EVALUATING ORGANIZATIONAL READINESS TO IMPLEMENT CHANGE WITHIN THE WORKPLACE

by

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ABSTRACT

DIPIN V. KASANA. Evaluation of Organizational Readiness to Implement Change within the Workplace. (Under the direction of DR. JAKE SMITHWICK)

Organizational change is an initiative to transition from a current state to a desired future state, where the initiatives can be either planned or unplanned, based on motivational factors. This study evaluates the impact of organizational characteristics and change management strategies adopted by facility management (FM) professionals to implement planned and unplanned changes due to internal and external factors. The implementation of new or innovative workplace strategies (i.e., flexible workspace) were considered as planned changes, whereas changes implemented at facilities in response to the COVID-19 pandemic were considered as unplanned changes (e.g., remote working, safety protocols, etc.). The research team adopted multiple survey-based methodologies to collect information on planned and unplanned change management experiences from FM professionals and employees across the world. Through the help of an FM association, more than 1,500 responses were collected from organizations across 60 different countries. Using machine learning algorithms and other statistical concepts, the research team was able to identify the impact of key organizational attributes, change characteristics, and change management strategies responsible for the successful implementation and adoption of planned or unplanned change initiatives. The research findings provide industry specific recommendations for FM professionals to guide workplace change management efforts and improve the likelihood of successful change adoption within a built environment. With the limited availability of academic research on facility change management, this research can also assist professionals from a variety of occupations (e.g., design, development, human resources, real estate, and other leadership functions) to deliver successful change adoption, for both planned and unplanned change initiatives.

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LIST OF ABBREVIATIONS

BIFM - British Institute of Facility Management

CDC - Centers for Disease Control and Prevention

FM – Facilities Management

FMs – Facility Managers

IFMA - International Facilities Management Association

MMSF – Millions Square Feet

OCM – Organizational Change Management

SF – Square Feet

SME - Subject Matter Experts

WHO - World Health Organization

INTRODUCTION

As Cotts (2009) once wrote, “until facility managers develop better research, they will remain at a disadvantage in managing space as well as in proving their business worth to their companies.” This research is focused on providing facilities management (FM) professionals with data driven insights to enhance the implementation of various strategies or change initiatives as a result of internal or external motivating factors through a structured change management process. A professional within the FM industry is responsible for ensuring functionality, safety, comfort, and efficiency of a built environment, through the integration of people, place, process, and technology (IFMA, 2013). FM professionals are also referred to as technical experts of a built environment, and their ability to lead various change management efforts are central toward organizational success (Chotipanich, 2004). The findings of this research study will assist FM professionals to reevaluate their change management strategies and adopt best practices based on the type and nature of the change initiative, and to increase the likelihood of successful implementation.

Chapter One investigates the FM readiness to implement new or innovative workplace strategies (i.e., flexible workplace) through organizational change management and other moderating factors. Using machine learning algorithms, this research identifies the impacts of key organizational change management practices, organizational features, and change characteristics on the successful implementation of a planned change at the workplace. The limited academic research and exponential growth in the flexible workplace portfolio has established the need to conduct this study. The findings of this study will allow FM professionals to increase the likelihood of achieving the intended benefits, long-term adoption, and overall success with the implementation of new or innovative workplace strategies.

Chapter Two presents an analysis of FM's readiness to implement various unplanned changes or strategies due to unforeseen circumstances (i.e., the COVID-19 pandemic). Through a survey-based methodology, a total of 892 responses from FM professionals throughout the world were collected to record individual feedback on the implementation of the most significant changes made in response to the COVID-19 pandemic. In addition, follow-up interviews were conducted with 30 FM professionals that either championed or struggled during the change implementation process. Using advanced statistical concepts, the analysis helped to identify the key change management strategies and organizational characteristics that had a significant impact on the successful change implementation, long-term adoption, and achievement of intended benefits. The findings of this chapter will assist FM professionals to utilize best practices for the successful implementation of unplanned change initiatives due to unforeseen circumstances.

Finally, Chapter Three focused on the change initiatives as a result of the COVID-19 pandemic; however, the feedback on change implementation and adoption parameters was studied from the perspective of workers at the forefront of these initiatives (i.e., employees that were directly impacted by the change), as opposed to the FM professionals or leaders responsible for implementing the changes. This was a follow-up study from Chapter Two, where 32 organizations agreed to participate in the research and provided feedback on the change implementation process, from a total of 352 employees. Through various analysis techniques, two major areas were investigated in this chapter. First, the disparate perceptions of the change implementation process, particularly between change leaders and employees, were studied. Second, the identification of statistically significant factors, which either had a positive or negative impact on the successful change adoption based on end users' perspectives. The

findings of this chapter will highlight the major areas with significant differences between the FM professionals and employees, as well as identify key strategies from employees' perspectives responsible for successful change implementation.

Organizational change management is a key aspect of FM, but the limited guidance and nearly non-existent research within the FM industry creates unique challenges for FM professionals, especially during times of crisis like the COVID-19 pandemic. While most change management research studies are either focused on a different industry or consider change as agnostic, this thesis synthesizes three unique studies to enhance change management efforts within the FM industry based on the types of change, motivational factors, or perspectives of end-users. In addition, all three studies are based on a unique dataset collected through distinct methods and address contrasting issues.

CHAPTER 1:
ASSESSMENT OF FACILITY ORGANIZATIONAL READINESS TO IMPLEMENT FLEXIBLE WORKPLACE STRATEGIES: AN INTERNAL CHANGE MANAGEMENT STUDY

1.1 INTRODUCTION

Space planning and management are key components implemented by facilities management (FM) professionals and are essential to an organization's ability to accommodate industrial developments, growth within the company, expansion of staff, and an increasingly popular strategy to cater to individual needs (Roper, 2014; Chotipanich, 2004). The former Vice President of Citibank's facility planning referred to space as the "frontier" of FM (Cotts, 2010). According to Cotts (2010), facility managers (FMs) are responsible for primary business operations, including forecasting, planning, allocating, and managing the physical dimensions of a built environment. Roper (2014) asserts that space planning can be a highly complex process, especially when changes in the workspace can result in higher distraction, lower productivity, and complicate communication channels between employees. While space planning is a critical function of FM, it is mainly associated with the four major components of growth (Cotts, 2010). Firstly, space planning is necessary during the growth of an industry or a field, such as manufacturing companies expanding operations to incorporate more sustainable or energy efficient processes. Secondly, the growth within an organization or a company needs space planning efforts to accommodate for a new department or business activity, such as integrating a data analytics department. Thirdly, the implementation of new and innovative workplace strategies requires active space planning, such as adoption of a flexible workspace model. Finally, space planning is critical to accommodate for the individual needs of employees, such as handicap friendly workspace (Cotts, 2010).

Per Roper (2014), flexibility at the workplace, in contrast to space growth, does not require assigning any additional space; instead, flexible workspaces aim to successfully accommodate a dynamic set of activities without hindering productivity. Depending on the industry, "flexibility" has a variety of meanings. Roper (2014) defined flexibility within space management as an effort to develop the most suitable working environment that would satisfy the needs of existing employees as well as easily adapt to the needs of future employees. Flexible workspace is one such space planning strategy that enables different industries to explore flexibility within their respective portfolio, either by dedicating a portion of their existing space as flexible workspace or by leasing flexible workspace from a third-party operator for their employees. On average, facility owners were perceived as being comfortable with dedicating 15-30% of total space towards a flexible workspace (Greenwood, 2018).

As the FM industry continues to evolve, FMs are more involved in the leadership and strategy development roles for FM activities related to project management, operations and maintenance, finance and business, and space management (Roper, 2014). Among these leadership roles, facility managers are primarily responsible to provide guidance to staff or service providers as well as act as mediator to communicate the positive and negative impacts of major changes to the senior leadership within the organization (Cotts, 2010). To successfully implement new strategies and perform leadership duties in a rapidly changing environment, facility managers should adopt a structured change management approach. Within the FM context, change management can be defined as "a process that involves defining, refining, and implementing plans for changes" (IFMA, 2013).

Research Objectives

The purpose of this study was to identify the key parameters that had a statistically significant impact on successfully delivering a planned change initiative implemented due to internal events or circumstances. As organizations continue to evolve and explore new ways of working, the risk of failure to successfully deliver a new workplace solution can be very high (Myerson, 2010). Considering an exponential increase in the adoption of flexible workplace strategies and limited research in the field, this study aims to investigate the impact of organizational characteristics (size, location, facility, etc.), scale of change, and Organizational Change Management (OCM) practices on successful change adoption, through three distinct measures – 1.) overall change success, 2.) change benefits achieved, and 3.) long-term or sustainable adoption.

1.2 LITERATURE REVIEW

"Flexible workspace," sometimes referred to as coworking spaces, does not have a precise definition due to its disproportionate application throughout the industry and resulting lack of academic research. A recent report by Smith (2019) helps to differentiate coworking from flexible workspace strategies. According to Smith's (2019) report, flexible workspace can be defined as a space in the form of a service, offering a multitude of arrangement options and necessary office amenities, whereas coworking spaces can be referred to an entry-level form of flexible workspace. In contrast to coworking spaces, flexible workspaces offer more control to an organization in terms of the design and branding of the space. In exchange for enhanced control, flexible workspaces generally require longer term commitments (Smith, 2019; CBRE, 2019).

The market for flexible workspace across the United States (US) has shown consistent annual growth, at a rate of approximately 26% over the last decade, where the market grew from 9 MMsf (million square feet) in 2010, to 84.9 MMsf in 2019 (CBRE, 2019). This rapid expansion of the flexible workspace inventory can be credited to megacities throughout the US, where the top 10 cities account for 64% of the total flexible workspace (CBRE, 2019). In particular, Manhattan leads the market with 21% (15 MMsf) of the total flexible workspaces in the US (CBRE, 2019). In terms of flexible workspace as a percentage of total workspace, San Francisco's flexible workspace market penetration leads with 4% of the total market in the US (CBRE, 2019; Nelson, 2019). Organizations like WeWork, Regus, Space, Knotel, to name a few, are the largest flexible workspace operators, with WeWork managing 33% (23.4 MMsf) of the market (CBRE, 2019; Smith, 2014; Nelson, 2019). While the major changes in offices spaces over the last few decades have benefited young knowledge workers with enhanced collaboration and flexibility at work, it has also created inherent barriers for older knowledge workers (Myerson, 2010).

Types of Office Space

According to Greenwood (2018), the different kinds of office spaces can be divided into three major categories: i) coworking space, ii) speculative office space, and iii) traditional office space, as shown in Figure 1.1. These office space types are distinguished based on the leasing term, operational costs, allocated space, and several other factors (Greenwood, 2018). The coworking space can be defined as shared office space with multiple tenants that provide flexible membership (between one month and one year), a "plug and play" environment with necessary equipment, and access to attractive amenities for its end users (Greenwood, 2018). Generally, a

membership to a coworking space costs between $500 and $1100 (i.e., $60 to $200 per sf), where the typical area of a workstation ranges from 55 to 85 sf (CBRE, 2019).

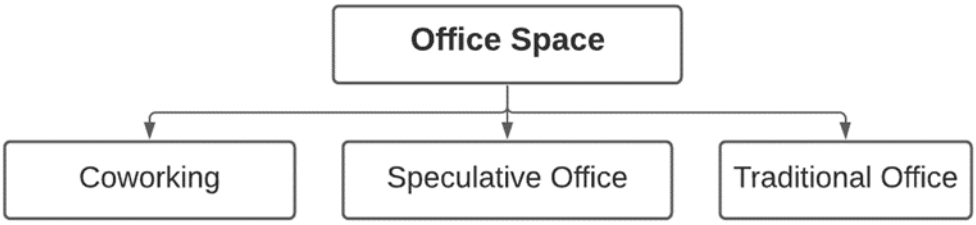

Figure 1.1: Types of office space, adopted from Greenwood (2018)

Speculative office space provides access to single tenant with turnkey space delivery, where the space does not include access to equipment and furniture. The typical lease term for a speculative office lasts from 4 to 6 years, and costs users approximately $40 to $45 per sf, having a workstation ranging from 110 to 140 sf in size (CBRE, 2019; Greenwood, 2018). Finally, the traditional office space model provides tenants with superior flexibility and control over the design, brand, and layout of the leased space, which are generally leased from 5 to 10 years, making it the longest lease option among all office space types (Greenwood, 2018). Traditional office spaces typically cost $30 to $40 per sf, with a tenant improvement allowance, and a workstation area ranging from 145 to 175 sf (Greenwood, 2018).

Evolution of Flexible Workspace

The evolution of flexible workspace began in 1962, when Omni Offices, established in Chicago, Illinois, started the first shared working space in the form of executive suites (Meuner, 2018). Figure 1.2 highlights the key events during the evolution of flexible workspace. In 1995, the first hackerspace, c-base, was founded in Berlin, Germany, which enabled likeminded individuals to collaborate and share knowledge while having access to the latest technology. The

concept of flexible workspace grew during the late 1990's, and by 1999, the biggest market among flexible workspaces, coworking spaces, was founded by the American game designer, Bernard DeKevon, when he coined the term 'coworking' to encourage collaborative efforts and equitable status among employees (Meuner, 2018). The concept of a coworking space became a reality when it was first implemented in 2002, after Schraubenfabrik (a.k.a. the mother of coworking) was formed by converting a discarded factory into a working space for start-ups and entrepreneurs in Vienna, Austria (Meuner, 2018). Finally, the flexible workspace strategy ascended in 2005, after the first official coworking space was formed by Brad Neuberg, in San Francisco, California (Meuner, 2018).

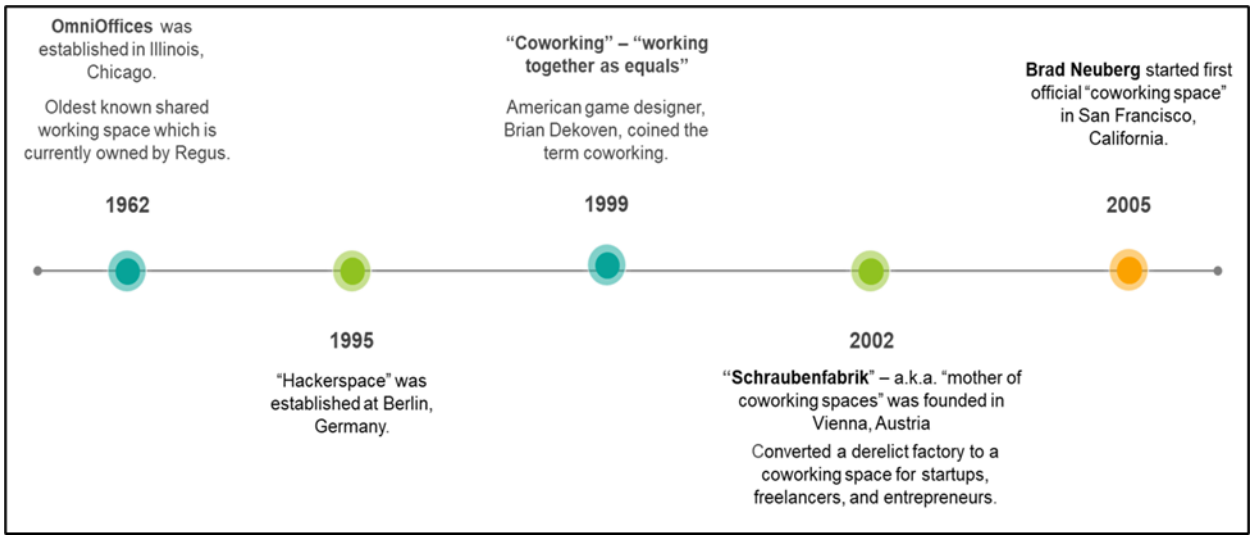

Figure 1.2: Evolution of flexible workspace, adopted from Meuner (2018)

Flexible workspaces offer a variety of features that can be customized based on an organization's profile, needs, and industry goals (CBRE, 2019). Figure 1.3 provides a flowchart, representing the five most common types of flexible workspaces based on size, popularity, and level of service in the current market (HOK, 2018). Among them, coworking spaces (a.k.a. Hubs) are shared office spaces generally provided and managed by third-party operators and employed by tenants on a monthly or other short-term membership basis. Coworking spaces aim

to promote a sense of community, encourage interaction, and create a casual environment, while also being equipped with high-tech support and other business amenities required for the effective operation of modern office spaces (HOK, 2018). Conversely, Serviced Offices (a.k.a. Executive Suites) are the most traditional type of flexible workplace, which are essentially located at first class buildings aiming to display professional environment, and provide organizations with private offices, meeting rooms, flexible lease terms, and shared communal amenity area (HOK, 2018).

