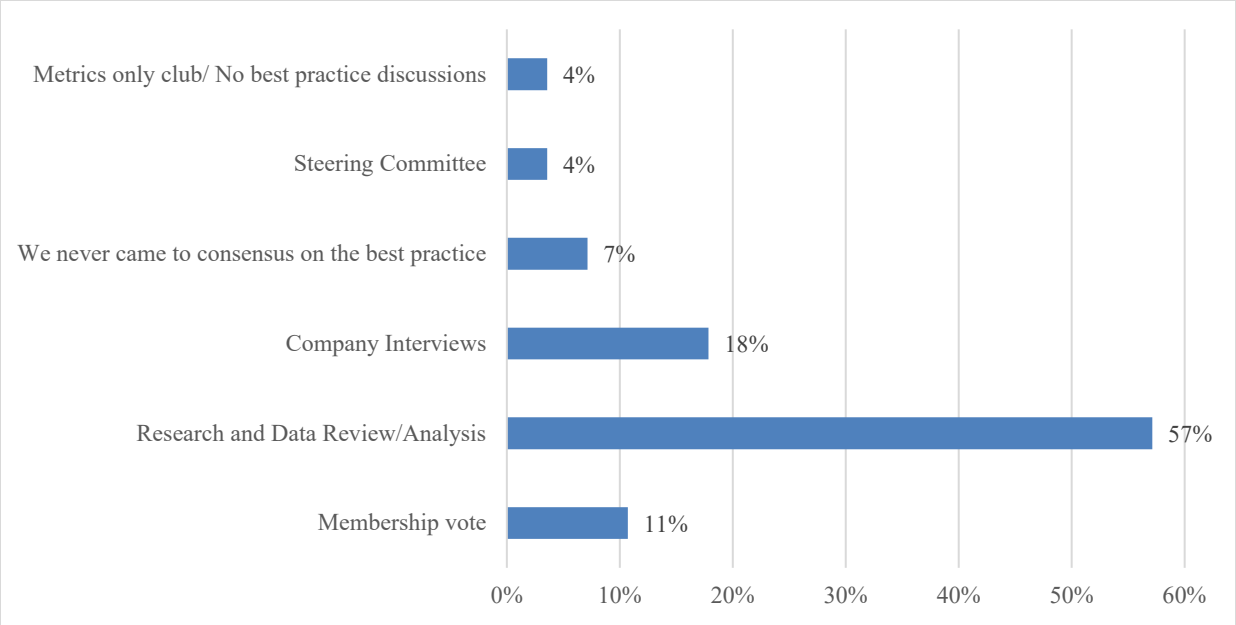

Figure 3.14: Means for Determination of Network Best Practices (N = 28).

3.7 DISCUSSION

The results of this study serve to assess how the field of facilities management has adopted and implemented benchmarking as a management tool. Very few benchmarking use surveys are published in research literature and this paper presents the first of its kind benchmarking use survey for the FM field. Compared to a previous multi-industry benchmarking use survey (Adebanjo et al., 2010), facilities management as a field has adopted and implemented benchmarking at similar rates to general industry, if not slightly less so. This is important because it suggests that practitioners have been successful at adopting the method to achieve field specific results. There are, however, some significant differences worthy of further discussion regarding FM benchmarking use and participation in benchmarking networks.

FM Benchmarking Use/Disuse

Facility Managers report using benchmarking at a rate similar to that reported by Adebanjo et al (2010). In their survey, 69% of respondents reported using informal benchmarking, whereas 64% of facility managers report using it currently. When comparing facility managers to industry respondents who don't use benchmarking, there are some differences between the results of Adebanjo et al.'s (2010) survey and this current one. Facility managers noted a lack of understanding of benchmarking as their primary reason and a lack of knowledge in planning benchmarking as their third most common reason. Adebanjo et al.'s (2010) top three reasons in order were lack of resources, lack of partners, and lack of technical knowledge. This suggests that lack of formal and technical knowledge of benchmarking is a greater barrier to its use in facilities management than reported by general industry surveys. Pursuit of further efforts to disseminate this knowledge for FM practitioners could be beneficial for the field and further academic study.

While 64% of respondents indicated they use benchmarking, only 27% reported having had a formal benchmarking team. This finding is particularly interesting, as forming a benchmarking team is considered a fundamental aspect of benchmarking models (Camp, 1989, Spendolini, 1992). The lack of a benchmarking team seems to indicate that the majority of facility managers are engaging in informal benchmarking (37%), and that there may be some confusion between benchmarking vs. performance management as is noted in the literature (Alstete, 2008). A single champion can only do so much in changing an organization and numerous individuals reported their benchmarking process to be carried out be a single person activity. Benchmarking has to be adopted at the organizational level as an aspect of a learning culture in order to truly reap the potential benefits offered by process benchmarking and active

benchmarking networks (Hinton et al., 2000). This may be best achieved through a designated benchmarking team.

Facility Managers report using various modes of benchmarking at rates similar to those reported by general industry surveys except in regard to process or best-practice benchmarking. While a previous survey (Adebanjo et al., 2010) found that 39% of businesses use this form of benchmarking, the current survey found that only 27% of facility managers report having used this form of benchmarking. While it is common for fewer organizations to use this form of benchmarking due to its resource and expense requirements, fewer than expected FMs report its use. Considering that this form of benchmarking is considered to be the most rewarding, there is need to further develop and create opportunities for its use in the FM field. Due to its definition, process benchmarking has to occur in the context of a benchmarking network of peer organizations. Considering how few respondents reported getting data from benchmarking networks (7%), it is likely that true process benchmarking is occurring at an even lower rate and that there may be some misunderstanding as to what process benchmarking is.

Another interesting finding comes from the reported source of external benchmarking data. The majority (63%) of respondents who use benchmarking report using data from IFMA. These results are most likely skewed in favor of IFMA, as the respondent list in this survey was developed by the researchers through their work with IFMA. About half (49%) of the respondents reported that Outside Consultants/Subject Matter Exports were the 2nd most common source of data. This result suggests that facility managers heavily rely upon outside expertise for their benchmarking projects, which again suggests that formal benchmarking knowledge is not as readily abundant within the field. Further, of the sources of external data utilized by facility managers, very few are validated and checked data. Most benchmarking

surveys are not validated as they rely upon self-report. Verified information tends to occur direct from organizational partners (37%), participation in a benchmarking club or network (11%) or from verified sources such as Energy Star (1%), where collection of data is automated. This suggests facility mangers are heavily relying upon unverified data to make their benchmarking comparisons. While this may work reasonably for metric benchmarking, diagnostic and process benchmarking will be most effective with verified data sources beyond self-report measures.

FM Benchmarking Networks

Only 7% of facility managers have ever participated in and received benchmarking data through a benchmarking network or club. This suggests that the most effective form of benchmarking, process benchmarking, is not being utilized to its fullest extent for facility management functions. Future research and professional societies should work on developing these resources and disseminating benchmarking knowledge for practitioners. Although the sample of respondents who had participated in a benchmarking network was small (N = 18-26), networks focused on energy consumption and savings were the most common. Half of the participants in these networks were still participating, suggesting that there is an ongoing need and interest in participating in these experiences for sustained continuous improvement, rather than as a temporary means to solve a problem. 89% of participants reported successfully implementing the best practices identified in these groups, suggesting their potential to be highly effective at assisting facilities with making productive leaps through true best practice implementation. While there were various methods reported for how the groups determined the best practices, research and data review/analysis and company interviews accounted for the majority (75%) of methods for determining best practices.

3.8 CONCLUSION

This paper reviews the results of a multi-industry benchmarking use survey of the facilities management field. It is one of only a handful of multi-industry benchmarking use surveys in research literature and moreover, it is the first of its kind survey of how facility mangers are using and implementing benchmarking as a management tool for their facility operations. The importance of this survey lies in the fact that it verifies estimates of benchmarking use reported in previous surveys, and using those surveys as a comparison base, it serves to provide an assessment of how well the emerging field of facilities management has adopted the various modes of benchmarking in management operations.

The results of this survey suggest that while the FM field has widely adopted informal benchmarking, it may fall slightly behind general industry in the extent to which it uses formal benchmarking procedures, teams, and process or best-practice benchmarking. Further, the field relies heavily upon unverified data sources and outside consultant/subject matter expertise for its benchmarking initiatives and projects. The results of this survey suggest that formal and technical knowledge of benchmarking may be a barrier to its successful use in facilities management.

Finally, this paper provides the first evidence of FM professionals participating in benchmarking networks for FM functions and yields additional insights into the utilization of process benchmarking for sustained continuous improvement, though it suggests the technique is currently underutilized in the FM field.

As the field of facilities management faces increasingly competitive operating demands, mastery of this method for continuous improvement will needed to ensure that it can be sustained

to meet long-term organizational, municipal, and regional goals for facility operations. As such, the following are recommendations for practitioners, researchers, and associations to help further benchmarking knowledge in this field.

1. Creation of educational opportunities and classes on technical benchmarking.
2. Establishment of more benchmarking networks and groups with verified data.
3. Move to reliance upon verified data and development of internal expertise.
4. Education on the importance of benchmarking models and the use of benchmarking teams.
5. Support for and creation of networks of organizational partners interested in process benchmarking for sustained continuous improvement.

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CHAPTER 4: BENCHMARKING AND ORGANIZATIONAL LEARNING CULTURE IN FACILITIES MANAGEMENT: THE KEY DRIVER FOR SUSTAINED CONTINUOUS IMPROVEMENT

4.1 ABSTRACT

There are over two decades of research literature discussions on the relationship of organizational learning and benchmarking. They are connected by a common culture that embraces, shares, and disseminates knowledge using data-driven decision making. Fundamentally, organizational culture and benchmarking are complimentary in the pursuit of superior performance. Facilities management as a field with an evolving origin that began around the same time as these concepts were embraced by the larger business community. While there exists some research literature on the use of benchmarking in facilities management, the research evidence tends to be limited and is primarily driven by case studies and small surveys. To date, the connection of benchmarking and organizational learning culture in Facilities Management has not been documented. This study marks the first multinational, multi-sector survey of how facility managers are using benchmarking and how its use and sophistication relate to the strength of the learning culture at their individual organizations. A total of 585 responses from facility professionals were obtained and compared in terms of their benchmarking use and learning culture. Four case studies are also presented that further examine this relationship in a qualitative manner. The results of this study provide facility practitioners with a means to assess and benchmark their organizational support for benchmarking initiatives. Development of the learning culture is a best practice that will help to ensure that continuous improvement initiatives can be sustained to meet long-term organizational goals. Conversely, if a strong learning culture is not present, benchmarking initiatives may be an inefficient use of facility resources.

4.2 INTRODUCTION

The understanding that benchmarking and organizational learning are inherently connected has been expressed in the research literature for at least the past 20 years (Oakland, 1999; Pemberton et al, 2001). These concepts/methodologies have been integrated into standard business culture and vocabulary as organizations have sought to assess, measure, set goals, and improve performance using data-driven decision-making processes (Auluck, 2002). The central issue connecting benchmarking and organizational learning is the acquisition and implementation of knowledge for problem-solving for which benchmarking provides an effective tool for organizations to drive this learning experience. Previous research indicates that "benchmarking brings the greatest benefits to an organization's performance when combined with effective organizational learning" (Pemberton et al., 2001, p. 123). Thus, superior performance is only likely to be achieved with both a strong organizational learning culture and the utilization of benchmarking to sustain the continuous improvement over time. Underlying this process is the premise that organizations can learn from each other and exists in a mutually beneficial environment of knowledge sharing (Ammons & Roenigk, 2015).

While these concepts were integrated into the popular lexicon of business in the 1990's due to the highly read publications of Robert Camp (1989) and Peter Senge (1990), not every organization, field or business sector has effectively been able to utilize these principles to achieve long-lasting change and continual improvement. There exists a scarcity of research literature on the implementation of organizational learning culture and how practitioners are using benchmarking in the facilities management field. This most likely stems from the fact that the field of facilities management is a rather young field that has been in the process of defining itself since the 1980's (Pitt & Tucker, 2008; Tay & Oi, 2001; Ventovuori et al., 2007).

Ventovuori et al., (2007) discussed the perceptions of facilities management as a business function and noted that the literature suggests there are competing views on how FM is perceived and whether it should be managed as a function strategically aligned with core business objectives. Historically it has been perceived as a technical function (Barrett, 2000) that was simply an operational cost of doing business. More recently, however, associations, academics, and practitioners have been pushing to move the function into a strategic position within the organization to maximize the value that it can provide to the organization (Barrett, 2000; IFMA, n.d; Roper & Payant, 2014). Seeing as how there is disagreement on this issue and a lack of research indicating the existence of high-level FM benchmarking projects, it is reasonable to think that organizations who are not incorporating the FM department as a strategic partner may be contributing to the lack of research literature. This perception of the lack of strategic connection to the core business may prevent meaningful facility-oriented benchmarking from occurring in many organizations and may be related to a lack of successful integration of the departments into the strategic structure of the larger learning organization.

This research was undertaken to address this current knowledge gap on the relationship of organizational learning and benchmarking as it specifically applies to the field of facilities management. Facility Management oriented organizations such as the International Facilities Management Association (IFMA) and a growing body of academic literature on facility-oriented benchmarking suggests that there is an ongoing need for benchmarking support for practitioners and motivation to maximize these benchmarking efforts to sustain continuous improvement for long-term organizational goals and competitiveness. There, however, has been no research to date that addresses the role of organizational learning culture in facilitating the benchmarking process in the facilities management field.

4.3 LITERATURE REVIEW

Benchmarking

Benchmarking is a tool for continuous improvement that was born out of the Total Quality Management (TQM) movement (Camp, 1989). Benchmarking has been heavily researched by both practitioners and academics (Abbleby, 1999; Bhutta & Huq, 1999; Camp, 1989; Pemberton et al, 2001; Ventovuori et al., 2007; Yarrow & Prabhu, 1999). Though it is beyond the scope of this review to address the volume of research on benchmarking, its fundamental forms will be summarized. Metric benchmarking is simply comparison of performance based upon metrics and is considered the most widely utilized, yet least effective form of benchmarking. Diagnostic benchmarking is the use of benchmarking for identification of problems and is considered a precursor to the final and most involved form of benchmarking, process benchmarking. Process benchmarking is also known as best practice benchmarking and it is the formal process of benchmarking an entire business process, identification of a best practice, and implementation of that best practice (Camp, 1989; Pemberton et al, 2001). Research has demonstrated that the more intensive the benchmarking project, the greater the costs and the larger the potential for organizational benefit and superior performance (Yarrow & Prabhu, 1999).

Organizational Learning & Benchmarking Culture

Having an established "benchmarking culture characterized by a desire to change processes as well as outputs and willingness to look externally for ideas, appears to be a key antecedent factor for successful benchmarking" (Hinton et al., 2000, p. 54). As a result, "A culture of shared learning throughout the organization has to evolve" (p. 56) for benchmarking to

be truly adopted at the organizational level beyond the isolated work of a champion (Hinton et al., 2000). Petri & Kuhne (2013) noted that the acquisition of knowledge is a crucial element in a benchmarking network. Pemberton et al (2001) stated that "Where organizational learning is absent…the benchmarking process is of limited value in terms of generating superior performance..." (p. 124).

Research on the use of benchmarking networks and process benchmarking seems to be intertwined with organizational learning (Ammons & Roenigk, 2015; Askim et al., 2008; Auluck, 2002; Hartley & Benington, 2006; Pemberton et al., 2001) in that, an organizations capacity for learning can determine the success with which they engage in process benchmarking and network participation. Ammons & Rivenbark (2008) note that the practice of collecting performance metrics is a well-established practice for U.S municipalities. Documentation and evidence that these measures are being used to effect organizational change is, however, lacking (Hatry, 2002). There is some evidence that there is a disconnect between collecting benchmarking information and acting upon that information to effect organizational change (Knutsson et al, 2012). Poor performers in a benchmarking network may externalize responsibility for their actions and high performers may use the data to justify complacency. This suggests that some organizations fail to follow the continual improvement process that is the very purpose of benchmarking. Results from overviews of benchmarking networks suggests not everyone who participates improves, meaning that there are organizational characteristics that may also be contributing to successful participation. Given that less than 5% of benchmarking projects result in the transfer of a best practice (CCI, 1993) suggests that benchmarking projects are failing to add consequential value in achieving superior performance.

Szulanski (1993) studied intraorganizational best practice transfers and found that it took an average of 27 months to identify a best practice and at least 9 months to leverage the information for continual improvement. This means the average process benchmarking project takes approximately 3 years to complete a cycle. Without an organizational culture to support the long-term benchmarking process, benchmarking efforts are not likely to succeed (Hinton et al., 2001). This stands in stark contrast to a survey administered by (Adebanjo et al., 2010), where 65% of the respondents (n = 453) reported that it takes them less than 4 months to complete a benchmarking project excluding the implementation phase. This suggests that most organizations who engage in benchmarking are not utilizing or participating in process benchmarking that is inherently linked to sustained continuous improvement (Ammons & Roegnik, 2015).

Jaafari (1996) noted that the industries of the built environment (i.e., construction, facilities management, architecture) tend not to have organizational learning mechanisms in place due to the project-oriented nature of their products. Without a systematic methodology to acquire and disseminate knowledge, such organizations may have difficulty in improving their performance and implementing more demanding forms of benchmarking over time (Love et al., 1999). While there is no research specifically addressing the role of organizational learning in the field of facilities management, it should be noted that the evolution of the field over time suggests that change management and cultural change is firmly rooted in the push for the discipline to redefine itself as a technical function to a core strategic function (Grimshaw, 1999; Ventovuori et al., 2007; Loosemore & Hsin, 2001). Inherent to this embrace of cultural change and evolution is the notion that organizational learning has to be embraced.

Defining Organizational Learning

There is a multitude of research on organizational learning that has steadily been growing since the 1980s. (Popper & Lipshitz, 2000). "Organizational learning is concerned with developing new organizational knowledge with the purpose of enhancing organizational performance (Pemberton et al., 2001, p. 126). Organizational knowledge is "A shared collection of principles, facts, skills, and rules which inform organizational decision-making, behavior, and actions…developed from the knowledge of individuals in the organization. Superior knowledge, if appropriately managed, should create superior performance" (Stonehouse & Pemberton, 1999, p.132). The theories behind the mechanisms for organizational learning can get rather detailed and there is some disagreement as the particulars of the multitude of theories on the topics (Levitt & March, 1988; Popper & Lipshitz, 2000). External benchmarking projects not only require learning within an individual organization, but further require that organizations can learn from one another in a process of interorganizational learning (Ammons & Roenigk, 2015). Process benchmarking or best-practice benchmarking makes use of the mimetic learning process and is viewed by some "as a means of operationalizing the learning organization model" (Ammons & Roenigk, 2015, p. 316). Knowledge sharing is a crucial element of the benchmarking process and can include explicit knowledge, such as that which is shared through articles, reports, books, manuals and conferences and tacit knowledge, such as that which is acquired through experience and interaction. Best-practice benchmarking should ideally include the dissemination of explicit knowledge, as well as provide opportunities for the acquisition of tacit knowledge, facilitated through site visits, meetings, and active dialogue.

Measuring Organizational Learning Culture

The growth in popularity and research in organizational learning in the 1980s spurred an interest to develop theories of organizational learning and a means to evaluate organizations in this regard. One such tool that has been widely utilized and administered to organizations is the *Dimensions of a Learning Organization Questionnaire* (DLOQ) (Watkins & Marsick,1997). Since its publication in 1997, the DLOQ has been administered to over 200 organizations, been translated into 14 languages, has been published in over 70 research studies. Since 2002, the creators have received over 173 requests for use from researchers in 38 countries (Marsick, 2013).

The DLOQ is reported to measure changes in organizational culture that influence the extent to which the individuals in the organization are able to learn and share knowledge. (Marsick & Watkins, 2003). The means scores from the DLOQ allow the benchmarking of organizational learning culture so that learning outcomes can be linked to performance changes in an organization over time. The questionnaire consists of 55 questions pertaining to organizational learning culture and seven questions regarding organizational demographics. Respondents are given 55 statements regarding the use organizational practices and asked to indicate the frequency with which the practices occur in their organization on a six-point Likert scale from “Almost Never” to “Almost Always”. (Marsick, 2013; Marsick & Watkins, 2003). The questionnaire is based on a theory developed and tested by the authors that maintains that the learning organization consists of seven distinct dimensions. These dimensions include Creates continuous learning opportunities, promotes inquiry and dialogue, encourages collaboration and team learning, establishes systems to capture and share learning, empowers

people towards a collective vision, connects the organization to its environment, and provides strategic leadership for learning (Marsick & Watkins, 2003).