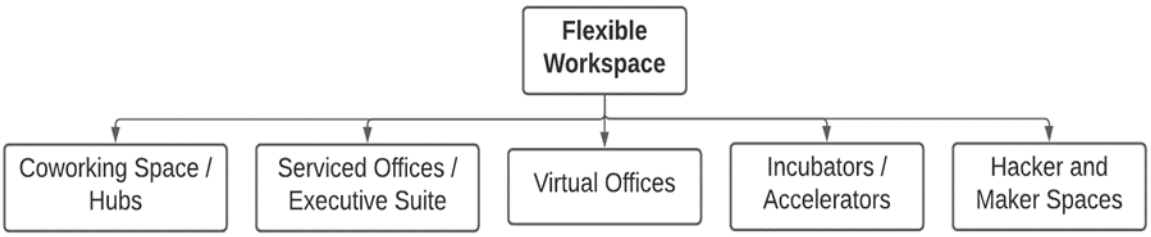

Figure 1.3: Types of flexible workspace, adopted from HOK (2018)

Flexible workspace options are also available to those that do not wish to commit to a lease agreement. Virtual Offices are one such option, providing a variety of services and office space to tenants without requiring them to sign a lease. Virtual offices are generally preferred by medium to large organizations, where the services offered typically include a professional mailing address, phone answering service, general office equipment, and meeting rooms (HOK, 2018). In stark contrast to the conventional Executive Suite, Incubators and Accelerators are spaces designed to meet the needs of start-up companies, where features are tailored according to the company's current valuation and size (HOK, 2018). Incubators are considered most appropriate for new start-ups as the owner provides space and other mentoring services with low- or no-cost space for a small equity stake in the company; whereas Accelerators are better suited for promising start-ups that can thrive from the immersive entrepreneurial environment and

enhanced networking opportunities (HOK, 2018). Finally, Hacker and Maker spaces are generally utilized by individuals sharing common interests to work, collaborate, share technology and tools, and learn from each other, in exchange for payment of membership fees (HOK, 2018).

Flexible Workspace Leasing Models

Prior to the adoption of flexible workspace solutions, landlords and tenants (flexible workspace operators) draft legal agreements, outline tenant's needs, and define the business strategies to address the risks and opportunities (CBRE, 2019). While considering a landlord's perspective, CBRE (2019) outlined four flexible space leasing models to address the risks and rewards involved for both parties. Figure 1.4 highlights the four common types of flexible workspace leasing models based on the characteristics of the agreement.

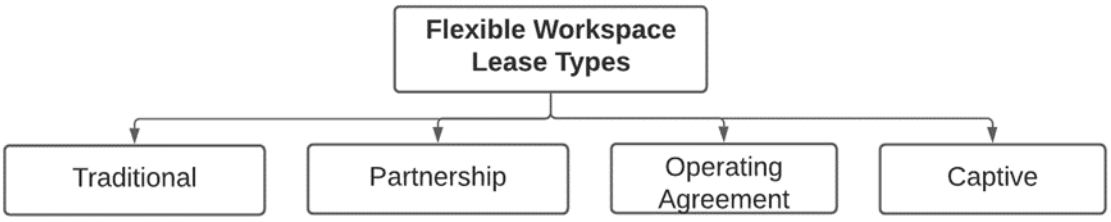

Figure 1.4: Types of flexible workspace leasing models from landlord's perspective, adopted from (CBRE, 2019)

The traditional leasing model is the most commonly and widely used flexible space leasing model, where landlord and tenant undergo a long-term lease for a fixed rent amount, and tenant bears all the risk while also keeping any profit. In contrast to the traditional model, the partnership model allows a landlord and tenant to share the profits and losses from the flexible workspace for the duration of the lease term. Under the operating agreement model, the landlord

outsources the flexible workspace to a third-party operator for a fixed management fee and takes the responsibility for all the associated risks. Finally, the captive model enables landlords to build, design, and manage the flexible workspace without the involvement of any third-party operator, which enables the landlord to maintain complete control over the flexible workspace by agreeing to bear all of the associated risks (CBRE, 2019).

On the other hand, Nelson (2019) illustrated three leasing models for organizations or tenants planning to implement flexible workspace solution, such as flex & core, city campus, and suburban models. In flex & core lease models, organizations undergo long-term leases to accommodate the variation in workforce and support the organization's core business operations through the flexible workspace. For the city campus model, organizations aim to increase the number of office locations, locally or globally, to facilitate access to a physical office space for remote workers and telecommuters. Finally, the suburban model can be considered as an extension to the city center model, where the office spaces are easily accessible by workers from the city's center and other locations (Nelson, 2019).

According to LoRusso (2018), the market for flexible workspace operators has grown rapidly and consistently over the last decade; however, it is expected that businesses of all sizes will aim to explore the opportunities offered by flexible workspace solutions to achieve organizational agility and flexibility on behalf of their portfolio. Kossek (2014) developed a five-step approach to assist facility managers or senior management to successfully implement flexibility at the workplace. In the first step, facility managers should assess the impact of changes at workplace on all the involved parties. Secondly, the senior management should identify job requirements or responsibilities that are most suited to benefit from the flexibility. Thirdly, facility managers should coordinate with other senior professionals to establish

performance goals and milestones. Fourthly, a formal change management approach must be taken to effectively navigate and communicate the modifications at the workplace. Finally, the performance of implemented changes should be continuously monitored for effective adoption through feedback from employees and other stakeholders (Kossek, 2014).

Change Management

Over the last 100 years, researchers have published an overwhelming number of change management models across all industries to identify key Organizational Change Management (OCM) practices. However, the limited availability of academic research on applications of OCM within the FM industry enabled FM professionals to adopt an interdisciplinary approach towards change initiatives, where best OCM practices are acquired from other relevant fields like Architecture, Engineering, and Construction (AEC). Even though, traditionally both FM and AEC have been slow to adopt new and innovative methods, change management has become a core competency over the last few years with a rapid growth in innovative solutions, such as integration of Building Information Modeling (BIM), smart products, scanning technologies, among others (Lines, 2017; Maali; 2020). Burnes (2009) defines OCM as necessary steps taken to ensure the successful implementation of new and innovative practices aimed at achieving organization-wide goals. Lines (2017) and Maali (2020) derived seven key OCM practices using the academic literature from AEC and organizational behavior fields to assist organizations with successful implementation of change initiatives in an interdisciplinary environment. Based on the recommendations from various researchers, these seven key OCM practices focused on leadership, training resources, communication, timeframe, change agent, benchmarks, and workload adjustments. Figure 1.5 illustrates the key seven OCM practices and three change

adoption measures utilized to study the successful implementation of a technology in the AEC industry.

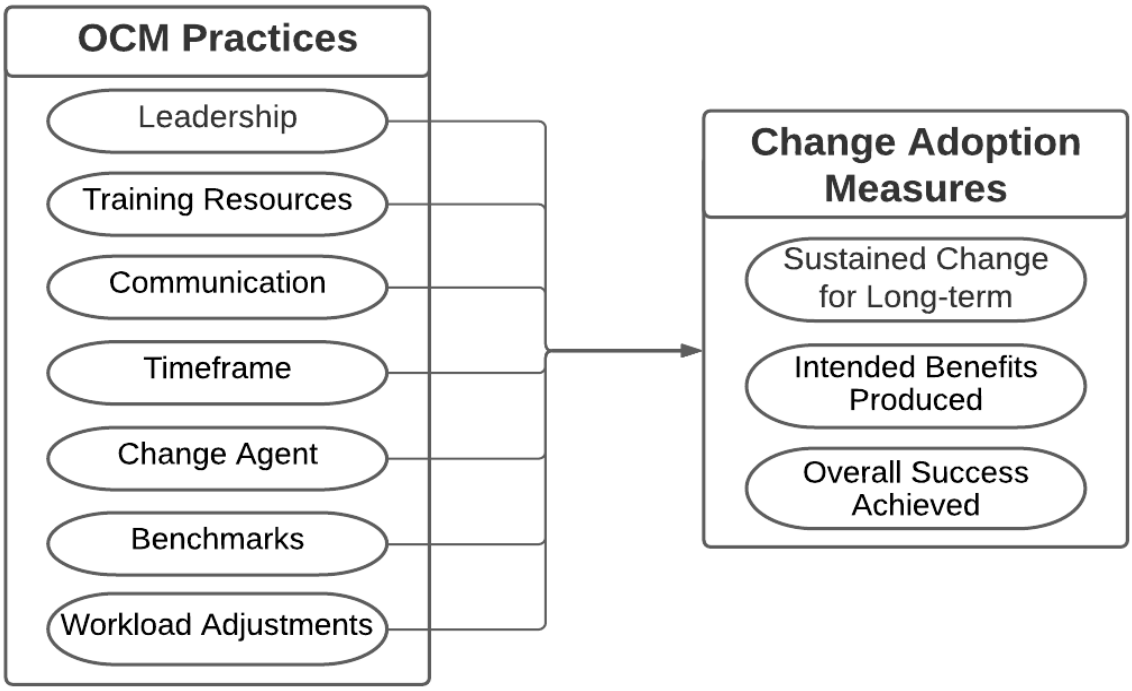

Figure 1.5: Key OCM practices and change adoption measures, adopted from Maali (2020) and Lines (2017)

1.3 RESEARCH METHODOLOGY

The data for this study was collected using a survey-based methodology, where a robust questionnaire was developed through an extensive literature review and discussion with subject matter experts within the FM industry. The survey aimed to collect details on areas like organizational characteristics, facility overview, employee demographics, flexible workspace, and various aspects of change management practices through quantitative and qualitive responses. Some of the questions aimed to collect details on organizational and facility characteristics were adopted from International Facilities Management Association's (IFMA)

benchmarking reports to ensure consistent reporting of the findings for better-quality applications. Using the Qualtrics platform, the survey questionnaire was distributed to approximately 2,250 FM professionals throughout the world, who were identified through a previous study conducted by IFMA. The data was collected for six weeks, between March 2021 and April 2021, where a total of 336 completed responses were collected with a response rate of approximately 15%. The average response time to complete the survey was approximately five minutes, where the survey was designed to customize questions based on responses to previous questions.

Data Description

The dataset developed for this study can be broken down into three major groups based on the type of information collected through the available parameters – 1.) organizational characteristics, 2.) OCM parameters, and 3.) change adoption measures. Figure 1.6 catalogs all the major parameters among the three groups that were studied in this research. While most of the parameters were recorded on a qualitative scale (i.e., ordinal, nominal, or binary), other factors like occupants, size, etc. were recorded on a quantitative scale (i.e., numerical) but converted to an ordinal scale for better generalization and improved statistical analysis performance. Most of the parameters within the organizational characteristics group were adopted from IFMA's benchmarking reports. The industry parameter considered 35 different sectors that were categorized among three major industry types, such as institutional (e.g., government, association, religious, research, etc.), services (e.g., banking, healthcare, real-estate, etc.), and manufacturing (e.g., equipment, consumer, construction, etc.). The change parameters included details on the scale of change (i.e., flexible workspace), OCM practices utilized, and

reaction of employees towards the change. Meanwhile, the change adoption measures were used as an outcome or target parameters to study the performance change initiatives.

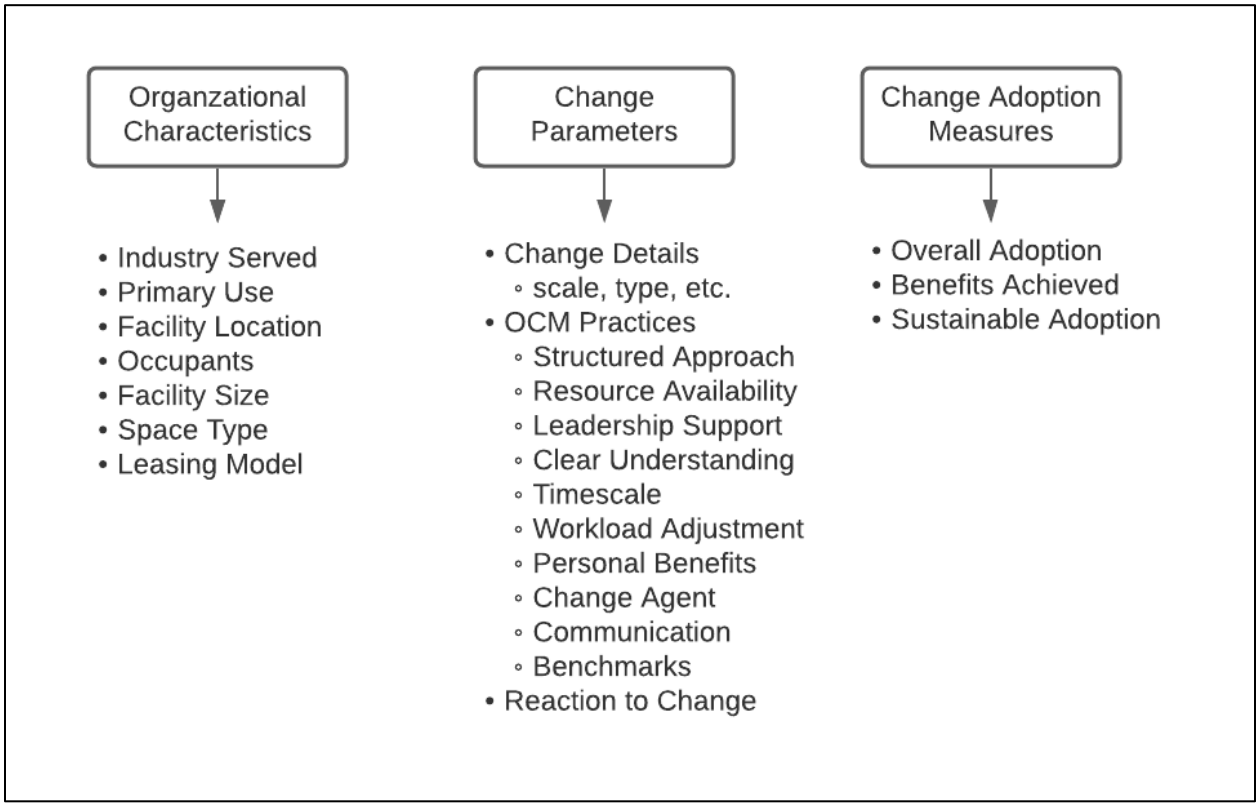

Figure 1.6: Key parameters

1.4 DATA ANALYSIS AND RESULTS

The descriptive analysis was performed to visually explore relationships between key parameters and understand the distribution of the available data through tables and charts. For the statistical analysis, three different random forest models (i.e., machine learning algorithms) were developed to study the importance of key parameters on successful change implementation, using the three change adoption measures. Additionally, follow-up logistic regression models were developed for each random forest model to validate the results and investigate the impact of less important parameters.

Descriptive Analysis

The descriptive analysis was performed to understand the characteristics and distribution of the available information through tables and charts. Table 1.1 provides a breakdown of the number of responses recorded across three major categories for the internal change (i.e., flexible workspace). As seen in Table 1.1, most of the responses were recorded from flexible workspaces that were established within the last five years and had less than 5,000 square feet of area, with 20 or less daily occupants.

Table 1.1: Number of responses across major categories of flexible workplace

Flexible Workspace	Category	N	% N
Area (SF)	Less than 5,000	154	54%
	5,000-50,000	86	30%
	50,000-100,00	18	6%
	More than 500,000	29	10%
Occupancy (# of people)	Less than 10	62	30%
	10-20 occupants	41	20%
	20-50 occupants	63	31%
	More than 50	38	19%
Age (# of years)	Less than 5	187	61%
	5-10 years	67	22%
	10-20 years	41	13%
	More than 20	11	4%

Figure 1.7 helps to understand the distribution of common features offered at flexible workspace, where flexible working hours was the most common feature offered at 75% of the organizations. Other top features that were offered at flexible workspaces included unassigned seating arrangements, access to various workstation types, and the option to work from different locations. Figure 1.8 illustrates the employee reaction to the implementation of flexible workspace strategies, where most employees demonstrated a positive reaction, reporting 70% employees actively cooperated during the change implementation phase.