The DLOQ has also received rigorous research attention and has demonstrated reliability and construct validity (Yang, 2003; Yang et al., 2004; Yang et al., 1998). Additional shorter versions of the questionnaire have also demonstrated the same reliability and construct validity as the more intensive 55 question version (Yang, 2003; Yang et al., 2004). The questionnaire examines individual learning and organizational learning across the seven dimensions in both the 55-question version the shortened 21 question version (Marsick, 2013; Yang et al., 2004). A seven-question version was also developed that measures the strength of the overall learning organization but cannot be broken down into analytic specifics regarding the seven dimensions or individual learning. It is best utilized as a unidimensional measure of learning culture. Critics of the research have indicated that the research on the DLOQ may not hold up in terms of a multi-dimensional measure of learning culture but do indicate that the instrument is appropriate as a unidimensional "measure of respondents perceptions of their organization's general orientation for learning" (Kim et al., 2015, p.104). In terms of interpretation of the difference in scores, the scores represent low to high learning cultures (Watkins & O'Neil, 2013).

The importance of this tool for assessing learning organization characteristics is that it provides a quick measure of the degree to which organizations are embracing a learning culture that is substantiated by previous research and for which norms exists to compare results. It has a long history of use and has been proven sufficiently reliable and valid to be able to demonstrate organizational learning over time within an organization. Since organizational learning culture is indelibly intertwined with benchmarking culture (Hinton et al., 2001), an assessment of this dimension of an organization may provide a reliable indicator of the extent to which

organizations embrace the learning elements necessary for formal benchmarking initiatives, process benchmarking capability, and sustained continuous improvement. These factors make the DLOQ arguably the most robust and effective method for benchmarking organizational learning culture.

4.4 RESEARCH OBJECTIVES

The overall objective of this study was to carry out an international multi-sector study of the relationship of benchmarking use and organizational learning culture specific to the field of facilities management. While there exists previous research linking organizational learning culture to benchmarking, there exists no research examining the relationship as it exists specific to facilities management functions. Demonstration of the relationship of organizational learning culture to implementation of benchmarking for continual improvement offers the potential for practitioners to leverage the knowledge and culture within their organizations to systematically improve their performance over time as it relates to long-term organizational goals. The objectives for this study were to:

1. Determine if organizational learning culture is more developed in organizations that utilize benchmarking for FM-oriented functions.
2. Determine if organizational learning culture is more developed in organizations that utilize formal benchmarking initiatives with formal benchmarking teams.
3. Determine if benchmarking sophistication. as measured by use of all the modes of benchmarking, is related to strength of organizational learning culture.
4. Determine if organizational learning culture is more developed in organizations that use process benchmarking for FM purposes.

5. Determine if there are business sector differences in organizational learning and benchmarking as it relates to facility management functions.
6. Identify case studies of facility managers within organizations that utilize benchmarking and examine the strength of their learning culture and critical success factors in achieving ongoing change.

4.5 METHODS

Survey Development

A survey was developed to assess benchmarking use in facility professionals. The benchmarking mode distinctions used in this survey include metric, diagnostic, and process benchmarking as utilized by numerous researchers (Appleby, 1999; Pemberton et al., 2001; Yarrow & Prabhu, 1999). This survey also used the internal and external benchmarking mode distinction as utilized by Camp (1989). Using this broad perspective of benchmarking modes allows for a simple assessment of approaches to benchmarking in the field of FM that can easily be compared to other industries and fields. These benchmarking modes were defined for all participants in the survey. The definitions for these modes were specifically applied to the facilities management field and can be found in the survey content in APPENDIX A: Benchmarking Modes & Networks Survey

The question content for the survey was developed from an extensive literature review on benchmarking networks and organizational learning both external to and within the facilities management and construction fields. A total of 46 questions were developed for the survey. Not every respondent was asked every question using within survey logic to present follow-up questions relevant to their choices. See Figure 4.01 for an illustration of the survey logic.

Someone with very little benchmarking experience could complete the survey in as little as 5 minutes, while those with more benchmarking experience could complete the survey in 10-15 minutes. Many of the questions specific to benchmarking practices were taken from Adebanjo et al.'s (2010) benchmarking survey to create comparable data that would allow comparison of facility-oriented benchmarking to general industry trends. Some of these questions were modified to fit the FM industry, such as benchmarking team members and frequency of benchmarking projects. Other questions were developed specifically for the FM industry based upon previous research experience and a literature review. The overall topics are listed below. See the APPENDIX A: Benchmarking Modes & Networks Survey for full survey.

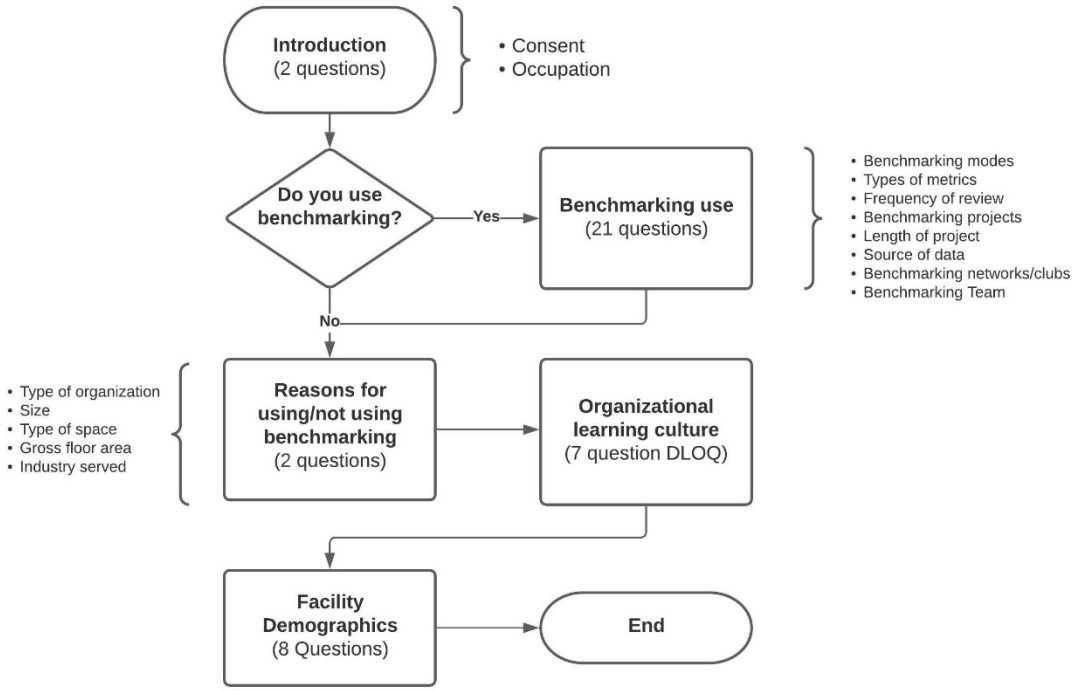

Figure 4.01: Benchmarking Survey Logic & Content

Survey Platform

The survey was developed and administered through the Qualtrics survey service. Upon completion of the survey, the results of the survey were downloaded in the form of an SPSSS file.

Survey Distribution

1. The respondents for this survey were identified through previous participation in FM focused webinars given by the research group.
2. A pilot survey was sent to 200 FM contacts. An email invitation was sent from Qualtrics Survey Service on 02/17/21. On 2/23/21 responses were reviewed. A total of 15 responses were recorded, indicating a 7.5% response rate. Responses were checked in detail and no problems with survey logic or incomplete surveys were noted.
3. Survey was sent out to 3,566 contacts through Qualtrics on 02/24/21.
4. On 03/02/21, 18 respondents had indicated that they participated in an FM-focused benchmarking network. The respondents were sent an email to see if they would be willing to discuss the details of their responses further. See APPENDIX C: Case Study Email Invitations.
5. On 03/03/21 and 03/10/21 A reminder was sent out to respondents who had not completed or taken the survey. Reminders were sent out at varying times of the day to ensure that the time at which the email was delivered did not limit the chances of the invitation being seen. See APPENDIX B: Email Invitation Examples for additional information.
6. The survey was closed on 03/17/21.

7. A total of four respondents were contacted and interviewed for the purpose of creating case studies that reviewed the use of benchmarking for facility-oriented functions within their organization.
8. A total of 585 responses were recorded out of 3463 emails sent indicating a response rate of 17%.

Case Study Methodology

Potential case studies were identified from a qualitative question from the survey that was displayed after a respondent indicated that they had achieved a quantifiable change through benchmarking in their organization. Respondents who gave a description of how they improved a process or metric through benchmarking were identified for follow-up contact. An email was sent to 18 respondents who described a quantitative change in the open-ended question on the survey.

Only 18 respondents reported that they had received data from participating in benchmarking networks and gave written examples of how they had utilized the process to achieve quantifiable change. Of these identified participants, only four of the participants responded to the follow-up emails requesting an opportunity to discuss their experience with the networks at length. Each structured interview with the facility manager was recorded and summarized for the paper in terms of the organization, benchmarking network participated in, benchmarking projects, critical success factors, and organizational learning scores.

4.6 RESULTS

Respondent Locations

The geographic region of the respondents is reported in Table 4.01. The majority (73%) of the respondents were from North America. Responses were recorded from 50 countries and territories. The regions of the respondents are summarized below.

Table 4.01: Geographic regions of respondents

Region	N	% of sample
North America	334	73%
USA	280	61%
Canada	39	9%
Mexico	3	1%
Caribbean	12	3%
South America	5	1%
Europe	19	4%
Middle East	31	7%
Africa	42	9%
South-Pacific	4	1%
India	12	3%
Asia	11	2%
Total	458	

Demographics

Table 4.02 summarizes the demographics of these respondents to this survey. The first column lists the sample size and the second column lists the overall proportion of the demographics in the survey. The respondents to this survey were primarily facility managers. 73% of the respondents identified as in-house facility managers, 10% as outsourced facility managers, and 11% as FM consultants. The remaining 6% identified as various job titles including vendor, project manager, professor, property manager, and energy manager. Most facility managers in this survey were responsible for portfolios of buildings (multiple buildings

in multiple locations) (66%), while 19% reported being responsible for a campus of buildings (multiple buildings in one location, and the remaining 15% were responsible for a single building or a space within a building. 44% of 480 respondents reported that the organization was private, 37% reported that it was a public organization, and 15% reported being a Not-for-Profit organization. The remaining 4% reported as other, which included mixed forms of the other organization types. The industries represented in this survey include 14% from the manufacturing sector, 43% from the service sector (Banking, Insurance, etc.), and 43% from the Institutional Sector (Education, Government, Cultural Institutions, etc.). Various organizational sizes were well represented in this survey with 32% reporting as small, 27% as medium, 21% as large, and 21% as enterprise (See Table 1 for definitions of size ranges).

Benchmarking Use and Organizational Learning Culture

Table 4.02 lists the demographics of the respondents to the survey, sample size, and precent of the sample in the first 3 columns. Column 4 in Table 4.02 lists the percentage of respondents who use benchmarking and Column 5 lists the respondents mean scores on the unidimensional 7-question version of the DLOQ (Marsick & Watkins, 2003).

Table 4.02: FM Demographic, Benchmarking Use, and Mean DLOQ Score Summary Table

1	**2**	**3**	**4**	**5**
	N	Percent of Sample	Percent of Respondents that use Benchmarking	Mean Unidimensional DLOQ Scores
Organizational Size				
Small: Less than 500 employees	153	32%	57%	4.08
Medium: 500-2,000 employees	127	27%	61%	3.89
Large: 2,001-10,000 employees	98	21%	63%	3.97

Enterprise: More than 10,000 employees	100	21%	71%	4.25
Sector				
Manufacturing	64	14%	61%	4.23
Service	199	43%	66%	4.21
Institutional	195	43%	57%	3.76
Type of Organization				
Private	210	44%	65%	4.19
Public	177	37%	64%	3.91
Not For Profit	72	15%	50%	3.86
Other	21	4%	53%	3.86
Respondent Type				
In-house Facility Manager	401	73%	61%	3.98
Outsourced Facility Manager	56	10%	71%	4.04
Consultant	58	11%	72%	4.35
Other	32	6%	63%	3.83
Type of Facility Space				
Space within a building	34	7%	38%	4.28
A Single Building	39	8%	51%	4.07
Multiple Buildings in One Location	91	19%	64%	3.86
Multiple Buildings in Multiple Locations	316	66%	66%	4.03
Overall	481		64%	4.02

The distribution of the mean unidimensional DLOQ scores is shown in Figure 4.02. The overall mean for facility managers on the DLOQ was 4.02. Overall, the distribution is left skewed and as indicated by the ordinal nature of the DLOQ scores, non-parametric Mann-Whitney tests were performed to determine the relationship between benchmarking use and strength of organizational learning culture.

Figure 4.02: Overall Distribution of Mean Unidimensional DLOQ Scores

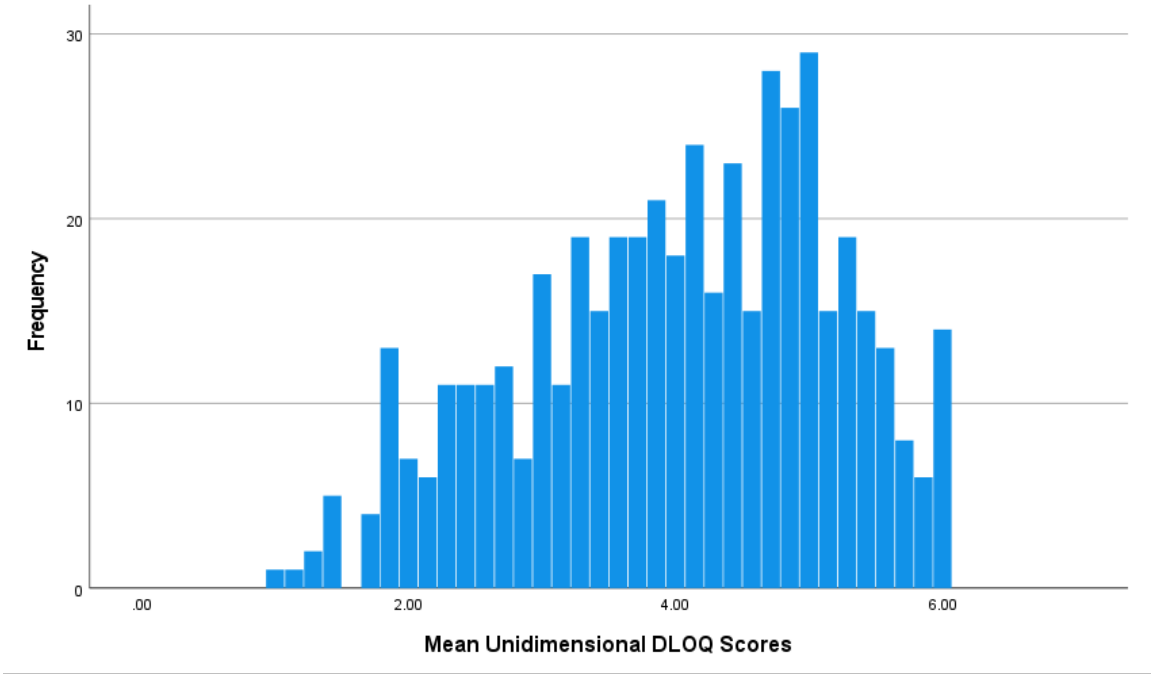

Table 4.03 presents the Mann-Whitney U analyses of the relationship between benchmarking use and methodologies with strength of organizational learning culture. The first Mann-Whitney test indicated that the strength of organizational learning culture was greater for facility managers that use benchmarking (Mean Rank = 268.31) than for facility managers that do not use benchmarking (Mean Rank = 196.13), U =19043.5, $p < .001$. The second Mann-Whitney test indicated that the strength of organizational learning culture was greater for facility managers that utilize benchmarking teams (Mean Rank = 133) than for facility managers that do not have benchmarking teams (Mean Rank = 116.66), U =6386.5, $p = .075$. The third Mann-Whitney test indicated that the strength of organizational learning culture was greater for facility managers that utilize all five benchmarking modes (internal, external, metric, diagnostic, and process) (Mean Rank = 166.87) than for facility managers that do not utilize all the queried benchmarking modes (Mean Rank = 144.05), U =7303, $p = .045$. The fourth Mann-Whitney test indicated that there was not a significant difference in the strength of the organizational learning

culture between facility managers who use process benchmarking (Mean Rank = 152.41) and those who do not (Mean Rank = 138.93), U = 9114.5, p = .176.

Table 4.03: The Relationship of FM Benchmarking Use to Organizational Learning Culture

Independent Variables		N	Mean Rank	Mean DLOQ Score	Mann-Whitney U Statistic	Sig.
Use Benchmarking	Yes	299	268.31	4.25	19043.5	<.001
	No	182	196.13	3.63		
Use Benchmarking Team	Yes	103	133	4.43	6386.5	0.075
	No	143	116.66	4.15		
Use all Five Benchmarking Modes	Yes	78	166.87	4.45	7303	0.045
	No	221	144.05	4.18		
Use process benchmarking	Yes	119	152.41	4.53	9114.5	0.176
	No	169	138.93	4.25		

Sector Analysis of Organizational Learning Culture in Facilities Management

The distribution of DLOQ scores varied by the business sector in which facility managers were operating (Services, Manufacturing, Institutions) (*See Figure 4.03: Distribution of Mean FM DLOQ Scores by Business Sector*). This difference in rank distribution by sector suggested a Kruskal-Wallis test was the most appropriate method to determine if business sector had an effect on the strength of the organizational learning culture.

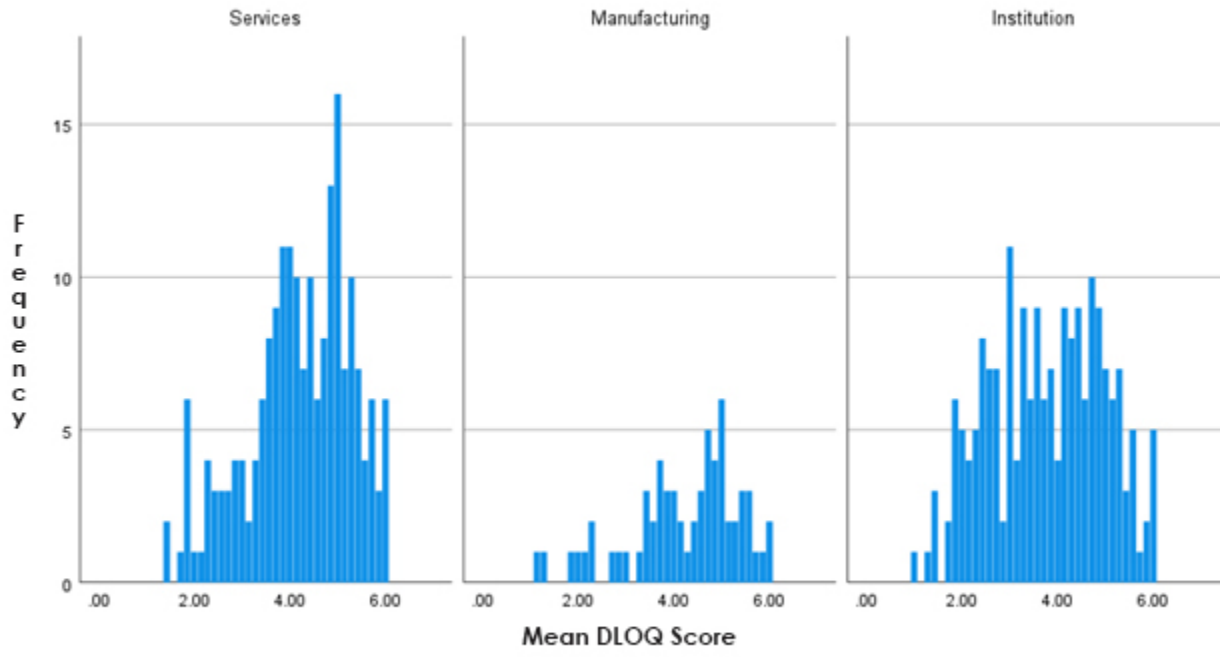

Figure 4.03: Distribution of Mean FM DLOQ Scores by Business Sector

Table 4.04 presents the results of a Kruskal-Wallis test and follow-up Mann-Whitney tests on the relationship of business sector and organizational learning culture. The Kruskal-Wallis test indicated that the type of business sector (Services, Manufacturing, Institutions) had a significant effect on the strength of the organizational learning culture, H (2) = 16.505, p = .000. The between groups comparisons were made using Mann-Whitney Tests. The first Mann-Whitney test indicated that the strength of organizational learning culture was greater for facility managers from the Services sector (Mean Rank = 216.65) than for facility managers in the Institutional Sector (Mean Rank = 174.13), U =14867, p < .001. The second Mann-Whitney test indicated that the strength of organizational learning culture was greater for facility managers from the Manufacturing sector (Mean Rank = 151.88) than for facility managers in the

Institutional Sector (Mean Rank = 121.57), U =4669.5, p =.005. The third Mann-Whitney test indicated that there was not a significant difference in the strength of the organizational learning culture between facility managers in the Services sector (Mean Rank = 129.28) and those in the Manufacturing sector (Mean Rank = 1332.25), U = 6032, p = .783.