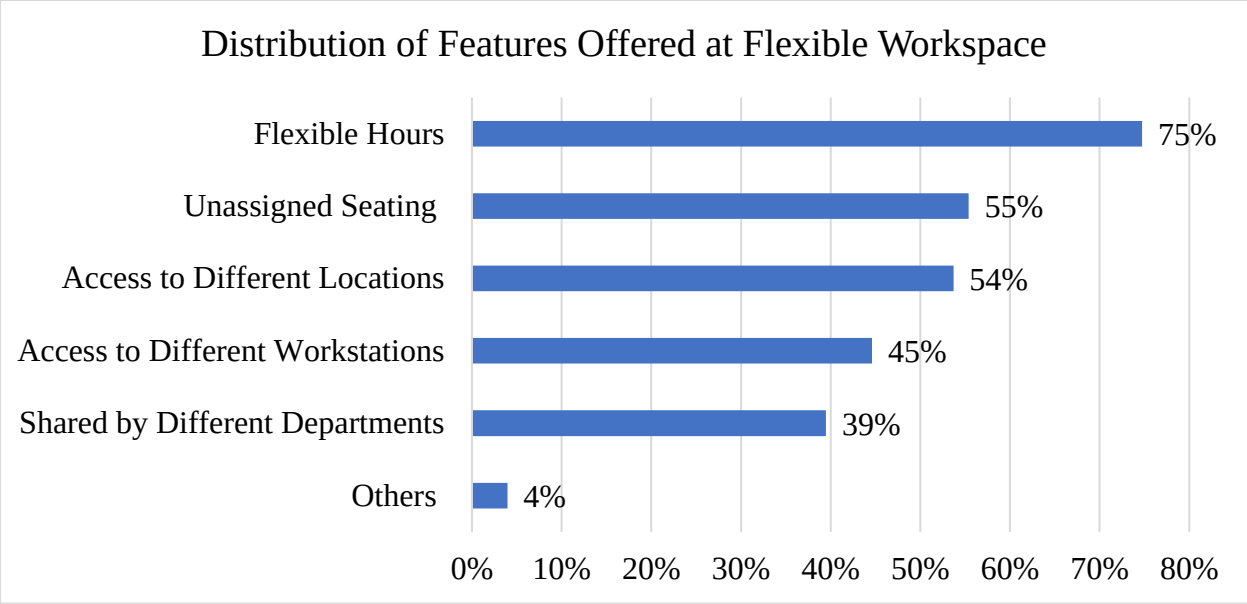

Figure 1.7: Distribution of flexible workspace features

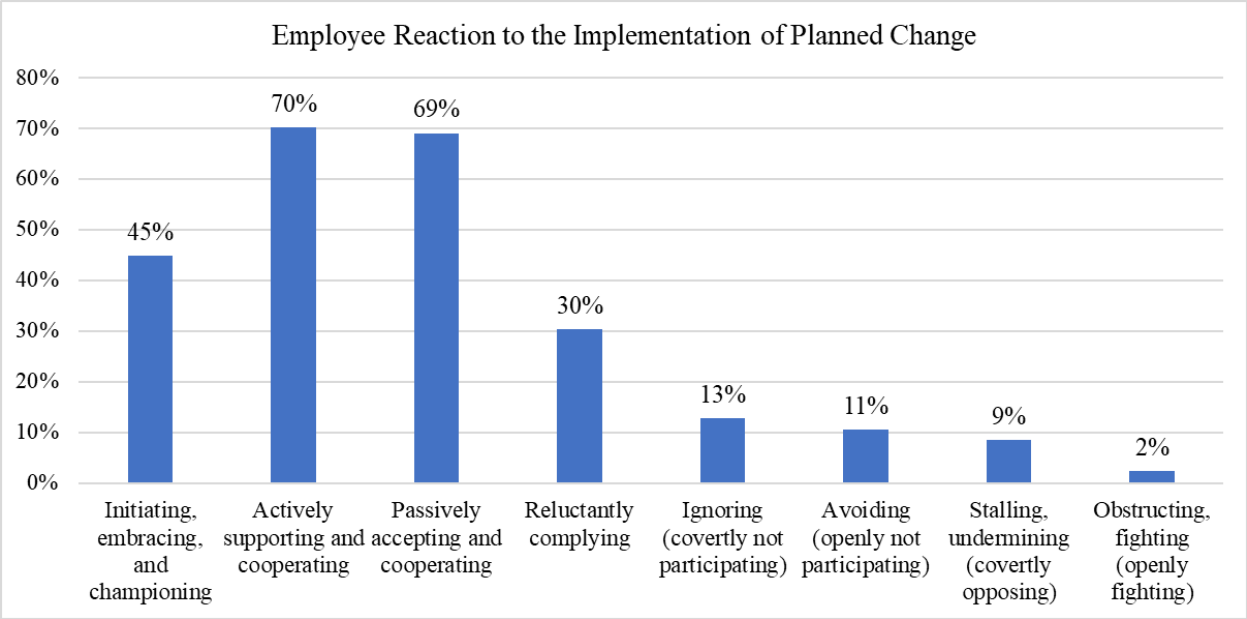

Figure 1.8: Employee reaction to planned change initiative

To visually inspect the relationship and variation in the successful change implementation, the overall change adoption measure was plotted against a few moderating factors like industry, facility occupants, magnitude of change, among others. Figure 1.8 provides a distribution of overall change adoption ratings, recorded on a 1 to 7 scale, across three major

industries. The size of the circle in Figure 1.8 indicates the number of responses recorded based on the industry served and overall adoption rating. While the number of responses were different across industry types, the distribution for change adoption measures were consistent for all industries.

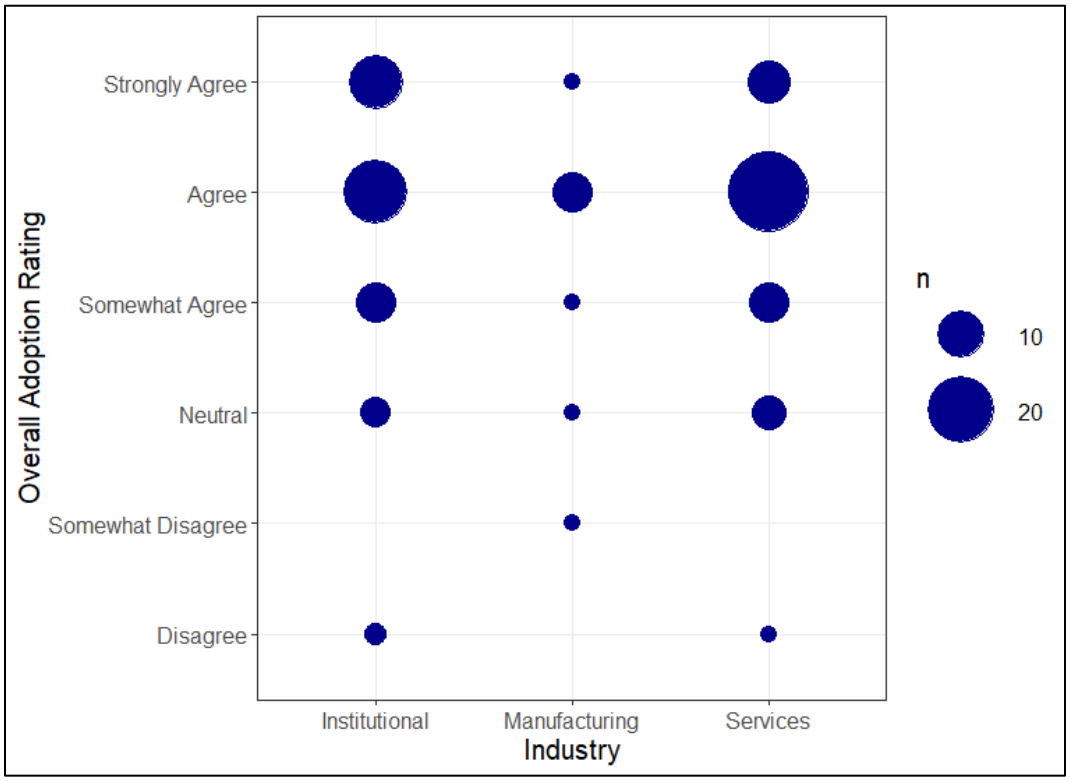

Figure 1.9: Distribution of responses based on overall change adoption success across industry types

Similar patters were observed in Figure 1.9 and 1.10, where the number of facility occupants and magnitude of change (measured through number of flexible solutions) were studied against the overall change adoption measure. The similarity among these distributions further corroborated the need to conduct statistical analysis to identify the relationship between various available parameters and change adoption measures.

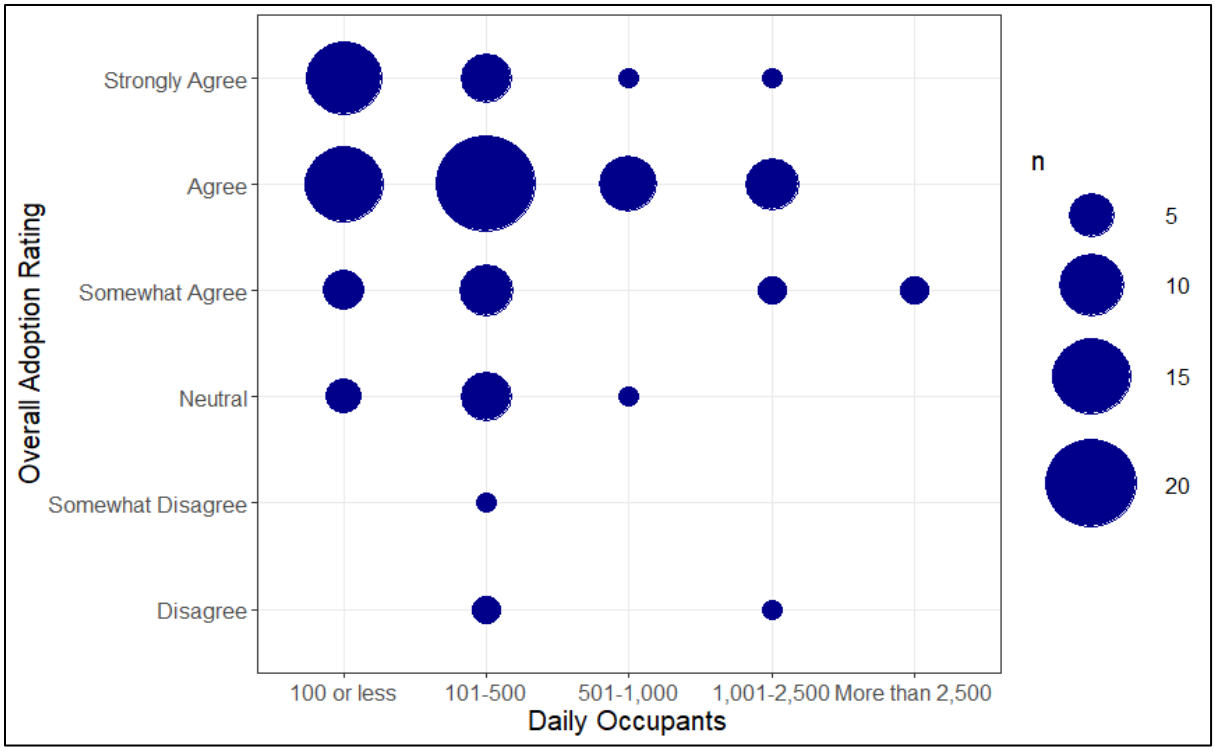

Figure 1.10: Distribution of responses based on overall change adoption success across facility occupants

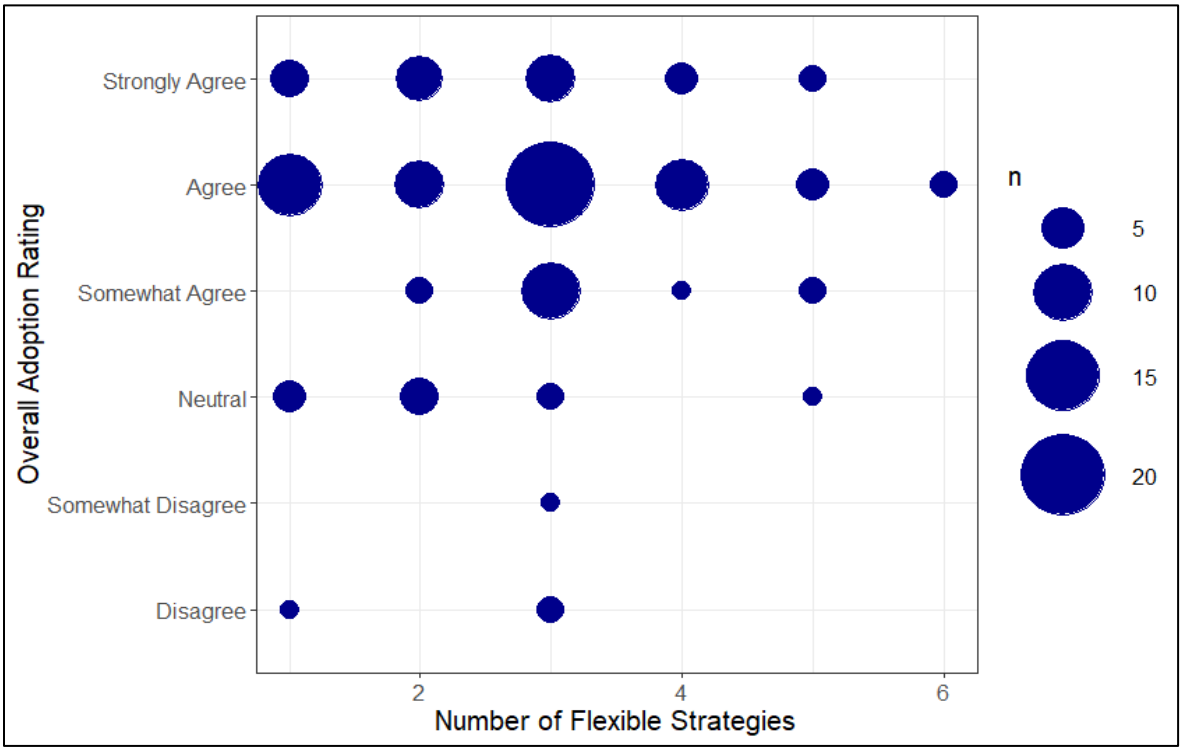

Figure 1.11: Distribution of responses based on overall change adoption success across flexible strategies offered

Statistical Analysis

The statistical analysis was performed to further investigate the impact of key factors on the successful implementation of flexible workspace in an organization with the help of the three change adoption measures. In other words, the aim of the analysis was to identify and quantify the parameters that had a statistically significant impact to successfully deliver the overall change adoption, achieve the intended change benefits, and long-term adoption. Based on the data type of change adoption measures and purpose of the analysis, random forest (i.e., machine learning algorithm) and logistic regression models were developed for each change adoption measure. Considering the skewed distribution of OCM practices and change adoption measures, these parameters were transformed from an ordinal scale (1 to 7 scale) to a binary scale (1 and 0), where responses on a 1 to 5 scale were recorded as 0, and a 6 to 7 scale were recorded as 1. The binary scale helped to classify responses with higher agreement from others based on the feedback on OCM practices and change adoption measures. This data transformation also helped to increase the performance of statistical models.

Random forest is one the most robust and widely used classification methods (James, 2013). It is an ensemble model that uses a combination of decision tree models to develop a final model, where each decision tree model is developed using a randomly selected data sample with different sets of independent parameters and number of responses. This technique of randomly selecting data with replacements for each model, also known as the bootstrapping technique, helps to develop a dynamic model that allows researchers to overcome common issues like collinearity and bias. Logistic regression is another popular classification method, which helps to identify parameters that had a positive or negative impact on the outcome variable based on a

sigmoid curve. While the interpretation of random forest model can be difficult, the logistic regression lacks robustness (James, 2013).