Table 4.04: The Relationship of Business Sector and Organizational Learning Culture

Kruskal-Wallis Test				
Comparison	**N**	**H**	**df**	**Significance**
Business Sector on DLOQ Scores	453	16.505	2	0.000

Post-hoc Mann-Whitney U tests				
Comparisons	**N**	**Mean Rank**	**Mann-Whitney U Statistic**	**Significance**
Services	196	216.65	14867	<.001
Institutions	194	174.13		
Manufacturing	63	151.88	4669.5	0.005
Institutions	194	121.57		
Services	196	129.28	6032	0.783
Manufacturing	63	132.25		

CASE STUDIES

The following case studies are summaries of benchmarking activities and responses to the survey from facility managers who were contacted post completion of the online survey. The following practicing facility managers were willing to discuss their benchmarking activities and methods for the purpose of advancing the state of benchmarking within the greater facilities management field. Table 4.05 summarizes the case studies in terms of their benchmarking

modes, use of benchmarking teams, DLOQ scores, and critical success factors as reported by the respondents. The case studies provide qualitative evidence of the trend linking strength of organizational learning culture and use of benchmarking in the facilities management field in that the organizations with higher DLOQ scores show a greater benchmarking use sophistication can their counterparts. The Case studies are presented in terms of an organizational description, benchmarking network participation, benchmarking projects, and critical success factors.

Table 4.05: Case Study Findings Summary

Case Study	Organization	Benchmarking Modes	Benchmarking Team	FM's DLOQ Score	Critical Success Factors
1	**Fine Art Museum**	All modes	Yes	5.43	Top management support
					Metric oriented culture
					Knowledge sharing culture
					Data-driven decision making
2	**Property Management Company**	Internal, external, metric, diagnostic	Yes	4.42	Top management support
					Metric oriented culture
3	**Software Company**	Internal, external, metric, diagnostic	No	4.17	Knowledge sharing culture
					Data-driven decision making
					Metric oriented culture
4	**FM services company**	Internal only: metric & diagnostic	Yes	2.42	Data-driven decision making
					Metric oriented culture

Case Study #1

Institution

The organization is a non-profit Fine Arts Museum located in the US. It consists of a 300-acre landscaped campus that integrates nature and architecture into the presentation of their museum galleries. The galleries require specific temperature and humidity controls for preservation of their museum pieces. The campus consists of a group of buildings totaling over 400,000 gross square feet (GSF). The museum opened in the mid-2000s with approximately 20,000 GSF and has expanded rapidly since then to include multiple buildings, including a LEED-Certified Gold Facility. As a result of their mission, they have created a museum experience with highly specialized buildings and grounds that are unique, even among museum facilities. The Museum mission considers one if its core values to be continuous improvement.

In 2015 a new facility manager was brought on board to manage their upcoming expansion plans. The owners of the property have been highly engaged and involved in numerous business ventures with tech companies and industrial organizations that regularly utilize industrial quality management techniques, such as benchmarking. These techniques originate from the Total Quality Management (TQM) movement and Lean operating principles. As a result of this experience, they sought to integrate these principles into the operation of their museum facilities.

Benchmarking Network

The museum began to participate in the International Association of Museum Facility Administrators (IAMFA) in 2015 and shortly thereafter joined their benchmarking program for museums and cultural institutions (IAMFA, 2021). They sought to identify a high-quality data source that would allow for comparison of their unique facilities. The annual fees for their

participation have varied from $500 to $1,700 throughout their participation in the program. These rates vary according to institution size, first year participants, and multi-year participants (IAMFA, 2021).

This program is a service offered and managed by the Facility Issues organization (FacilityIssues, 2021). The program consists of an annual benchmarking survey that addresses the following topics: space utilization, FTE ratios, outsourcing, environmental controls, sustainability, strategic planning, emergency preparedness, project management, performance-based contracting, and others. In addition to the annual reporting of facility operating data, the programs implement workshops that include the following: roundtable discussions, best practice presentations from peer organizations, data reviews, forums, and practical take-aways. The topics of the benchmarking groups are identified by the steering committee and include an in-depth process analysis of a specific topic. Best-practices are discussed and determined through the group's steering committee and members are encouraged to determine for themselves and adapt the practices that will work most effectively in their individual institutions.

This benchmarking group has had over 130 institutions from nine countries participate in their program since the group started and was started by the Canadian Museum of History (FacilityIssues, 2021). While participants in this group have varied from year-to-year, they consistently have a core group of 15-20 museum facilities who remain consistently involved with the program. The museum is still currently participating in this network.

Benchmarking Projects

The museum has identified benchmarking teams for their projects that typically consists of five people including the facility manager, senior and middle management, an internal benchmarking expert, and the process owner from the department being benchmarked. This team

meets once a month to review progress made towards their benchmarking goals. Their benchmarking projects typically take longer than 10 months and they have participated in more than 10 benchmarking projects in the past three years. They reported using all benchmarking modes addressed in the survey. Their sources of data include IFMA, IAMFA, organizational benchmarking partners, and the IAMFA benchmarking group.

The museum's initial involvement with the IAMFA benchmarking program was on the topic of facility staffing. Through participating in the program and engaging other organizational partners they were able to accurately identify the proper staffing ratios for forecasting their staffing needs in expanding their facilities by 200,000 GSF. Following the success of this initial benchmarking project they established an organizational goal to achieve the lowest EUI (Energy Use Intensity) of their peer organizations in the network. Initial data collection revealed that they were at the median values in terms of energy consumption and through implementation of several best practices determined in the group they were able to consistently lower their EUI three years in a row, moving from average to "best-in-class" energy performance.

Critical Success Factors

Their facility manager considers support from top management and a metric oriented business culture to have been critical success factors in the use and implementation of their benchmarking projects and in sustaining the continuous improvement cycle. The museum's core value of continuous improvement is indicative of strategic support for a benchmarking culture. Glenstone's top three reasons for utilizing benchmarking include improving process performance, improving financial performance, and learning what other similar organizations are doing. Their facility mangers' score of 5.43/6.00 on the Dimensions of the Learning Organization Questionnaire (DLOQ) indicates that they have a very strong and well-established

organizational learning culture that regards FM as a strategic partner. This is likely facilitating their use of process or best-practice benchmarking to achieve sustained continuous improvement in their facility operations. They have a company goal of "Reinventing the ways museums operate" and systematically establish goals and metrics through which to measure their performance and identify opportunities for improvement on a continuous basis.

Case Study #2

Organization

This organization is a commercial property management company located in British Columbia, Canada. They currently manage commercial building space and have begun to move into residential as well. They are a small organization of less than 500 employees and have multiple facilities in multiple locations totaling over 3 million square feet.

Benchmarking Network

The property management company is an ongoing member of the Building Benchmark BC network (Building Benchmark BC, 2021), which is sponsored by the federal government (Natural Resources Canada, 2021. They have also participated in the Portfolio Manager benchmarking program offered by Energy Star. Building Benchmark BC was formed by the provincial government to assist building owners and property managers in evaluating and improving their energy consumption and emissions. This program launched on January 21,2020 and offers incentives for participation and reporting of energy related data. They meet quarterly and their annual report lists data on 735 participating facilities representing over 5 million square feet. The goal of this program is to help building owners and managers in the continuous improvement process necessary to meet upcoming climate regulations regarding CO^2e emissions. Best practices were identified through research and data analysis and review

independently and was not addressed by the benchmarking network. This network consists of a wide variety of facilities.

Benchmarking Projects

The facility manager reports being in 3-5 benchmarking projects in the past 3 years that lasted 2-4 months each. They began this benchmarking process and data collection in 2011 and have been utilizing various techniques, software, and resources for the past 10 years. They use a benchmarking team that typically consists of eight members and meet once a quarter. They have utilized data from Building Occupiers Management Association International (BOMA), Building Benchmark BC, and other national reports and databases to compare their performance. The content of their benchmarking projects has been primarily centered around energy consumption and sustainability. They report joining the Building Benchmark BC network to identify sources of comparable data. Additional direction and data validation was provided by PUMA (PUMA Utility Monitoring, 2021) and Risk Check (Risk Check, 2021) serving as an outside consultant to the property management corporation. They have also used Green Check and a local engineering firm as benchmarking consultants and for data verification and benchmarking reports.
Their organization has an identified benchmarking team that typically consists of 8 people including the facility manager, senior management, and an external benchmarking expert that meets on a quarterly basis. The organization engages in benchmarking to improve process and financial performance, and to encourage a cultural shift to a learning culture.

Critical Success Factors

Their facility mangers' score of 4.42/6 on the Dimensions of the Learning Organization Questionnaire (DLOQ) indicates a moderately established learning culture. While this organization has participated in benchmarking networks, there is no indication that they have

utilized process benchmarking as identification of best-practices was left to the individual participants. Their use of multiple software and consulting services has likely contributed towards their success more so than their participation in the benchmarking network itself, as the network mainly engages in metric benchmarking. The Canadian government's support and incentivization of benchmarking likely makes the process more feasible and cost effective. The organization is driven by a concern and interest in becoming sustainable and meeting long-term climate goals. The company regularly identifies customized strategies to decrease energy consumption and implemented them to achieve and sustain continuous improvement in regard to energy consumption and greenhouse gas emissions. They report success in increasing their energy performance and are currently working to develop means for taking additional actions beyond the easier targets they have addressed through their benchmarking activities. Senior management support of their benchmarking efforts and sustainability initiatives likely contribute to a benchmarking culture that facilitates their regular use of benchmarking projects. Their continued involvement in with benchmarking has amounted to millions of dollars in energy savings since it was rolled out in 2011. These efforts are supported by organizational strategic plans and built into their capital plans. Their organization embraces transparency with their customers, and they are not inhibited by a fear of sharing information.

Case Study #3

The Organization

This organization is an American multinational corporation that was founded in the 1970s. The organization was ranked as one of the largest independent software corporations in the world. Prior to being bought out, the organization had multiple facilities in multiple locations

totaling over 11 million GSF and had over 2,000 employees. Executive leadership had created a data-driven culture that supported benchmarking and the sharing of knowledge.

Benchmarking Network

The organization's involvement with a benchmarking network was directly the result of an upper management decision to seek out and participate in a benchmarking group. The organization stayed in the benchmarking group for over 10 years until they were bought out. This group was for fortune 500 companies and involved 3 meetings a year and conference calls. Membership required providing data (which was still kept anonymous) and a small annual fee for participation. The membership varied over the years, but primarily consisted of a core of 6-10 other organizations.

Benchmarking Projects

In the past three years the organization participated in 3-5 benchmarking projects that lasted approximately 2-4 months. They utilized data from IFMA, Outside Consultants/ Subject Matter Experts, and direct from organizational partners, and from their participation in the benchmarking network. The organization did not however, have an identified benchmarking team. When queried about the lack of a team, the facility manager responded that the FM department was not regarded as a strategic partner within the organization and limited resources were allocated for this purpose. The organization's initial involvement in the benchmarking network was for the purpose of identifying whether their staffing costs were in line with industry standards in janitorial and maintenance performance (metric benchmarking).

Initial evaluation of staffing at similar facilities suggested their facilities were understaffed. They were able to use the information to prevent layoffs but lacked the funds to hire more staffing to meet the needs. Continued involvement in the network led to diagnostic

benchmarking and process benchmarking that allowed them to reduce janitorial costs by converting to day cleaning and centralized trash collection. They were also able to identify extraneous information in their customer satisfaction surveys, that they used to leverage with executive leadership to change their survey questions and frequency. Doing this allowed for them to collect targeted data that allowed them to more effectively manage their supplier performance to customer satisfaction expectations.

Critical Success Factors

Executive Leadership's emphasis on a data-driven and knowledge sharing culture substantially contributed to the success of the FM department's benchmarking activities. The FM department's top three reasons for undertaking benchmarking include improving process performance, improving financial performance, and learning what other similar organizations are doing. Their facility mangers' score of 4.17/6 on the Dimensions of the Learning Organization Questionnaire (DLOQ) indicates a moderately established learning culture, however, upper management's view of the FM department as a cost of doing business, rather than as a strategic partner likely limits the FM department from being engaged in true process benchmarking and sustaining long-term continuous improvement.

Case Study #4

Organization

This organization is an FM service provider that provides janitorial services. The organization gets its data from benchmarking reports and databases such as IFMA, BOMA, ASHE, & APPA. The company has its own centralized department of continual improvement where the decisions to use benchmarks are made and they are brought to the client. The clients

don't pick out the benchmarks (metrics), they are recommended as part of the FM contract and the contracts are managed to those metrics. Clients are generally only concerned with the results. For example, in the contract discussed in the interview, the custodial staff directly report to them, but all other services are contracted out. The facility manager reports that every contract is different. He believes that facilities are being compared at a higher corporate level, but they are not specifically benchmarking facilities against one another (external benchmarking). The facility manager is specifically responsible for managing educational facilities consisting of 5 million GSF.

The facility manager came into the account in 2019 and described indicated that initial performance evaluations were at 68% positive. One year later in October of 2020, that percentage increased 18 points to 86% positive. He reports that the key was aligning the expectations in cleaning, as perception is the most important factor. The facility manager designed a whole new labor model, increased the pay, added a .5 FTE, and decreased the portfolio of buildings each manager managed. These practices helped to educate people on the scope of the services that were being provided and improve cleanliness scores through higher quality management and employee support.

The facility manger sees the importance of benchmarking as using analytics to show value to the clients. He reports that technology facilitates efficiency because it allows the gathering of data to track efficiency, such as tracking custodians, using RFID, barcodes, etc. that allow real time tracking.

Benchmarking Projects & Culture

The benchmarking at these facilities is exemplary of metric and diagnostic internal benchmarking. The organization has not participated in a benchmarking network or utilized

process benchmarking. They report using a dedicated benchmarking team of approximately five people that meets on a monthly basis, however, they have not participated in a benchmarking network or club. The facility manager's description of the benchmarking that the company was engaging in seemed consistent with performance management rather than true formal benchmarking. He reported participating in 6-10 benchmarking projects in the past year that each lasted from 4-6 months and reports using data from IFMA and APPA. Their benchmarking teams typically consists of 5 people including senior management, data analysts, and external suppliers. The facility manager considers its top reasons for benchmarking to be improving process and financial performance, and to develop new products/services. Their facility mangers' score of 2.42/6 on the Dimensions of the Learning Organization Questionnaire (DLOQ) indicates a poorly developed organizational learning culture and the facility manger reported that the organization is reluctant to share information. This current culture may be preventing the company from engaging in and benefitting from process and external benchmarking.

Critical Success Factors

While this case may not represent advanced benchmarking, it is evident that the organization values metrics and continually measuring and improving performance, suggesting a focus on data-driven decision making.

4.8 DISCUSSION

Quantitative Analysis

The quantitative analysis in this paper suggests that benchmarking use and sophistication is related to strength of organizational learning culture. While no tested quantitative tools exist for measuring benchmarking culture, organizational learning culture in the form of the DLOQ

(Marsick & Watkins, 2003) serves as a robust proxy for the concept due to the many conceptual parallels. Facility managers who use benchmarking, utilize formal benchmarking teams, and have participated in all levels of benchmarking modes report the perception of a stronger organizational learning culture at the organizations within which they operate. Facility managers who do not use benchmarking for their operations report a perception of a significantly weaker organizational learning culture. Though the research literature suggests that process benchmarking and organizational learning are complimentary and necessary for sustaining true continuous improvement, the results of this study indicate that the relationship between this mode of benchmarking and organizational learning culture may be more complicated than can be detected with the DLOQ and self-report benchmarking data obtained in this survey.

Even within the field of facilities management, there are sector differences in the use of benchmarking and the strength of the organizational learning culture. The services and manufacturing sectors both report a significantly higher perception of learning culture and a higher use of benchmarking for facilities management purposes. Given the bureaucratic nature of the institutional sector (government, education, etc.) these results are not unsurprising as larger bureaucratic structure may be likely to hinder the implementation of strategies that facilitate organizational learning.

Case Study Qualitative Analysis

The case studies represent a qualitative example of how various facility managers working for very different organizations are using formal benchmarking and performance management to achieve and sustain continuous improvement at their organizations. The same trend lining benchmarking and organizational culture noted in the quantitative analysis is also

apparent in the qualitative analysis of case studies. While the case studies may likely represent a positive experience bias with benchmarking outcomes, as only individuals who reported achieving quantifiable change were contacted for this information, it is important to include this information for practitioners in the FM field who are still only marginally using formal benchmarking with teams (27%), as well as for the 38% of facility managers who are not using benchmarking. In terms of the qualitative analysis of the case studies, the studies with the highest organizational learning culture scores also seemed to be the most actively involved with and sophisticated in their use of benchmarking in its various modes. Further, Case Study #4 seems to indicate that some organizations that embrace internal benchmarking as performance management may still experience reluctance to share information and engage in external or competitive benchmarking with other organizations. Further, the facility manager interviewed for this case study also reported the lowest level of perceived learning culture in their organization.

Organizational Learning Culture as the Critical Success Factor in Benchmarking

What is made abundantly clear form both the quantitative and qualitative analyses examining the role of organizational learning in facilities management benchmarking use and sophistication is that the culture of the organization and its use of and ability to sustain continuous improvement benchmarking techniques are indelibly intertwined. Organizational learning culture facilitates the use of benchmarking as a learning technique, and the use of benchmarking is a characteristic of a strong learning culture. To succeed at the task of using benchmarking to achieve continuous improvement, continuous learning has to occur, and there has to be an appropriately developed learning and data-driven culture to facilitate this process. Organizational Learning Culture and benchmarking culture are both complimentary and parallel.

Facilitating the development of this culture is likely to enhance benchmarking efforts, while those organizations with a low learning culture, are likely to resist benchmarking initiatives and may have various engrained barriers to benchmarking that will limit its success in achieving true superior performance.

Future Research

The results of this study lay a foundation for ongoing research efforts examining the relationship of organizational learning culture, benchmarking culture, and benchmarking use. More detailed examination of this relationship using the full-length form of the DLOQ and administering the questionnaire to the entire organization is likely to yield more precise results and insights that can impact organizational change initiatives. While the DLOQ serves as a robust proxy for benchmarking culture, development of a robust and sound means for quantitatively assessing benchmarking culture is also likely to yield greater insights into the specifics of how organizational culture and benchmarking are related in facilities management.

4.9 CONCLUSION

This study utilized both quantitative and qualitative means for examining the relationship between benchmarking and organizational learning culture. Using a multi-national, multi-sector survey, this research presents the first large-scale examination of FM-oriented benchmarking and organizational learning for the field of facilities management. Given that FM benchmarking research and organizational learning research tends to be in the form of case studies, this wide-scale survey helps to illuminate the importance of culture for maximizing benchmarking initiatives for the facilities management field. Learning how to effectively leverage learning culture for the purpose of sustaining performance improvement is the most fundamental critical

success factor for facility-oriented benchmarking. Furthermore, utilizing benchmarking is a necessary tool in implementing a learning culture characterized by data-driven learning. The results of this study suggests that effective benchmarking does not occur without an effective organizational culture supporting it. One may not exist without the other and this knowledge can be used to maximize the process of continual improvement or recognize the organizational limitations that suggest the efforts would most likely result in failure. For practitioners, the results of this study can be used to assess and benchmark culture as part of the continuous improvement process.

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CHAPTER FIVE: OVERALL CONCLUSION

The three studies in this dissertation are a means of bridging the knowledge gap on practitioner benchmarking use in the built environment industries. Case studies on facility and construction-oriented benchmarking are difficult to find and prior to this research, there existed no large-scale surveys on the use of benchmarking by facility practitioners. This research provides a detailed case study on developing a continual improvement initiative for a construction manufacturer, a quantitative analysis of how facility practitioners are using benchmarking compared to their peers in general industry, a quantitative assessment of how the strength of organizational learning culture is related to benchmarking use and sophistication, and four case studies on how facility managers are using benchmarking and engaging in benchmarking networks in the pursuit of continual improvement.