A total of six models, three random forest and three logistic regression models, were developed to individually assess each change adoption measure using the two analysis techniques. While the random forest model was used as primary analysis method to identify the most important parameters based on the outcome variable, logistic regression helped to determine the relationship between identified parameters and outcome variable. The data cleaning and statistical analysis was performed using the RStudio platform. Each model was developed using 70% of the randomly selected data and the performance was calculated through its predictive accuracy on the remaining 30% dataset. For this study, the random forest model was developed using 1,000 decision trees and fine-tuned to identify the optimum number of randomly selected parameter to create each decision tree.

Discussion of Results

The first model (Model 1) was developed to identify the key organizational characteristics and OCM practices (see Figure 1.6 above) that had a significant impact on the overall change adoption measure. Table 1.2 provides the result of random forest analysis for Model 1, which shows the top 15 parameters based on their importance on overall change adoption success. Among these top 15 factors, the top 10 parameters belong to the OCM practices and the other five represent the organizational characteristics.

Also shown in Table 1.2, the availability of sufficient resources and financial support was the most critical parameter for successful overall adoption of flexible workspace. The clear understanding of the necessary steps to implement the flexible workspace was the second most

important factor that accounted for the overall change adoption, followed by the appointment of a dedicated individual to lead the change effort. Other key OCM parameters for successful overall change adoption included clear communication channels, workload adjustment, and support of leadership. While the OCM practices had the most significant impact of overall change adoption, other organizational characteristics had some impact as well. Organizations that had multiple buildings within suburban areas and offered two flexible workspace solutions demonstrated higher success with overall change adoption. As shown in Table 1.3, Model 1 was statistically significant with P-Value less than 0.0035 and a predictive accuracy of 81.32%. In other words, Model 1 was successfully able to predict approximately 81% of the organizations' outcome for overall change adoption measures.

Similar to Model 1, Table 1.2 provides a list of the top factors for Model 2 and Model 3, where Model 2 was based on the achievement of intended benefits from the change and Model 3 looked at successful long-term adoption of the change. As shown in Table 1.2, clear understanding of the necessary steps to implement the flexible workspace was the most significant factor to determine the outcome of benefits or performance gains, as well as long-term change adoption. The availability of sufficient resources and a dedicated leader to drive the change were other important factors that governed benefits achieved, whereas the timescale of the change implementation and presence of a change agent were critical to determine the success of long-term adoption.

In addition to the OCM practices, the number of flexible workspace solutions (e.g., hours, location, workstation, etc.) offered had a significant impact on the benefits achieved, where organizations that offered either one, two, or three solutions were among the top 15 factors. Finally, organizations with multiple buildings or facilities used primarily within industrial sectors

demonstrated higher impacts on change benefits achieved. For long-term adoption, the organizational demographics, like facilities located at rural areas or flexible workspaces of size 50,000 to 100,000 square feet, were among the other key success factors. The predictive accuracy for Model 2 and Model 3 was recorded as 82.42% and 81.32%, respectively, as shown in Table 1.3. Both models were statistically significant with p-values less than 0.05.

Table 1.2: Random Forest model results (top 15 of 44 parameters)

	Model 1: Overall Change Adoption		**Model 2: Change Benefits Achieved**		**Model 3: Long-term Change Adoption**	
#	**Parameters**	**Importance**	**Parameters**	**Importance**	**Parameters**	**Importance**
1	Resource Availability	100	Clear Understanding	100	Clear Understanding	100
2	Clear Understanding	91	Resource Availability	87	Timescale	88
3	Change Agent	85	Change Agent	77	Change Agent	87
4	Communication	84	Workload Adjustment	76	Resource Availability	83
5	Workload Adjustment	78	Communication	71	Workload Adjustment	68
6	Leadership Support	74	Leadership Support	69	Communication	58
7	Benchmarks	66	Personal Benefits	64	Structured Approach	57
8	Personal Benefits	61	Benchmarks	63	Leadership Support	52
9	Structured Approach	61	Structured Approach	53	Facility Location: Rural	51
10	Timescale	58	Timescale	45	Flexibility: 1 Offerings	45
11	Individual Involvement	39	Flexibility: 1 Offerings	33	Personal Benefits	37
12	Facility Location: Suburban	39	Space: Multiple Buildings	33	Flex Area: 50,000-100,000 SF	33
13	Space: Multiple Buildings	38	Flexibility: 2 Offerings	33	Space within a Building	29
14	Flexibility: 2 Offerings	33	Facility Use: Industrial	32	Flexibility: 4 Offerings	27
15	Own and leased to Others	32	Flexibility: 3 Offerings	30	Facility Use: Laboratories	25

Table 1.3: Random Forest model performance

	Model 1	**Model 2**	**Model 3**
Accuracy	81.32%	82.42%	81.32%
95% CI	71.18%, 88.72%	73.02%, 89.60%	71.78%, 88.72%
P-Value	0.0035	< 0.0003	0.012

Based on the results of logistic regression model (see Appendix 1.1), the OCM parameters, such as involvement of the change agent, timescale of the change implementation,

and communication of personal benefits from the change, did not show enough evidence to have a direct impact on successful overall change adoption however, the remaining OCM strategies recorded a positive impact on the overall change adoption measure. In addition, the number of flexible solutions offered had an inverse effect on overall successful adoption, where the likelihood of successful overall adoption for single flexible solution was higher as compared to multiple solutions. Similarly, for the achievement of benefits (see Appendix 1.2), most OCM practices recorded a positive impact except for the timescale and change agent. Organizations with multiple buildings in multiple locations that offered fewer flexible solutions were more likely to achieve benefits from the change. Based on the third logistic model (see Appendix 1.3), all the OCM practices identified in Table 1.2 had a positive impact on successful long-term change adoption. In addition, smaller organizations located at rural or industrial location and offered fewer flexible solutions also demonstrated a positive relationship with long-term change adoption.

In summary, it can be inferred that organizations should ensure the availability of financial and other necessary resources, have a clear understanding of action steps needed to implement the change, and appoint a change agent to lead the change effort, which can lead to successful planned change adoption irrespective of the desired outcome. In addition, the organizations are highly recommended to be conscious of the magnitude of the planned change initiative, since there was enough evidence that change magnitude had an inverse impact on the successful outcome.

1.5 CONCLUSION

This study evaluates the impact of organizational change management practices, organizational features, and change characteristics on the successful implementation of a planned workplace change. In particular, this study investigated the implementation of flexible workplace solutions at facilities. The successful implementation was measured based on three factors – overall adoption, benefits achieved, and long-term adoption. Through an extensive survey, a total of 336 responses from organizational leaders were collected to record their experience with the implementation of flexible workplace solutions.

Using machine learning algorithms, three random forest models were developed to identify significant factors responsible to predict the outcome for each change adoption measure. In addition, three logistic regression models were created to determine the relationship between the significant factors identified through the random forest model and the change adoption measures. All three random forest models were statistically significant at a 95% confidence level and recorded an accuracy of approximately 82%.

Based on the results, most of the OCM practices had a dominant and positive impact on the outcome of each change adoption measure, where all 10 OCM practices were identified among the top factors responsible to predict the outcome of the overall adoption and benefits achieved measures. Meanwhile, the outcome of long-term change adoption measures had eight out of the top 10 OCM practices among the top listed factors. While the arrangement of OCM parameters varied based on the change adoption outcome, some of the OCM practices had consistent and positive impacts, irrespective of the outcome parameter. In particular, the three most impactful OCM strategies applicable for all three change adoption measures included

availability of financial and other resources, clear understanding of necessary steps to implement the change, and adjustment of employee workload to accommodate change.

The organizational features and change characteristics did not have as significant an impact as the OCM practices but had some impact on change adoption measures. Organizations with multiple buildings at multiple locations were more successful with the change adoption, meanwhile organizations that provided fewer flexible workplace solutions demonstrated higher success. Hence, FM professionals and other leaders responsible for implementing workplace strategies can increase the likelihood of successful change adoption by focusing on the OCM practices based on the desired outcome. Future research in this area can explore the feedback from end users to identify additional critical factors and accordingly develop a framework for change leaders to enhance the change implementation process.

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1.7 APPENDICES

Appendix 1.1: Logistic regression model results for overall flexible workspace adoption

```
Coefficients: (1 not defined because of singularities)
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                      0.06497  180.71784   0.000  0.99971
Q23_flex_involvement1                                                            0.57257    0.53439   1.071  0.28397
Q24_int_structured_approach1                                                     0.59577    0.64749   0.920  0.35751
Q24_int_leadership1                                                              1.60849    0.61890   2.599  0.00935 **
Q24_int_resources1                                                               1.02960    0.68961   1.493  0.13543
Q24_int_clear_understanding1                                                     1.66310    0.81724   2.035  0.04185 *
Q24_int_timescale1                                                              -0.46291    0.73008  -0.634  0.52604
Q24_int_workload1                                                                0.13321    0.69337   0.192  0.84765
Q24_int_personal_benefits1                                                      -0.50385    0.69660  -0.723  0.46949
Q24_int_change_agent1                                                           -0.24529    0.77906  -0.315  0.75288
Q24_int_benchmarks1                                                              0.97410    0.69790   1.396  0.16278
Q24_int_communication1                                                           1.25665    0.66351   1.894  0.05823 .
total_flex.L                                                                     8.92486  647.96865   0.014  0.98901
total_flex.Q                                                                     9.50532  591.51170   0.016  0.98718
total_flex.C                                                                     6.85318  404.07967   0.017  0.98647
`total_flex^4`                                                                   3.36567  204.90626   0.016  0.98690
`total_flex^5`                                                                   2.00482   68.30385   0.029  0.97658
`Q4_space_typeMultiple buildings in multiple locations.`                        -0.31921    0.69588  -0.459  0.64643
`Q4_space_typeMultiple buildings in one location.`                              -0.39673    0.93533  -0.424  0.67144
`Q4_space_typeMultiple buildings in one location. Specify number of buildings` -3.84955    1.59800  -2.409  0.01600 *
`Q4_space_typeSpace within a building`                                          -0.65145    0.85392  -0.763  0.44552
`Q5_own_leaseOwn and lease to others`                                            1.04707    0.91972   1.138  0.25493
`Q5_own_leaseOwn and occupy`                                                     0.36916    0.67014   0.551  0.58173
`Q28_facility_settingCentral Business District`                                  0.01109    0.76734   0.014  0.98847
`Q28_facility_settingIndustrial park`                                            1.71000    1.54232   1.109  0.26755
`Q28_facility_settingRural Area`                                                -0.15700    1.79667  -0.087  0.93037
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`      -0.02157    0.82245  -0.026  0.97908
`Q28_facility_settingSuburban area`                                             -0.30379    0.81923  -0.371  0.71077
`Q30_primary_useEducation (Education/Training/Classrooms)`                       1.21615    1.41217   0.861  0.38913
Q30_primary_useIndustrial                                                       -0.89213    2.09586  -0.426  0.67035
Q30_primary_useJudicial                                                             NA         NA      NA       NA
Q30_primary_useLaboratories                                                     -1.17163    1.76936  -0.662  0.50786
Q30_primary_useOffice                                                           -0.37775    1.21444  -0.311  0.75576
Q30_primary_useOther                                                            -0.97212    1.31311  -0.740  0.45911
four_IndustriesManufacturing                                                     0.82523    1.05992   0.779  0.43623
four_IndustriesServices                                                          0.26607    0.53770   0.495  0.62071
flex_area_range.L                                                               -0.12462    0.69341  -0.180  0.85737
flex_area_range.Q                                                               -0.99021    0.78706  -1.258  0.20835
flex_area_range.C                                                               -0.86365    0.90147  -0.958  0.33804
flex_occupants_range.L                                                          -0.01570    0.66976  -0.023  0.98130
flex_occupants_range.Q                                                           0.36040    0.57668   0.625  0.53200
flex_occupants_range.C                                                           0.01295    0.49525   0.026  0.97914
flex_age_range.L                                                                -0.74639    0.99666  -0.749  0.45392
flex_age_range.Q                                                                -1.72079    0.90592  -1.900  0.05750 .
flex_age_range.C                                                                -0.73744    0.67271  -1.096  0.27298
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 271.33  on 214  degrees of freedom
Residual deviance: 145.60  on 171  degrees of freedom
```

Appendix 1.2: Logistic regression model results for benefits achieved from flexible workspace

```
Coefficients: (1 not defined because of singularities)
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                    -0.84866  242.57331  -0.003 0.997209
Q23_flex_involvement1                                                          -0.15549    0.52401  -0.297 0.766677
Q24_int_structured_approach1                                                    0.54645    0.66405   0.823 0.410566
Q24_int_leadership1                                                             1.27019    0.71681   1.772 0.076395 .
Q24_int_resources1                                                              1.48046    0.78768   1.880 0.060173 .
Q24_int_clear_understanding1                                                    3.73137    0.94799   3.936 8.28e-05 ***
Q24_int_timescale1                                                             -2.31475    0.90169  -2.567 0.010254 *
Q24_int_workload1                                                               1.26313    0.72936   1.732 0.083303 .
Q24_int_personal_benefits1                                                      0.06314    0.67318   0.094 0.925277
Q24_int_change_agent1                                                          -0.05490    0.79500  -0.069 0.944942
Q24_int_benchmarks1                                                             0.71885    0.65714   1.094 0.273994
Q24_int_communication1                                                          0.77178    0.69060   1.118 0.263756
total_flex.L                                                                    8.25316  869.76742   0.009 0.992429
total_flex.Q                                                                    7.24840  793.98540   0.009 0.992716
total_flex.C                                                                    6.02287  542.39548   0.011 0.991140
`total_flex^4`                                                                  1.84902  275.04524   0.007 0.994636
`total_flex^5`                                                                  1.06864   91.68306   0.012 0.990700
`Q4_space_typeMultiple buildings in multiple locations.`                       -0.48224    0.85396  -0.565 0.572275
`Q4_space_typeMultiple buildings in one location.`                             -0.57728    1.00702  -0.573 0.566471
`Q4_space_typeMultiple buildings in one location. Specify number of buildings` -4.54980    2.13878  -2.127 0.033396 *
`Q4_space_typeSpace within a building`                                          0.75782    0.93122   0.814 0.415766
`Q5_own_leaseOwn and lease to others`                                           1.10381    0.74321   1.485 0.137494
`Q5_own_leaseOwn and occupy`                                                    2.68438    0.73310   3.662 0.000251 ***
`Q28_facility_settingCentral Business District`                                -0.40013    0.81235  -0.493 0.622323
`Q28_facility_settingIndustrial park`                                           1.41955    1.53080   0.927 0.353760
`Q28_facility_settingRural Area`                                               -0.38437    1.45123  -0.265 0.791117
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`      1.45533    0.93914   1.550 0.121227
`Q28_facility_settingSuburban area`                                             0.41002    0.95310   0.430 0.667051
`Q30_primary_useEducation (Education/Training/Classrooms)`                     -3.22356    1.64706  -1.957 0.050329 .
Q30_primary_useIndustrial                                                      -2.14533    2.08357  -1.030 0.303178
Q30_primary_useJudicial                                                            NA         NA      NA       NA
Q30_primary_useLaboratories                                                    -3.81262    1.95128  -1.954 0.050712 .
Q30_primary_useOffice                                                          -3.23771    1.41057  -2.295 0.021714 *
Q30_primary_useOther                                                           -3.10505    1.49534  -2.076 0.037849 *
four_IndustriesManufacturing                                                    0.01135    0.98383   0.012 0.990797
four_IndustriesServices                                                         1.00453    0.57598   1.744 0.081154 .
flex_area_range.L                                                              -0.36945    0.78814  -0.469 0.639237
flex_area_range.Q                                                               0.61141    0.70642   0.866 0.386762
flex_area_range.C                                                              -0.12280    0.71257  -0.172 0.863181
flex_occupants_range.L                                                          0.14854    0.73930   0.201 0.840759
flex_occupants_range.Q                                                          0.81966    0.63573   1.289 0.197287
flex_occupants_range.C                                                          0.60476    0.53225   1.136 0.255861
flex_age_range.L                                                               -0.98437    1.05044  -0.937 0.348709
flex_age_range.Q                                                               -0.71721    0.87626  -0.818 0.413079
flex_age_range.C                                                               -0.47449    0.67036  -0.708 0.479067
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 285.84  on 214  degrees of freedom
Residual deviance: 137.00  on 171  degrees of freedom
AIC: 225
```