The results of these studies suggests that while these industries have begun to utilize benchmarking techniques at rates similar to general industry, there are some noted differences in how practitioners are engaging in benchmarking compared to their peers. The results of this study provide practitioners with practical knowledge on benchmarking, a means to assess their use of the techniques compared to their peers (benchmark their benchmarking use), tools and techniques for continual improvement developed from Total Quality Management initiatives and Lean Six Sigma, case studies on how organizations have been able to utilize sophisticated benchmarking to sustain continuous improvement, and an understanding of the role that organizational learning plays in nurturing the benchmarking environment and culture that can be used to create and promote and more learning inclusive environment among facility and construction-oriented staff. Together these articles provide a comprehensive examination of how

the built environment is approaching its continuous improvement process and an impetus to advance the field through leveraging and disseminating the knowledge contained within.

The significance of this research is that it identifies the critical importance of organizational culture to benchmarking initiatives in the built environment. The benchmarking process occurs within the context of a culture that can either facilitate or impedes the institutional learning process. Developing an organization's capacity for learning and knowledge sharing will strengthen benchmarking initiatives. Simultaneously, identifying if your organization lacks a strong learning culture, may save facility managers from wasted resources on benchmarking projects that are not likely to succeed on achieving lasting change.

Together, this research provides benchmarking tools, examples of seeking continual improvement, a means to assess organizational learning culture, and examples of various facility-oriented benchmarking. While this research provides important contributions to the academic literature, its true impact is intended for practitioners in the field of the built environment. To this end, the following recommendations are made.

5.1 DODD' S STEPS TO ASESS AND IMPROVE FM BENCHMARKING

1. **Audit your OLC and benchmarking use/sophistication**
    - Determine Level of Benchmarking necessary to achieve goals
        - Internal, external, metric, diagnostic, process
    - Evaluate if you have the culture to support your goals
    - If not, work on strengthening your culture first and exploring other avenues

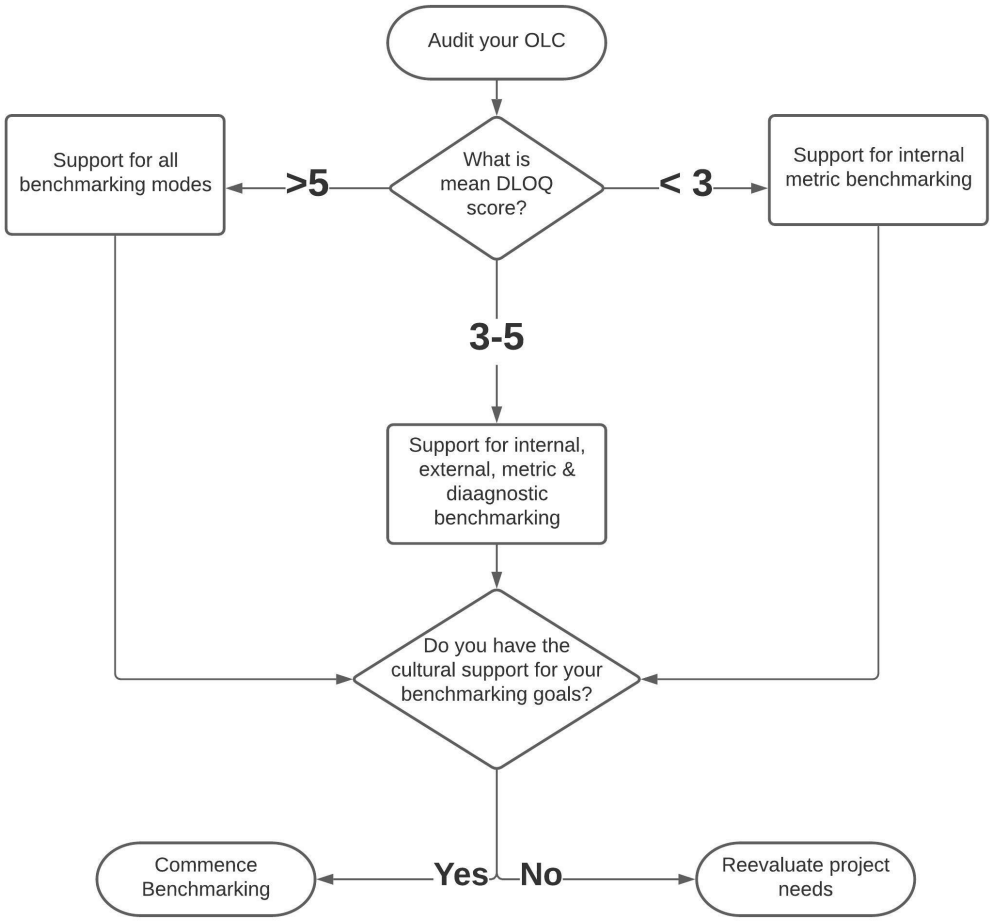

Figure 5.01: Benchmarking & OLC Audit Methodology

2. **Develop your culture.**
    - Obtain top management support
    - Emphasize data-driven decision making
    - Emphasize knowledge sharing and systems
3. **Follow a benchmarking model.**
    - Structured formal process
    - Create benchmarking team
4. **Learn from case studies & organizational partners.**
    - Critical Success Factors

5. **Develop an internal expertise on benchmarking and educate.**
6. **Identify benchmarking networks.**
7. **Seek out multiple data sources and verified data.**
8. **Complete a benchmarking model cycle.**
9. **Identify opportunities for continuous improvement.**
10. **Repeat Steps 1-9.**

Future Research

The research presented in this study lays the foundation for multiple lines of inquiry related to benchmarking and continual improvement in the built environment industries. The findings demonstrate that there are differences in benchmarking use and learning culture across organizational sizes and sectors, which suggests that further analysis of individual sub-groups is necessary for understanding the benchmarking process as it is being applied by practitioners in the field. The identified differences in metric review across metric types further suggests that individual assessment of benchmarking as it relates to financial, satisfaction, productivity, environmental, service quality, and spatial metrics is warranted by their differing frequencies.

This study uses the 7-question form of the DLOQ (Marsick & Watkins, 2003). The initial results linking benchmarking and the DLOQ should be followed up using the full 55 question version of the survey in a small sample study. Further, case studies examining benchmarking throughout an organization should be undertaken while administering the DLOQ survey to the entire organization or department for a better understanding of how the organization is perceived by multiple employees. This should allow for a more comprehensive understanding of the link between organizational learning culture and benchmarking.

It would also be highly beneficial to undertake a detailed case study of an FM benchmarking network to further understand the critical role that these groups can fulfill in relation to the benchmarking process and verified data. Finally, since this study focuses primarily on facility professionals, it would be highly beneficial to take this same approach to professionals in the construction industry to examine their approaches to benchmarking and how it may differ from other practitioners in the built environment.

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APPENDIX A: BENCHMARKING MODES AND NETWORKS SURVEY

Facility Management Benchmarking Use Survey

The purpose of this survey is to **understand how facility practitioners** are **using benchmarking** as a management tool. If you have never used "benchmarking", your response is **equally important!**

This study will benefit the FM industry by:

- Assessing benchmarking resources available for facility managers.
- Identifying areas for improvement.
- Pinpointing critical success factors for benchmarking projects.
- Assessing organizational support for benchmarking initiatives

This survey is for Facility Managers, Vendors, or Consultants. The survey will take less than 10 minutes to complete. **All of your responses will be kept confidential** - they will only be reported in aggregated form.

Please email Justin Dodd (jdodd@uncc.edu), PhD Candidate or Dr. Jake Smithwick (Jake.Smithwick@uncc.edu) if you have any questions or concerns!

1. With full knowledge of all foregoing, I agree, of my own free will, to participate in this survey.

- I agree - continue with the survey
- I do NOT agree - end the survey (and opt out)

2. What best describes YOUR role for the facility you will be providing benchmarking use data for?

- In-house Facility Manager
- Outsourced Facility Manager
- Consultant
- Vendor
- Other _____

Given your experience with multiple organizations as a consultant or vendor, please answer all questions thinking about the **largest or most complex facility organization** you have provided service to.

3. Benchmarking is the structured process of identifying areas for improvement, evaluating metrics, and searching for practices that lead to superior performance.

Does your Facilities Management department use "benchmarking" to evaluate and improve facility

operations?

- Yes
- No

4.. What types of benchmarking have you used specifically for facility management functions?

	Yes, we have used	No, we have not used	Not sure
Compared a facility in our organization to *another* facility **inside** our organization (*Internal Benchmarking*)	○	○	○
Compared our facilities to facilities **outside** of our organization (*External Benchmarking*)	○	○	○
We have benchmarked to determine **what** to improve (*Metric Benchmarking*)	○	○	○
We have benchmarked to identify what to improve AND **identified practices** to achieve our goals (*Diagnostic Benchmarking*)	○	○	○
We have participated in a benchmarking **partnership, club, or network** with other organizations to adopt a best practice and improve an agreed upon process (*Process Benchmarking*)	○	○	○

5.. Which of the following metrics do you consistently analyze and use to manage performance at your facility? (Select all that apply)

- Financial Metrics (FM costs/FTE, FM Costs/SF, etc.) (1)
- Spatial Metrics (Area/FTE, Area/workstation, etc.) (2)
- Environmental Metrics (Energy consumption/FTE, CO2 emissions/FTE, etc.) (3)
- Service Quality Metrics (Quality of catering services, Quality of Cleaning, etc.) (4)
- Satisfaction Metrics (FM satisfaction scores, workplace satisfaction, etc.) (5)
- Productivity Metrics (Timeliness of service provision or response, number of closed work orders, etc.) (6)
- We don't use ANY of these metrics! (7)

6.. How often do you "typically" review the following metrics?

	Daily	Weekly	Monthly	Quarterly	Every 6 months	1 year or more
Financial Metrics	○	○	○	○	○	○
Spatial Metrics	○	○	○	○	○	○
Environmental Metrics	○	○	○	○	○	○
Service Quality Metrics	○	○	○	○	○	○
Satisfaction Metrics	○	○	○	○	○	○
Productivity Metrics	○	○	○	○	○	○

7. A benchmarking project is a formal process that includes identification of benchmarks, creation of a benchmarking team, deciding whom to benchmark with, collecting & analyzing data, and taking action on the results.

About how many (#) benchmarking projects for facility management functions have you participated in during the past three (3) years?

- 0
- 1-2
- 3-5
- 6-10
- >10

8. On average, how long does a single benchmarking project take (from identification of the benchmarks through data collection & analysis)?

- Less than 2 months
- 2 to 4 months
- 4 to 6 months
- 6 to 8 months
- 8 to 10 months
- More than 10 months
- I don't know

9. Where do you typically get access to external FM benchmarking metrics for comparison?

- Image: IFMA Logo
- Image: BOMA Logo
- Image: APPA Logo
- Image: ASHE Logo
- **Outside Consultants/Subject Matter Experts**
- **Direct from organizational benchmarking partners** *Specific organizations exchanging metrics and practices in a spirit of collaboration to seek continual improvement.*
- **Participation in a Benchmarking Network or club** *A group of companies working together to measure & improve a specific process through identifying and implementing a best practice.*
- **National Reports/Databases**. Which ones? _____
- **Other sources:** _____

10. **You mentioned that you participated in a "Benchmarking Network or Club."**

Could you please briefly explain the specific Facility Management problem you were trying to improve through participation in the benchmarking network?

_____
_____
_____
_____
_____

Q14 **How long did you participate in the network (i.e., provide data and attend meetings)?**

- Less than 6 months
- 6 months - 1 year
- 1-2 years
- 2-4 years
- More than 4 years
- Still participating in the network

Q15 **About how many other FM organizations were in the benchmarking network with you?**

- 2-5 organizations
- 6-10 organizations
- 11-20 organizations
- 21-30 organizations
- More than 30 organizations
- Not sure

Q16 A "best practice" is an action or method to accomplish a certain task and has shown to produce consistent superior outcomes.

How did your Benchmarking Network / Club determine the "best practice" for any given area? Select all that apply.

- Membership vote
- Research and Data Review/Analysis
- Company Interviews
- We never came to consensus on the best practice
- Other: _____

Q17 And were you able to actually implement any identified best practices from the Benchmarking Network / Club?

- **YES**, we implemented the best practice(s)!
- **NO**, we DID NOT implement the best practice(s).
- I don't know

Q18 **Have your benchmarking initiatives produced any quantifiable changes?**

- Yes, the benchmarking improved a metric or process
- No, benchmarking did not improve a metric or process
- Not sure... waiting on results
- Not Sure. Please explain:

  _____

Q19 **Please select the top THREE reasons your facilities management department was not able to achieve change through the benchmarking project.**

- Lack of resources
- Lack of benchmarking partners
- Lack of technical knowledge in planning benchmarking project
- Lack of understanding of benchmarking
- Lack of top management commitment
- Other: _____
- Fear of sharing information
- No clear benefit from benchmarking
- High cost (outweighs potential benefits)
- Long time frame to complete the project
- Lack of authority in organizational decision making

Q20 **Please briefly describe what you were benchmarking and what was improved. Any quantifiable positive outcomes that you can share?**

For example, "We used data from **IFMA's 2017 O & M Report** to identify that our maintenance staffing profile was underperforming. We found that we had about **20% less staffing** than similar facilities. We conducted a **job task analysis** with a partner organization and were able to **justify hiring two additional maintenance technicians** the following year."

_____
_____
_____
_____
_____

Q21 P**reviously you indicated you were uncertain about whether benchmarking had produced any quantifiable changes for your organization.**

Could you please elaborate?

_____

Q23
Has your current organization ever had an identified "Benchmarking Team" who were assigned to a benchmarking initiative or project.

- Yes, we have had a benchmarking team
- No
- I don't know

Q24 **Who does your Benchmarking Team usually consist of? (Select all that apply)**

- Facility Manager
- Senior Management
- Middle Management
- Internal benchmarking expert
- Corporate Representative
- Facility Technicians
- Other: _____
- Data Analyst
- Process Owner (Dept. being benchmarked)
- Internal Customers
- External Customers
- Internal Suppliers
- External Suppliers
- External benchmarking expert (Consultant)

Q25 **About how many total people (#) are on the Benchmarking Team?**

_____

Q26 **About how often does the Benchmarking Team usually meet?**

- Once a week
- Once every 2 weeks
- Once a month
- Once every 2 months
- Once a quarter (every 3 months)
- We do not regularly meet
- Other: _____

Q28 **Select the top THREE reasons your facility management department undertakes benchmarking?**

- To improve the performance of our processes
- To address major strategic issues
- To learn what other organizations are doing
- To improve financial performance
- To develop new products/services
- Necessary for quality assessments
- To encourage a cultural shift to a learning culture
- Other: _____

Q29 **What are the top three reasons your facilities management department does NOT undertake benchmarking?**

- Lack of resources
- Lack of benchmarking partners
- Lack of technical knowledge in planning benchmarking project
- Lack of understanding of benchmarking
- Lack of top management commitment
- Other: _____
- Fear of sharing information
- No clear benefit from benchmarking
- High cost (outweighs potential benefits)
- Long time frame to complete the project

- Lack of organizational authority
- FM is not perceived as an organizational strategic partner

Q30 **How important is benchmarking to <u>YOU</u> personally?**

- Extremely important
- Very important
- Moderately important
- Somewhat important
- Slightly important
- Minimally important
- Not at all important

Q31 Given your experience with multiple organizations as a consultant or vendor, please answer the following questions thinking about the <u>largest or most complex facility organization</u> you have provided service to.

Just about done!
Please indicate how well the following statements describe your current organization.

	Almost Never (1)	(2)	(3)	(4)	(5)	**Almost Always** (6)
In my organization, people are **rewarded for learning.** (1)	○	○	○	○	○	○
In my organization, people **spend time building trust** with each other. (2)	○	○	○	○	○	○
In my organization, **team/groups revise their thinking** as a result of group discussions or information collected (3)	○	○	○	○	○	○
My organization makes **its lessons learned available** to **all** employees. (4)	○	○	○	○	○	○
My organization recognizes people for **taking initiative**. (5)	○	○	○	○	○	○
My organization **works together** with the **outside community** to meet mutual needs. (6)	○	○	○	○	○	○
In my organization, **leaders** continually look for **opportunities to learn.** (7)	○	○	○	○	○	○

Q34 **Which of the following best describes your organization?**

- Private
- Public
- Not-for-Profit
- Other: _____

Q35 **About how many full-time employees work for your entire organization? A guess is fine :-)**

- **Small:** Less than 500 employees
- **Medium:** 500-2,000 employees
- **Large:** 2001-10,000 Employees
- **Enterprise:** More than 10,000 employees
- Uncertain

Q36 **What type of facility space are you directly responsible for?**

- Space within a building
- A single building
- Multiple buildings in one location
- Multiple buildings in multiple locations.

Q37 **What is total Exterior Gross Floor Area of the facilities you are responsible for? (in square feet)**

_____

Q39 Which of the following industries best DESCRIBES the institution that you represent?

- 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)
- 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)
- Motor Vehicles
- Association (Association, Federation, Non-Profit Foundation, Society)
- Charitable Foundation
- Corrections (private, state, federal, city, county)
- Cultural Facilities (Private, Institutions, Government)
- Educational (Training Center, K-12, College / University)
- Federal Government
- State/Provincial Government
- City/County Government (Law Enforcement, Library, Parks / Public Open Space)
- Special Districts/ Quasi-government (Transportation Authorities, School Boards)
- Military
- Religious
- Research
- **Other Institution:** _____

Q40 **Would you like a final copy of my report? Please provide the contact information below.**

- Name _____
- Organization _____
- Email Address _____

APPENDIX B: EMAIL INVITATION EXAMPLES

Pilot Study (02/17/21)

Hello XXXXX,
I am a PhD candidate at the University of North Carolina at Charlotte, working under the direction of Dr. Jake Smithwick, and I could use your help. My research is evaluating how facility managers are using benchmarking as a management tool. Would you be willing to help me complete my studies and fill out a brief survey (5-10 minutes)?
The results of my project will enhance your own benchmarking efforts. I would be glad to send you a free summary white paper once I finish!

All of your responses will be kept confidential - they will only be reported in aggregated form.

Please email me at jdodd@uncc.edu or my advisor at Jake.Smithwick@uncc.edu if you have any questions or concerns.

Is this something you could help me with?

Thank you so much for your time and consideration.

Justin Dodd, M.S., LEED GA
Doctoral Teaching & Research Assistant
President, IFMA Student Chapter
UNC Charlotte | The William States Lee College of Engineering
Phone: (704) 689-6254 Email: jdodd@uncc.edu

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1st Mass Distribution Survey Email (02/24/21)
Hello XXXXXX,
I am a PhD candidate at the University of North Carolina at Charlotte, working under the direction of Dr. Jake Smithwick, and I could use your help. My research is evaluating how facility managers are using benchmarking as a management tool. Would you be willing to help me complete my studies and fill out a brief survey (5-10 minutes)? Even if you don't use benchmarking, your survey response would be much appreciated!
The results of my project will enhance your own benchmarking efforts. I would be glad to send you a free summary white paper once I finish!

All of your responses will be kept confidential - they will only be reported in aggregated form.

Please email me at jdodd@uncc.edu or my advisor at Jake.Smithwick@uncc.edu if you have any questions or concerns.

Is this something you could help me with?

Thank you so much for your time and consideration.

Justin Dodd, M.S., LEED GA
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APPENDIX C: CASE STUDY EMAIL INVITATIONS

Case Study Email (03/02/21) (Sent to 10 respondents)

XXXXXX,
Thank you for completing my survey on Benchmarking Use this past week.
I am very interested in learning more about your experience with an FM-focused benchmarking network.
Would you be available for a brief zoom chat or phone call this week or next?
This would be extremely helpful for my dissertation!

Regards,

Case Study Email (03/04/21) (Sent to 8 respondents)

XXXXXX,
I just wanted to personally thank you for completing my FM benchmarking use survey in the past week. I'm passionate about advancing the use of benchmarking in the facilities management field. That being said, I was hoping that we could talk further about your experiences in an FM-focused benchmarking network.
Less than 5% of facility managers have participated in one and that makes your experience valuable to my research and the greater community at large.
Would you have availability to meet with me briefly this week or next. I'd like to ask you some additional questions about the experience.

Regards,