Appendix 1.3: Logistic regression model results for long-term flexible workspace adoption

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	4.9983	606.7797	0.008	0.9934	
Q23_flex_involvement1	-0.3638	0.5529	-0.658	0.5106	
Q24_int_structured_approach1	0.1186	0.7050	0.168	0.8664	
Q24_int_leadership1	0.1844	0.6827	0.270	0.7871	
Q24_int_resources1	1.4605	0.6923	2.110	0.0349	*
Q24_int_clear_understanding1	1.5098	0.7851	1.923	0.0545	.
Q24_int_timescale1	0.7916	0.7222	1.096	0.2730	
Q24_int_workload1	1.4949	0.7701	1.941	0.0522	.
Q24_int_personal_benefits1	-1.5084	0.7494	-2.013	0.0441	*
Q24_int_change_agent1	0.4906	0.7787	0.630	0.5287	
Q24_int_benchmarks1	-0.8558	0.7258	-1.179	0.2384	
Q24_int_communication1	2.0700	0.7592	2.727	0.0064	**
total_flex.L	11.5225	1668.8241	0.007	0.9945	
total_flex.Q	9.9603	1523.4209	0.007	0.9948	
total_flex.C	7.2747	1040.6947	0.007	0.9944	
`total_flex^4`	2.6866	527.7289	0.005	0.9959	
`total_flex^5`	1.8631	175.9105	0.011	0.9915	
`Q4_space_typeMultiple buildings in multiple locations.`	0.7293	0.7567	0.964	0.3351	
`Q4_space_typeMultiple buildings in one location.`	0.3827	0.9954	0.384	0.7007	
`Q4_space_typeMultiple buildings in one location. Specify number of buildings`	-3.1088	1.8238	-1.705	0.0883	.
`Q4_space_typeSpace within a building`	0.8724	0.9539	0.915	0.3604	
`Q5_own_leaseOwn and lease to others`	-0.3497	0.8285	-0.422	0.6729	
`Q5_own_leaseOwn and occupy`	0.8103	0.6229	1.301	0.1933	
`Q28_facility_settingCentral Business District`	-1.2922	0.7980	-1.619	0.1054	
`Q28_facility_settingIndustrial park`	2.5168	1.5520	1.622	0.1049	
`Q28_facility_settingRural Area`	22.4802	1664.2419	0.014	0.9892	
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`	0.9757	0.8580	1.137	0.2554	
`Q28_facility_settingSuburban area`	0.4069	0.8253	0.493	0.6219	
`Q30_primary_useEducation (Education/Training/Classrooms)`	-0.6250	1.3046	-0.479	0.6319	
Q30_primary_useIndustrial	-2.2492	1.5585	-1.443	0.1490	
Q30_primary_useJudicial	NA	NA	NA	NA	
Q30_primary_useLaboratories	14.2110	2484.3438	0.006	0.9954	
Q30_primary_useOffice	0.2012	1.0704	0.188	0.8509	
Q30_primary_useOther	-1.4338	1.1724	-1.223	0.2213	
four_IndustriesManufacturing	-0.2901	0.8838	-0.328	0.7427	
four_IndustriesServices	0.5463	0.6077	0.899	0.3687	
flex_area_range.L	5.4906	348.2193	0.016	0.9874	
flex_area_range.Q	-10.0143	778.6408	-0.013	0.9897	
flex_area_range.C	-13.9103	1044.6561	-0.013	0.9894	
flex_occupants_range.L	-0.8091	0.7584	-1.067	0.2860	
flex_occupants_range.Q	-0.5616	0.6670	-0.842	0.3998	
flex_occupants_range.C	-0.2858	0.5841	-0.489	0.6246	
flex_age_range.L	-1.0121	0.9128	-1.109	0.2675	
flex_age_range.Q	-1.3875	0.8281	-1.675	0.0939	.
flex_age_range.C	-1.2137	0.7021	-1.729	0.0839	.

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 260.08 on 214 degrees of freedom
Residual deviance: 135.10 on 171 degrees of freedom
AIC: 223.1

Number of Fisher Scoring iterations: 17

CHAPTER 2:
STUDY OF EXTERNAL FACTORS IN FACILITY MANAGEMENT ORGANIZATIONAL CHANGE: THE CASE OF COVID-19.

2.1 INTRODUCTION

The operational and maintenance services carried out by facilities management (FM) are necessary to ensure the functionality of a built environment and delivered as an essential part of regular operations. Already a key strategic unit, the FM department becomes even more essential during unprecedented times, with facilities managers leading some of the most critical efforts with respect to risk mitigation, resource optimization, and other deliverables needed to ensure the success of an organization. (Chotipanich, 2004; De Valence, 2004). In North America, the security and emergency preparedness capabilities of FM became a prevalent concern after the terrorist attacks on September 11, 2001 (Cotts, 2010; Davenport, 2004). In the case of any facility emergency, issues concerning the organizational philosophy, coordination, and communication severely impact the emergency response plan (Davenport, 2004). Additionally, the availability of critical facility information in the areas of contacts and utilities, maps and floor plans, communications channels, and previously exercised emergency plans, are considered critical to overcome disaster in a built environment (Davenport, 2004).

The COVID-19 pandemic forced numerous organizations to implement a myriad of workplace changes. For many organizations, the burden of executing the workplace changes and supplying the enabling resources has fallen on FM. In a matter of weeks, facility professionals were charged with implementing new and innovative strategies, aligning internal needs with evolving external policies and regulatory guidelines, among a variety of other unique and urgent deliverables. FMs were tasked with developing socially distant workspaces, increased sanitation protocols, effective wayfinding strategies, optimal space utilization, rapid material procurement

plans, COVID-19 case tracking and response, and more. This study aims to assess the organizational capabilities to successfully implement and adopt the changes required within the workplace during the pandemic. In particular, the researchers investigate FM's role in facilitating the changes associated with transitioning from traditional in-office work environments to novel remote or hybrid-working models.

While relevant past Organizational Change Management (OCM) studies focus on adoption of "planned" changes (e.g., implementation of BIM or other digital software solutions), this study investigates organizational capabilities to successfully respond to "unforeseen" operational changes due to extreme external events (e.g., a worldwide pandemic). Considering the lack of research concerning workplace change adoption strategies across the FM industry, this study helps to provide insights on effective OCM practices in responding to unexpected circumstances.

Research Objective

This study aims to evaluate the organizational readiness to implement change initiatives resulting from unplanned or unforeseen circumstances, through the investigation of OCM practices, organization characteristics, and other moderating factors. This research examined the changes implemented at organizational facilities or workplaces by FM professionals during the COVID-19 pandemic. Through the analysis of extensive dataset collected using the survey-based methodology and assessment of follow-up interviews, this study helps to identify the key factors that had a significant impact on successful change adoption and discusses some of the major challenges faced by FM professionals during the COVID-19 pandemic. The successful implementation of change initiatives was measured and evaluated using the three change

adoption parameters – 1.) overall change adoption, 2.) change benefits achieved, and 3.) long-term or sustainable adoption.

2.2 LITERATURE REVIEW

According to the International Facilities Management Association (IFMA) and British Institute of Facilities Management (BIFM), facilities management (FM) can be defined as "the practice of coordinating the physical workplace with people and work of the organization: it integrates the principles of business administration / architecture /behavior/engineering science" (Pitt and Tucker, 2008). The primary purposes of FM can be divided into two levels, operational and strategic, based on short- and long-term results. Operational FM can be defined as the execution of day-to-day activities to ensure smooth organizational performance; whereas strategic FM can be referred to as the initiatives or policies implemented to effectively manage the organizational assets and portfolio (Barrett, 1995; Nutt, 2002). Historically, FM has been perceived as a cost-centered industry as it does not actively generate any revenue; however, the notion has radically shifted from a cost centric service to a value driven service due to its realignment to support organizational core businesses through cost reduction, space optimization, e-commerce growth, data-driven decision-making, sustainable strategies, advanced technology, among others (Roper, 2014; Chotipanich, 2004; Atkin and Brooks, 2000).

FM and Healthcare Emergency

An epidemic can be defined as a sudden increase in the number of infections than expected within a region, whereas pandemic refers to an epidemic at a larger scale, having an impact on multiple countries or continents (CDC, 2012). A pandemic of varying scale and

severity can occur every 30-40 years (Goldman, 2020). Wide-scale pandemics have historically been a low occurrence emergency scenario. Prior to the COVID-19 Pandemic, the H1N1 pandemic in 2009 claimed 9,820 lives among 47 million infections (Bass et al., 2010). Most pandemic plans relied heavily upon pharmacological interventions, and the literature rarely mentioned countermeasures such as social distancing, isolation, and quarantine. The last time quarantine was used at a national level was almost 100 years ago during the 1918 Influenza pandemic (Gernhart, 1999). As such, many non-healthcare facility emergency management plans may not have fully addressed or prepared for this scenario. While there exists significant literature on disaster preparedness in healthcare facilities, including pandemic preparations, there is limited relevant research on other facility types across different industries (Hollingworth, 2011; Lusby, 2006; Pierce et al., 2017; Garg et al., 2020).

The World Health Organization (WHO) officially declared a pandemic on March 11th, 2020, due to an overwhelming spread of a novel coronavirus causing COVID-19 infections (Goldman, 2020). As the COVID-19 infection continued to spread, organizations across industry types faced extreme challenges to continue their operations due to the impacts on supply chain, building infrastructure, employees' health, and social well-being (Goldman, 2020). The COVID-19 pandemic forced FM professionals to rapidly alter operations for the organizations they serve. Pursuant the guidelines from the Center for Disease Control and Prevention (CDC), the need to implement "work from home practices" (including alternating workdays and shifts with essential staff), and the overall uncertainty associated with the pandemic put tremendous pressure on facility managers to ensure their organization's ability to meet business or stakeholder obligations (Goldman, 2020). Some of the major risk factors addressed by facility managers during the pandemic included higher concentrations of workforce in a building, employee safety

in open workspaces, communication in multi-tenant occupied facilities, improved HVAC systems, sanitation, among others (Goldman, 2020).

It is a widely known fact within FM that emergencies can occur at any time, however, proactive planning and preparation is the key to effective risk mitigation that can differentiate minor incidents from major emergencies (Cotts, 2010). In the case of a pandemic, advanced preparation of strategies, policies, and procedures can assist facility managers to successfully implement, manage, and communicate the changes adopted as a part of the response plan to overcome some of the commonly identified challenges (Goldman, 2020).

Figure 2.1 summarizes the recommended strategies into four major action items and assists facility managers at the onset of an emergency (Cotts, 2010). The first step requires the development of a response team, as well as the identification of a leader, where the team is composed of individuals with diverse skill sets and from different backgrounds (e.g., human resources, legal counsel, financial affairs, information technology, others). Secondly, a strategic plan must be developed that consists of key objectives, common risks, duties of team members, and key milestones to track progress. Thirdly, the team should assess the availability of internal, external, and financial resources at their disposal to execute the developed strategies. Finally, the response strategies should be re-evaluated and modified based on the consultation of an expert in the field, as needed (Cotts, 2010).

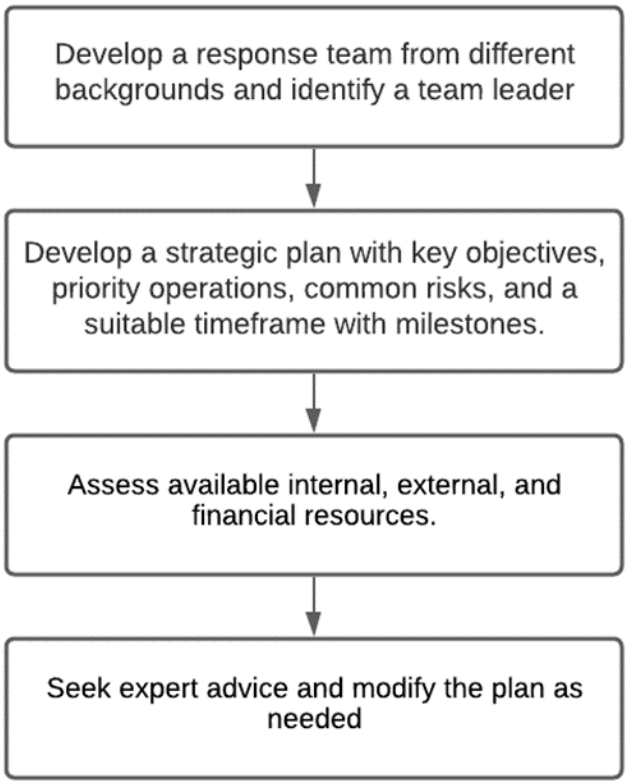

Figure 2.1: Summarized response plan for facility managers amid emergency, (adopted from Goldman, 2020)

Organizational Change Management within FM

As the FM industry continues to evolve, facility managers are more involved in the leadership and strategy development roles for FM activities related to project management, operations and maintenance, finance and business, and space management (Roper, 2014). Among these leadership roles, facility managers are primarily responsible to provide guidance to staff or service providers as well as act as mediator to communicate the positive and negative impacts of major changes to senior leadership within the organization (Cotts, 2010). To successfully implement new strategies and perform leadership duties in a rapidly changing environment, facility managers should adopt a structured change management approach. Within

the FM context, change management can be defined as “a process that involves defining, refining, and implementing plans for changes” (IFMA, 2013).

Best Practices within OCM

Lines (2017) and Maali (2020) derived seven key OCM practices using the academic literature from AEC and organizational behavior fields to assist organizations with successful implementation of change initiatives in an interdisciplinary environment. Based on the recommendations from various researchers, these seven key OCM practices focused on leadership, training resources, communication, timeframe, change agent, benchmarks, and workload adjustments. Figure 2.2 illustrates the key seven OCM practices and three change adoption measures utilized to study the successful implementation of a technology in the AEC industry.

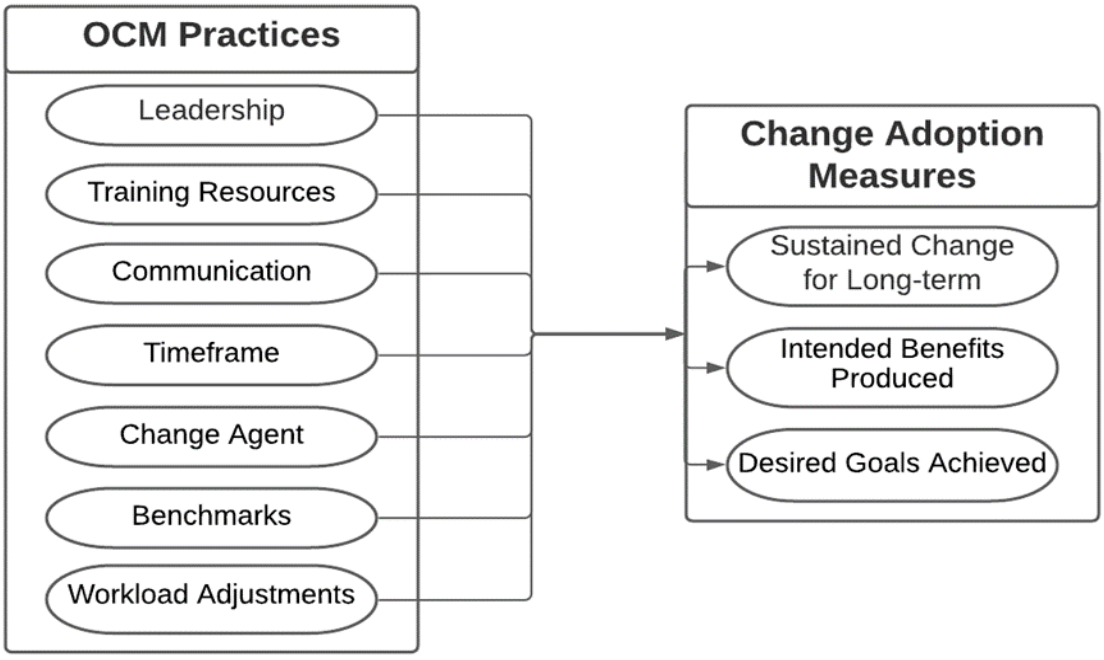

Figure 2.2: Key OCM practices and change adoption measures, adopted from Maali (2020) and Lines (2017)

In an organization, leadership refers to senior management or executives responsible to make major decisions. Researchers recommend that leadership should be actively involved in the OCM process, responsible for communicating the need and appropriateness of the desired changes and engaging with employees to ensure successful adoption (Beer and Eiesentat, 1996; Armenakis et al, 1999). The early involvement of leadership in the OCM process can mitigate the risk of change resistance or obstruction by the employees (Liao et al. 2018). In developing countries, active involvement of senior leadership has been proven as the key to successful change implementation (Ozorhon and Karahan, 2017). While several studies have demonstrated the positive effect of training resources on successful change adoption (Peansupap and Walker, 2006), Alvesson (2002) found that the lack of appropriate training resources can be a critical factor of a failed change initiative. Additionally, impractical timelines and unrealistic expectations can often lead to change resistance and harm the legitimacy of the OCM effort (Smollan, 2011). Through clear communication of benefits and drawbacks of the implemented change or changes, organizations can mitigate change resistance and achieve higher motivation among employees to pursue such change (Bourn et al., 2002; Arayici et al., 2011).

According to Wolpert (2010), change agents (also known as "internal champions of the change") play the most critical role in leading and guiding the change management process. For successful change adoption, organizations should assemble a change committee / team that governs the OCM process prior, during, and post implementation of the change (Cameron and Green, 2012; Covin and Kilman, 1990). Furthermore, Ahn et al. (2016) recommends developing an independent department within an organization to monitor the objectives of the implemented change(s) for improved results. To achieve a steady momentum during the OCM process, organizations must identify short- and long-term milestones to monitor the change progress

(Lines, 2017). Finally, organizations should consider employee workload adjustments in the OCM process to account for the time invested by employees to recognize and adapt to the change(s) (Maali et al., 2020; Peansupap and Walker, 2006). Through reduced workloads, organizations can significantly boost their employee morale towards change and achieve higher commitment during the OCM training phase (Smollan, 2011).

The change adoption period is commonly referred to as the phase following the implementation of change, which has the highest risk of change initiative failure due to the associated uncertainties (Smith et. al., 2014). Change agents or managers should study the performance of change adoption through assessment of benefits achieved, outcome as intended, leadership commitment, employee reaction, among others (Smith et. al., 2014). To study the impact of OCM practices on successful change adoption, Maali (2020) and Lines (2017) recorded change managers' feedback against three parameters, such as desired organizational goals, employee benefits achieved, and attained long-term sustainability, as shown in Figure 8. While the achievement of desired organizational goals and employee benefits were recorded using the initial expectations with the change initiative, the long-term sustainability of implemented change was based on three or more years of time (Maali, 2020; Lines, 2017).

2.3 RESEARCH METHODOLOGY

This study follows a survey-based methodology to collect data and, based on the recorded responses, conduct follow-up interviews with a few selected participants. Through an extensive literature review and discussion with Subject Matter Experts (SMEs), a robust survey questionnaire was developed to collect details on organizational characteristics, facility demographics, unplanned change events, utilized OCM strategies, and change adoption

successes. The survey primarily focused on unplanned change initiatives within the FM industry that were implemented as a response to the COVID-19 pandemic. Some of the common change initiatives studied through this research include modification of facility operations, transition from traditional ways of working to remote or hybrid working models, implementation of safety protocols (e.g., social distancing, sanitation, etc.), among others. Using the Qualtrics platform, the survey was distributed to approximately 2,400 FM professionals throughout the world and a total of 892 responses were collected, reflecting a response rate of 36%. A follow-up interview was conducted with 30 FM professionals, who either championed or struggled with the change implementation process, to learn more about their experiences. Each interview lasted for approximately 30 minutes with a total of 15 hours of conversation reported in this study. The data acquired through the survey questionnaire was collected from March 2021 to April 2021, with follow-up interviews conducted throughout May 2021.

Data Description

The final dataset included information on 22 different parameters from almost 900 organizations. The 22 parameters could be categorized into three distinct groups based on the type of information collected, and grouped according to organizational characteristics, OCM practices, and change adoption measures. The organizational characteristics included details on the physical portfolio (e.g., size, occupants, etc.), facility demographics (e.g., industry, use, location, etc.), and individual backgrounds. The OCM practices and change adoption measures collected information on the strategies utilized to implement the changes and the expected outcome on successful implementation. While the OCM practices and change adoption parameters were recorded on an ordinal scale of 1 to 7, with 2 representing strong disagreement

and 7 representing strong agreement, these parameters were converted to a binary scale to address the skewness in the data (James, 2013). Organizations that recorded a rating of 6 or above were considered as the higher agreement group, whereas ratings of 5 or less were treated as the lower agreement group. Overall, approximately 70% of the organizations were within the higher agreement group, and the remaining 30% fell into the lower agreement group.

2.4 DATA ANALYSIS AND RESULTS

This section includes the descriptive and statistical analysis of the available data to provide an overview of the collected information and explore key relationships among key performance indicators. Most of the charts within the descriptive analysis were developed using Microsoft Excel, Tableau, and RStudio. The statistical analysis was performed using only the RStudio platform. The research team used random forest (i.e., a machine learning algorithm) and logistic regression analysis methods to examine the impact of various organizational characteristics and OCM practices on the three change adoption measures. While the purpose of both the analysis methods were same, the results were mainly reported using the random forest method due its superior performance, and logistic regression helped to validate the findings. Finally, the findings of follow-up interviews were also reported using a table.

Descriptive Analysis

The dataset collected for this study represented over 800 organizations from more than 60 countries with details on various strategies adopted by FM professionals to implement changes in response to the COVID-19 pandemic. Considering most of the responses (~ 75%) were recorded from North America and the disparate impacts of COVID-19 on different nations, the analysis

was mainly performed on the data collected from the North American region. Figures 2.3 and 2.4 provide a breakdown of the responses collected based on the facility size in terms of facility area and number of daily occupants. As shown in Figures 2.3 and 2.4, almost half of the total data accounts for facilities with less than 50,000 square feet of area and 100 to 500 daily occupants.

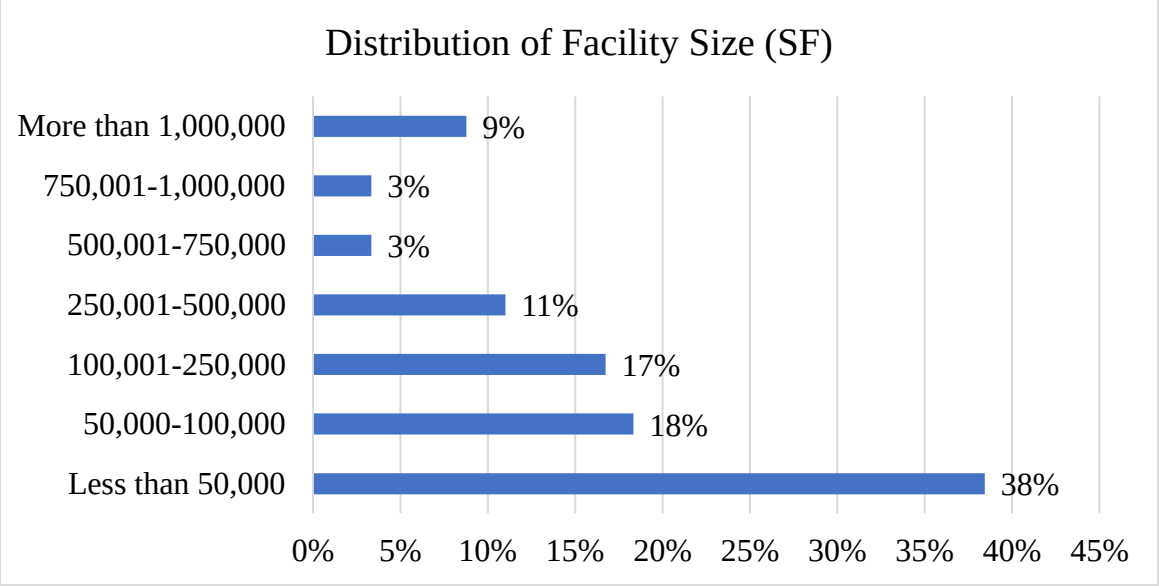

Figure 2.3: Number of responses based on the facility size (square feet)

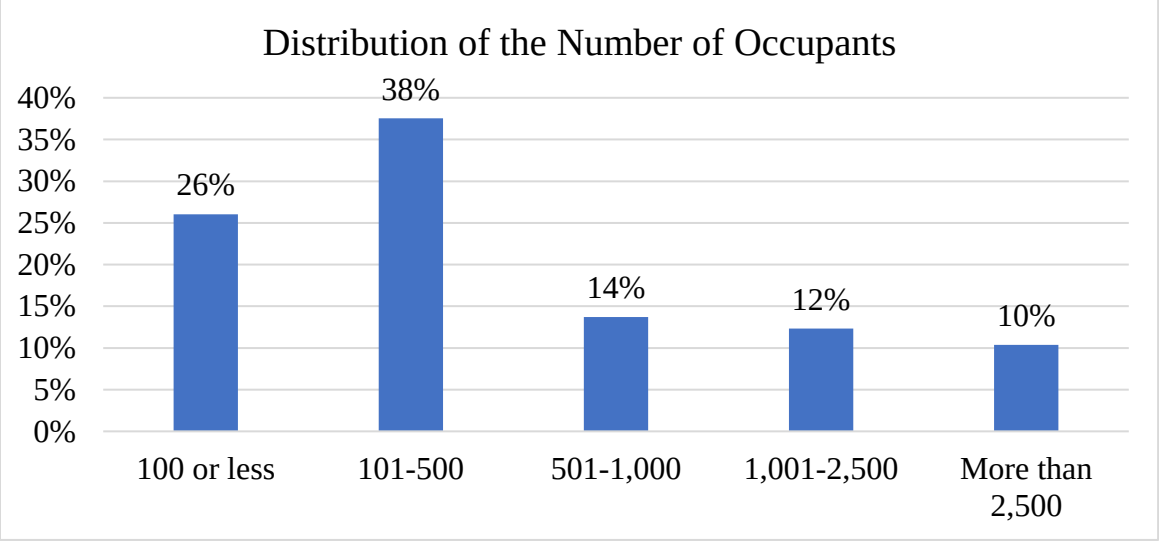

Figure 2.4: Number of responses based on the number of facility occupants

Figures 2.5 and 2.6 provide a distribution of the collected data based on the primary use of the reported facility, as well as the industry served. As shown in Figures 2.5 and 2.6, the collected data primarily consists of facilities used as office space, with equal representation in institutional and services industry types. Here, the "institutional" sector includes government, educational, religious, or association sectors and the "services" sector includes industries such as banking, healthcare, IT, real estate, and other services sectors.

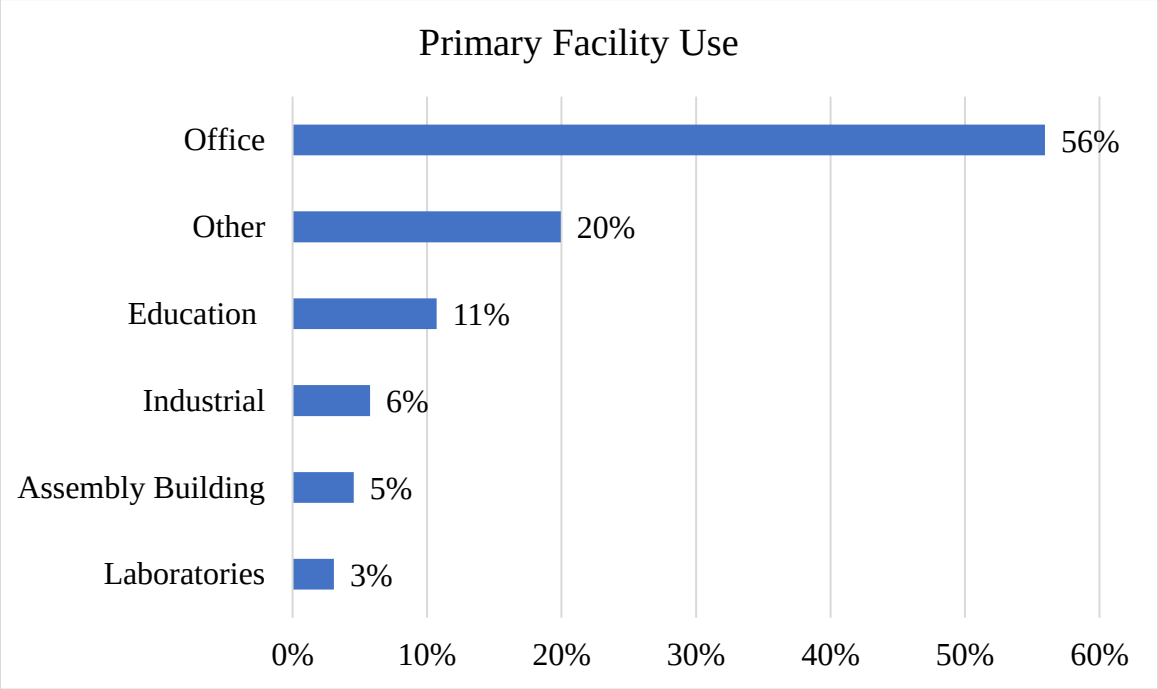

Figure 2.5: Distribution of the responses based on the primary use of the facility

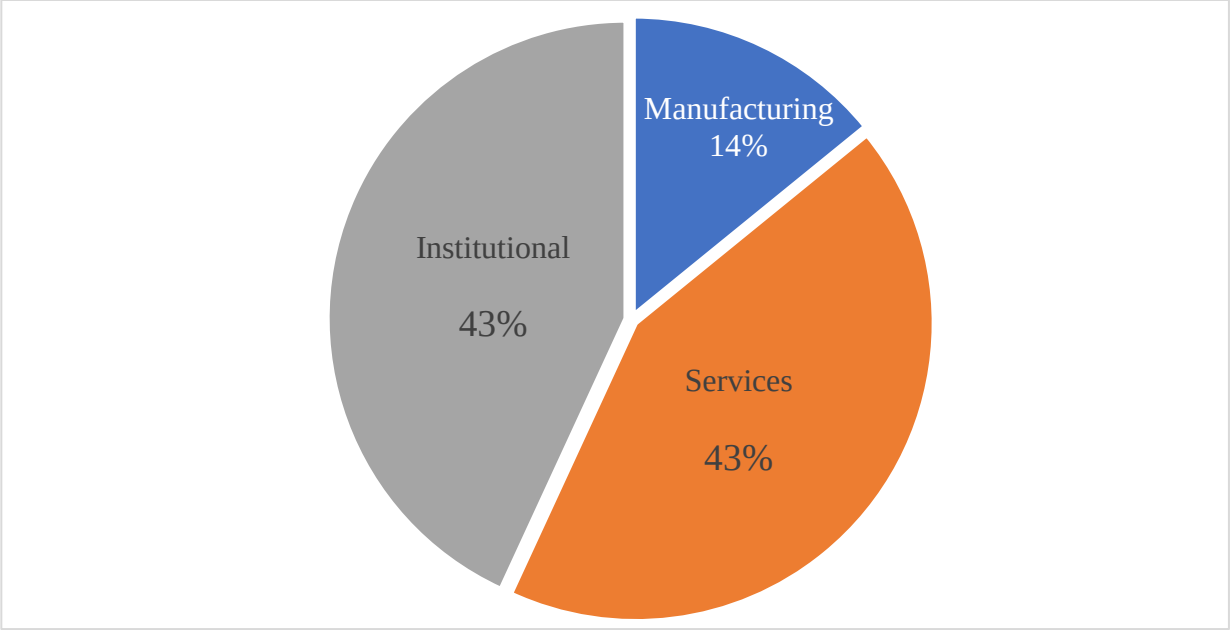

Figure 2.6: Distribution of the responses based on the industry served

During the COVID-19 pandemic, most organizations had to implement various changes to comply with healthcare guidelines and ensure employee safety. This study investigates four major changes implemented within the FM industry due to the COVID-19 pandemic (i.e., safety protocols, remote working, hybrid working, and facility operations). These changes were identified with the help of Subject Matter Experts (SMEs) within the FM industry. As shown in Figure 2.7, the transition from traditional ways of working to a hybrid working model (i.e., a mix of virtual and physical) was the most significant change event reported by FM professionals. It was followed by the implementation of the safety protocols and transition from traditional to remote working. Meanwhile, only a small number of FM professionals indicated that the modification in facility operations was the most significant change due to COVID-19.

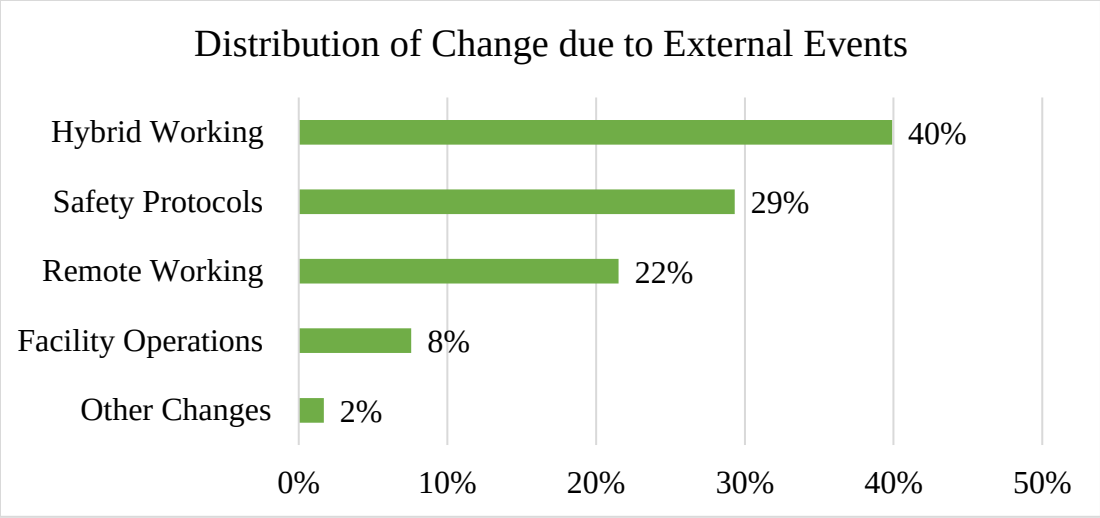

Figure 2.7: Distribution of the change implemented due to COVID-19

Figures 2.8 and 2.9 provide feedback on the change implemented during the COVID-19 pandemic through employee reaction and the three change adoption measures. Figure 2.8 illustrates the employee reaction to the change based on change leaders' perceptions, where most employees demonstrated a positive reaction, reporting almost 80% active cooperation by their employees.

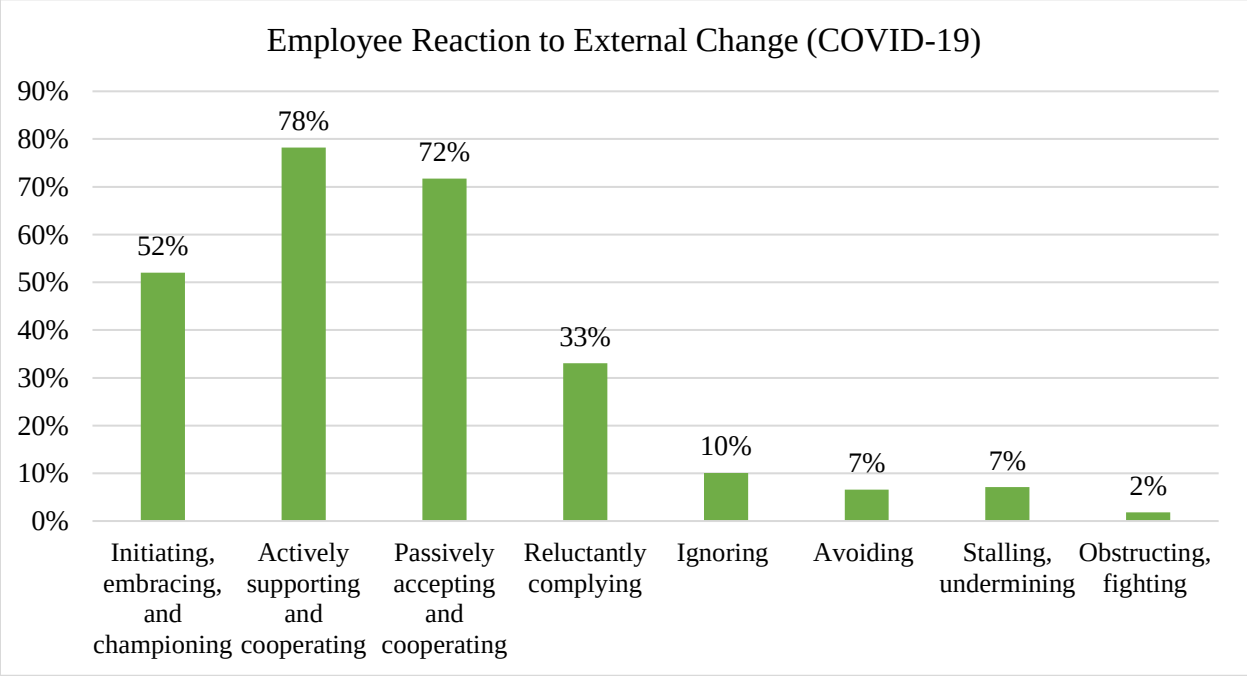

Figure 2.8: Distribution of employee reaction to the change event

As shown in Figure 2.9, the success with change adoption was higher as well as consistent among all three change adoption measures, such as overall adoption success, achievement of intended benefits, and long-term adoption. For easier classification, organizations with a strong agreement (i.e., agree and strongly agree responses) were classified as highly successful with change adoption, whereas the remaining organizations were classified as less successful. While the successful change adoption among the three measures was consistent (approximately 70%), the statistical analysis was critical to identify distinct factors responsible for successful or unsuccessful change adoption within each measure.

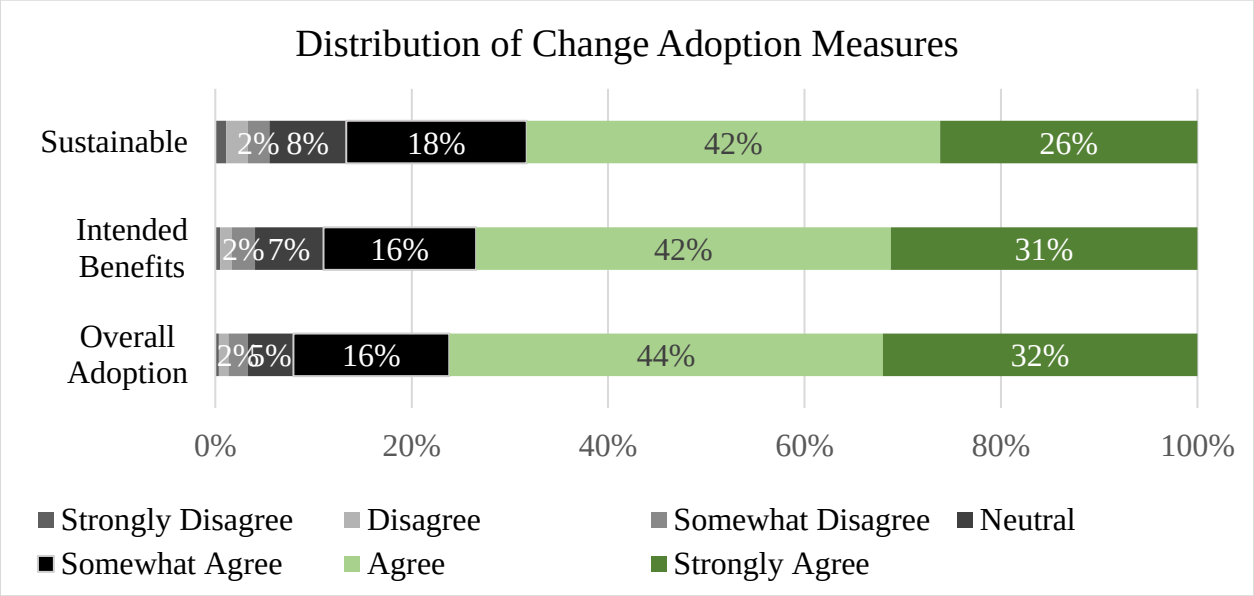

Figure 2.9: Distribution of the responses based on the primary use of the facility

Statistical Analysis

The research team used sophisticated analysis techniques like random forest model (i.e., a machine learning algorithm) and logistic regression to further examine the relationship between the data available on various factors and the change adoption measures. Three logistic regression models and three random forest models were developed for each change adoption measure (i.e.,

overall change adoption, change benefits achieved, and long-term change adoption). Considering the objective of the analysis and data type of outcome parameter, these analysis methods were selected. The random forest model helped to identify the top governing factors that drive the change adoption measures, whereas the logistic regression method helped to identify the relationship between the top factors and the outcome parameters.

As noted previously, random forest model is the most commonly used classification analysis method. Since the final model is a combination of multiple decision tree models, this method tends to perform much better than other classification analysis techniques like K-Nearest Neighbors (KNN), Linear Discriminant Analysis (LDA), logistic regression, among others (James, 2013). The random forest method allows the user to select any number of trees to develop the final model, and its ability to randomly select different sets of variables to create each decision tree makes it a highly robust and sophisticated method. This technique to randomly select data with replacement for each decision tree, also known as the bootstrapping technique, helps to overcome common data analysis issues like collinearity and bias. However, the random forest model struggles with the interpretation of the results like other machine learning algorithms. Logistic regression is another popular classification method, which uses sigmoid curves to classify an observation based on the calculated probability. While it is easier to interpret the findings of logistic regression, the model lacks in performance and struggles with collinearity and missing values (James, 2013).

After completing the data cleaning process, a total of 832 records were available to train and test the statistical models. Both the models, random forest and logistic regression, were developed using the randomly selected 70% of the available data and tested or validated using the remaining 30% of the data. A total of six statistical models, three logistic regression and three

random forests, were created for each change adoption measure as an outcome parameter. For a random forest model, a combination of 1,000 decision trees (ntree) and optimum number of randomly selected parameters (mtry) was calculated to prepare each model. The results from the random forest model helped to identify and rank the importance of top parameters responsible for differentiating successful organizations from others based on the three change adoption measures. Logistic regression helped to validate the findings and determine the relationship between the top parameters and the outcome measure. Table 2.1 provides a breakdown of all the parameters along with their levels (i.e., number of categories) that were used in the statistical analysis.

Table 2.1: Breakdown of data used for statistical analysis

Sr No	Parameter	Levels	Data Type
1	Change Agent	2 levels	Binary
2	Structured Approach	2 levels	Binary
3	Workload Adjustment	2 levels	Binary
4	Communication	2 levels	Binary
5	Timescale	2 levels	Binary
6	Personal Benefits	2 levels	Binary
7	Clear Understanding	2 levels	Binary
8	Leadership Support	2 levels	Binary
9	Resource Availability	2 levels	Binary
10	Involvement	5 levels	Ordinal
11	Major Change	5 levels	Nominal
12	Overall Adoption (outcome)	2 levels	Binary
13	Benefits Achieved (outcome)	2 levels	Binary
14	Long-term Adoption (outcome)	2 levels	Binary
15	Space Type	5 levels	Nominal
16	Own vs Leased	3 levels	Nominal
17	Facility Location	6 levels	Nominal
18	Facility Use	7 levels	Nominal
19	Occupants	5 levels	Nominal
20	Area	7 levels	Nominal
21	Industry Served	3 levels	Nominal

Discussion of Results

The first statistical analysis was conducted to identify and examine the relationship of most significant parameters that were responsible for overall change adoption during the COVID-19 pandemic. For this analysis, random forest and logistic regression models were developed with the overall adoption as the dependent or outcome parameter. Table 2.2 summarizes the results of the first random forest model (Model 1), where the top 15 factors (out of 47) are ranked in the order of their importance and helped to classify organizations with successful overall change adoption from the others that struggled with successful change adoption. As shown in Table 2.3, the first model recorded an exceptional predictive accuracy of 86.02% based on 30% of the test data and was statistically significant with a P-Value of less than 0.001. In other words, Model 1 was able to correctly classify 86% of the 236 organizations between the two categories of the overall change adoption (i.e., yes or no).

As shown in Table 2.2, nine out of the top 15 parameters represented the OCM practices used in this study, where the appointment of a change agent to lead the change implementation process was the most significant factor toward the accurate prediction of change adoption success. This was followed by the support of senior leadership and the timescale or speed of the change implementation process. Other factors like the availability of adequate resources or financial support and having the knowledge of personal benefits gained from the change were among the top five factors. In addition to the OCM practices, some of the organizational characteristics also had a significant effect on the accurate classification of the outcome parameter. In particular, the primary use of the facility was the most dominant factor, with judicial, educational, or other unidentified use facilities being among the top 15 factors. Other factors like the number of daily occupants and the leasing model were also listed among the top

factors, where the number of daily occupants were between 500 and 1,000 and facilities were owned but leased to others.

While the random forest model was critical to identify the top governing factors needed to accurately classify the outcome parameter (a successful organization change effort), the relationship between the outcome parameter and the governing factors was determined using the logistic regression results (see Appendix 1). Based on the results from the logistic regression analysis, a clear understanding of the necessary steps to implement the change was the only OCM practice that had a negative impact on successful overall change adoption. In other words, organizations did not have a clear understanding of the necessary steps to implement unplanned changes at facilities during the COVID-19 pandemic. Among the organizational characteristics, facilities with an occupancy count between 500 and 1,000 struggled with successful change adoption, as compared to organizations with more than 2,500 daily occupants.

Table 2.2: Random Forest model results (top 15 of 44 factors)

	Model 1: Overall Change Adoption		**Model 2: Change Benefits Achieved**		**Model 3: Long-term Change Adoption**	
#	**Parameters**	**Importance**	**Parameters**	**Importance**	**Parameters**	**Importance**
1	Change Agent	100	Change Agent	100	Change Agent	100
2	Leadership Support	92	Leadership Support	83	Structured Approach	83
3	Timescale	87	Personal Benefits	55	Workload Adjustment	55
4	Resource Availability	82	Timescale	54	Communication	54
5	Personal Benefits	68	Resource Availability	52	Timescale	52
6	Communication	64	Structured Approach	48	Personal Benefits	48
7	Structured Approach	51	Workload Adjustment	48	Clear Understanding	48
8	Clear Understanding	36	Clear Understanding	45	Leadership Support	45
9	Workload Adjustment	32	Communication	41	Resource Availability	41
10	Involvement: Little	28	FM Involvement	37	Industry: Services	37
11	Facility Use: Judicial	26	Facility Use: Laboratories	27	Owned & leased	27
12	Facility Use: Other Use	25	Positive Employee Reaction	20	Multiple Buildings	20
13	Facility Use: Education	23	Occupants: 500-1,000	17	Positive Employee Reaction	17

14	Occupants: 500-1,000	23	Facility Use: Education	15	Change: Other	15
15	Owned and leased	22	Multiple Buildings	15	Change: Facility Operations	15

Table 2.3: Random Forest models performance statistics

	Model 1	**Model 2**	**Model 3**
Accuracy	82.20%	79.66%	77.97%
95% CI	76.72%, 86.86%	73.95%, 84.61%	72.13%, 83.08%
P-Value	0.0172	0.0292	0.0009

The second analysis was performed to identify organizational features and OCM practices that had a significant impact on achieving the intended benefits or performance gains from the change implemented during the COVID-19 pandemic. The second analysis method was like the first analysis, where random forest and logistic regression models were developed to identify and determine the relationship of significant factors based on a measure of the change benefits achieved. Table 2.2 shows the results of the second random forest model (Model 2) and Table 2.3 provides the performance details of Model 2. As shown in Table 2.3, Model 2 was statistically significant with a P-Value of 0.029 and a predictive accuracy of approximately 80%. Table 2.2 lists the top 15 factors that helped to distinguish successful organizations from others, based on the achievement of intended benefits or performance gains from the implemented change.

The results showed that nine out of the top 15 parameters accounted for the OCM practices used in this study, where a dedicated individual to lead the change effort was the most important factor to achieve the intended change benefits. Other critical OCM parameters included the support of leadership and leadership's ability to communicate how the change would benefit everyone at a personal level during the implementation process. In addition to the OCM practices, the involvement of FM professionals was important to predict the outcome of

change benefits achieved. Among the organizational characteristics, parameters like facility use and number of occupants had a significant impact on the outcome parameter in Model 2.

Based on the results of the logistic regression model (Appendix 2.2), it can be inferred that all OCM practices had a positive impact on the achievement of intended benefits from the unplanned change. While most of the organizational characteristics identified in Table 2.2 showed a positive impact on the change benefits measure, the organizations with multiple buildings showed a negative impact on the outcome parameter, as compared to a single building.

The third analysis was focused on the long-term adoption of the change implemented due to the COVID-19 pandemic. Similar to previous analyses in this study, random forest and logistic regression models were developed to identify the most significant factors governing long-term change adoption. The third random forest model (Model 3) was statistically significant, with a P-Value of 0.0009 and recorded a predictive accuracy of 77.97%, as shown in Table 2.3. Based on the results (Table 2.2), the appointment of a change agent was the most important parameter to classify organizations based on the long-term change adoption as compared to others. In contrast to the other two change adoption measures, long-term change adoption was strongly impacted by the structured change management approach, workload adjustments, and effective communication about the change details during the implementation phase. In addition to the OCM practices, the leasing model and type of the unplanned change were among the most important parameters for determining the success of long-term change adoption.

Based on the results of the logistic regression model (Appendix 2.3), all 9 OCM practices had a positive impact on long-term change adoption, with the structured approach being the most significant parameter. Among the organizational characteristics, the organizations that owned the

facilities but leased to others struggled to sustain the change, as compared to organizations that only leased facilities. Additionally, organizations within the services industry were most successful with the long-term change adoption; however, changes associated with modifying facility operations were least likely to be adopted in the long-term, as compared to other change initiatives.

Follow-up Interview Results

Tables 2.4 and 2.5 help to synthesize a total of 28 follow-up interviews with organizational leaders based on the change experienced, challenges faced, opportunities identified, and other unique details associated with the OCM process. Table 2.4 includes details of organizations that had a positive experience with the change implementation process, whereas Table 2.5 highlights experiences of organizations that struggled with the change implementation process. As shown in Table 2.4 and 2.5, the feedback from each interview was summarized based on the most significant change experienced during the COVID-19 pandemic, where "#" indicated the interview number in the chronological order. The "Challenges" column identified the most significant shortcomings faced by each organization during the change implementation phase, whereas "Opportunities" column summarized the key factors that helped with successful change implementation. Finally, some of the unique strategies, future steps, or critical factors that had a significant impact on the outcome of change implementation process were summarized in the "Other Comments" column. The results in Tables 2.4 and 2.5 are summarized based on each interview and therefore may have repeated comments.

Table 2.4: Summary of OCM follow-up interviews for positive change experience

Change	#	Challenges	Opportunities	Other Comments
Implement Safety Protocols	1	Compliance to guidelines Misinformation	Active communication Leadership support	Advanced sanitation 50% occupancy reduction
	4	Lack of guidance Employee well-being	Positive relationship Knowledge sharing	Advanced sanitation Contact tracing & isolation
	6	PPE procurement issues	Active communication	Advanced sanitation
	8	N.A.	Supported home-office setup $1,500 incentives Active communication High transparency	Advanced sanitation Training provided Robust planning helped
	9	Misinformation Move to remote working	Dedicated response team Active communication	Supported home-office Advanced sanitation
	10	Lack of guidance PPE procurement Employee training Inefficient strategies	Active testing & isolation Supported home-office setup Leadership support Active communication	
	15	PPE procurement issues Information management	Crisis management team Active communication Leadership support	Health & safety website Advanced sanitation 50% occupancy reduction
	20	Employee engagement Move to remote working	CDC guidelines Change management team Contingency plan	Seek external expertise Focused on mental health
	25	PPE procurement issues Labor shortage Remote working transition	Dedicated response team Active communication Developed master plan	Health & safety website Transparent approach
	26	Limited financial support	IFMA guidelines	Advanced sanitation
	28	Compliance to guidelines	CDC guidelines Active communication Leadership support	Collaboration was critical
	29	Unrealistic timeline Misinformation	Leadership support Supported home-office setup Risk management plan	Plan for sudden changes
	30	External expertise failed Compliance to guidelines Poor reaction time	Feasible timeline	Future: hybrid working
Modify Facility Operations	2	Technology for older generation	Improved workplace reservation system Supported home-office setup Technology driven	Prior remote work experience helped 75% occupancy reduction
	31	Limited financial support Employee well-being	Supported home-office setup Prior change experience	80% occupancy reduction Future: remote working
Transition to Remote Working	13	Poor communication Manage offices globally	Supported home-office setup Active communication Crisis management team	Active contact tracing Survey based strategy Consulted firms for budget
	23	Government policies	Employee training Active communication	Employee well-being 2022 reopening estimated
Implement Hybrid Working Model	12	Sudden facility shutdown Compliance to tools	Supported home-office setup Developed office hubs Change management team Pro-active approach	Health & safety app Improved performance 50% occupancy reduction

Change	#	Challenges	Opportunities	Other Comments
Implement Hybrid Working Model	14	Employee training Employee well-being Poor communication Government policies	Supported home-office setup Active communication High transparency	Assigned happiness officer Enhanced air quality 85% occupancy reduction
	16	Information management Change management	Robust planning Dedicated response team Employee training Supported home-office setup	$1000 incentives Regular feedback collected Workplace data analytics Move to hoteling
	21	Employee well-being Information management	Leadership support Active communication Increased performance	Health & safety app 60% portfolio reduction Receptive Youngsters
	24	Information management Misinformation No contingency plan	Feasible timeline Leadership support	Regular feedback collected
	32	No home- office setup PPE procurement issues Poor space management	WHO guidelines Active communication Employee training	40% occupancy reduction Future: Reduce portfolio

Table 2.5: Summary of OCM follow-up interviews for negative change experience

Change	#	Challenges	Opportunities	Other Comments
Implement Safety Protocols	22	Compliance to guidelines Poor communication Diverse workforce Misinformation Labor shortage	IFMA guidelines Relationship with stakeholders	Old workforce stayed home
Transition to Remote Working	5	Traditional working culture change timeline (72 hours)	Consistent guidelines Innovative technology use	Future: moving to flexible workspace
	11	Poor communication Unrealistic timeline Unsupportive leadership PPE procurement issues	Guidelines from local agency Relationship with stakeholders	
Implement Hybrid Working Model	7	Poor leadership Unrealistic timeline Poor communication Delayed response No home- office setup provided	IFMA guidelines	Future: 10% occupancy reduction
	17	Poor communication Unsupportive leadership No decision-making authority Limited financial support	Supported home-office setup Prioritized employee well-being IFMA & CDC guidelines	Future: back to in-person working

The findings of the follow-up interviews, summarized in Tables 2.4 and 2.5, were consistent with the findings of the statistical analysis. Some of the commonly identified factors included streamlined communication, leadership support, a dedicated team, and realistic timelines, and some of the most significant factors toward successfully delivering the change. Some of the unique strategies utilized by organizations to champion the change included guidance from external expertise, home-office setups, financial incentives, employee well-being initiatives, technology support, among others. Meanwhile, most of the organizations that struggled to manage the change faced challenges in the areas of leadership, communication, timeline, misinformation, resource procurement, to name a few. Other unique challenges identified through the follow-up interviews included employee compliance with new guidelines, follow inefficient strategies, traditional culture, mental health, etc. Overall, organizational leaders believed that changes associated with the workplace were sustainable, however the changes associated with safety protocols or facility operations would be temporary. In addition, most of the organizations that had a positive experience with the remote or hybrid working model aimed to reduce their physical portfolio.

In summary, organizations are recommended to follow a formal change management approach to successfully implement unplanned change initiatives, where appointment of change agent to lead the change effort, active involvement and support of senior leadership, and speed or timescale of the change implementation process should be given significant attention. In addition, organizations should be conscious of the primary use of their facility when subjected to an unplanned change, where the successful outcome of an unplanned change initiative can vary based on the facility use.

2.5 CONCLUSION

During the COVID-19 pandemic, FM professionals served at the forefront of their respective organizations, responsible for implementing numerous unexpected changes while ensuring the continued functionality of their organization. This study evaluated the impact of organizational change management practices, change details, and organizational characteristics against the outcome of an unplanned change initiative. Some of the most significant change scenarios investigated through this study involved the implementation of safety protocols, modification in facility operations, and transitions to remote or hybrid working model. The outcome of the change implementation process was measured using three factors - overall adoption, benefits achieved, and long-term adoption. Through an extensive survey, the feedback on change implementation process was collected from a total of 892 FM professional, worldwide. Additionally, 32 follow-up interviews were conducted with the organizational leaders that either championed or struggled with the change implementation.

Using a machine learning algorithm, three random forest models were developed to identify the significant factors responsible for predicting the outcome for each change adoption measure. In addition, three logistic regression models were created to determine the relationship between the significant factors identified through random forest model and the change adoption measures. All three random forest models were statistically significant at a 95% confidence level and recorded an accuracy of approximately 80%. Based on the results, almost all nine OCM practices had the most significant and positive impact on the successful outcome of all three change adoption measures. This indicates the importance of the change management process on the successful implementation of the change initiative, irrespective of the expected outcome.

While all nine OCM practices were important, some of the critical strategies that drove the success included appointment of an individual to lead the change, support of leadership, and the timescale or speed of the change implementation process. For overall adoption and achievement of benefits, the facilities primarily used for educational or laboratory purposes had a positive impact. Meanwhile, the type of unplanned change initiative as a response to the COVID-19 pandemic had a significant impact on long-term adoption. The results of the statistical analyses were corroborated by the findings from the follow-up interviews, where leadership support, active communication, and realistic timelines were some of the key factors of successful change implementation.

Finally, this study helps to reestablish the significance of an organized and coordinated change management process at the time of crisis. While the importance of the identified OCM strategies vary based on the desired outcome, they remain the most substantial attributes toward successfully implementing change. Through a structured change management approach, FM professionals can increase the likelihood of successful change implementation, even where the circumstances of such change are not typically foreseeable.

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2.7 APPENDICES

2.1: Logistic regression model results for overall change adoption

```
Coefficients:
                                                                                  Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                     -2.675763   1.204835  -2.221  0.02636 *
`Q7_ext_changeModifications in Facility Operations & Maintenance Activities`     0.207866   0.753996   0.276  0.78279
`Q7_ext_changeOther:`                                                           -0.146934   1.097940  -0.134  0.89354
`Q7_ext_changeTransition to Hybrid Working Model (mix of virtual and physical)` -0.578540   0.363267  -1.593  0.11125
`Q7_ext_changeTransition to Remote Working Model (100% virtual)`                 0.178891   0.470522   0.380  0.70380
Q8_involvement.L                                                                 1.108344   0.491521   2.255  0.02414 *
Q8_involvement.Q                                                                -0.178068   0.442648  -0.402  0.68748
Q8_involvement.C                                                                 0.004057   0.406432   0.010  0.99204
`Q8_involvement^4`                                                               0.030075   0.356152   0.084  0.93270
Q9_1_ext_structured_approach1                                                    0.453638   0.350711   1.293  0.19584
Q9_2_ext_resources1                                                              0.521468   0.323682   1.611  0.10717
Q9_3_ext_leadership1                                                             0.891532   0.371481   2.400  0.01640 *
Q9_4_ext_clear_understanding1                                                   -0.641415   0.363607  -1.764  0.07773 .
Q9_5_ext_timescale1                                                              0.954597   0.329589   2.896  0.00378 **
Q9_6_ext_workload_adjustment1                                                    0.283626   0.351467   0.807  0.41968
Q9_7_ext_personal_benefits1                                                      0.949756   0.336335   2.824  0.00475 **
Q9_8_ext_change_agent1                                                           1.398105   0.351809   3.974 7.07e-05 ***
Q9_9_ext_communication1                                                          0.860843   0.337512   2.551  0.01076 *
ext_reactionpositive                                                             0.036443   0.310856   0.117  0.90667
`Q4_space_typeMultiple buildings in multiple locations.`                        -0.993458   0.513988  -1.933  0.05326 .
`Q4_space_typeMultiple buildings in one location.`                              -1.383942   0.587388  -2.356  0.01847 *
`Q4_space_typeMultiple buildings in one location. Specify number of buildings`  -1.671699   1.018756  -1.641  0.10081
`Q4_space_typeSpace within a building`                                          -1.354024   0.624038  -2.170  0.03002 *
`Q5_own_leaseOwn and lease to others`                                           -1.285744   0.504861  -2.547  0.01087 *
`Q5_own_leaseOwn and occupy`                                                    -0.470771   0.412047  -1.143  0.25324
`Q28_facility_settingCentral Business District`                                  0.285123   0.465827   0.612  0.54049
`Q28_facility_settingIndustrial park`                                            0.520221   0.730044   0.713  0.47610
`Q28_facility_settingRural Area`                                                 0.940260   0.966674   0.973  0.33071
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`       0.561324   0.535734   1.048  0.29475
`Q28_facility_settingSuburban area`                                              1.251031   0.562894   2.222  0.02625 *
`Q30_primary_useEducation (Education/Training/Classrooms)`                       2.560544   1.131753   2.262  0.02367 *
Q30_primary_useIndustrial                                                        0.774072   1.143411   0.677  0.49842
Q30_primary_useJudicial                                                         17.517641 646.708311   0.027  0.97839
Q30_primary_useLaboratories                                                      4.571932   1.705448   2.681  0.00735 **
Q30_primary_useOffice                                                            1.994826   1.027309   1.942  0.05216 .
Q30_primary_useOther                                                             1.919259   1.046490   1.834  0.06665 .
occupants_range.L                                                               -0.389938   0.498093  -0.783  0.43371
occupants_range.Q                                                               -0.765052   0.463171  -1.652  0.09858 .
occupants_range.C                                                               -0.736713   0.400232  -1.841  0.06566 .
`occupants_range^4`                                                             -0.293293   0.405927  -0.723  0.46997
area_range.L                                                                     1.468968   0.677321   2.169  0.03010 *
area_range.Q                                                                     0.593628   0.567566   1.046  0.29560
area_range.C                                                                    -0.261590   0.578447  -0.452  0.65110
`area_range^4`                                                                   0.136735   0.632741   0.216  0.82891
`area_range^5`                                                                  -1.142560   0.646312  -1.768  0.07709 .
`area_range^6`                                                                  -0.557367   0.590189  -0.944  0.34497
four_IndustriesManufacturing                                                    -0.070782   0.504706  -0.140  0.88847
four_IndustriesServices                                                         -0.315387   0.354673  -0.889  0.37388
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)
```

2.2 Logistic regression model results for change benefits achieved

```
Coefficients:
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                    -2.499773   0.947687  -2.638 0.008346 **
`Q7_ext_changeModifications in Facility Operations & Maintenance Activities`   -0.197660   0.618395  -0.320 0.749246
`Q7_ext_changeOther:`                                                          -0.572118   1.087120  -0.526 0.598701
`Q7_ext_changeTransition to Hybrid Working Model (mix of virtual and physical)` -0.296479   0.331663  -0.894 0.371368
`Q7_ext_changeTransition to Remote Working Model (100% virtual)`                0.253081   0.414437   0.611 0.541422
Q8_involvement1                                                                 1.028788   0.292989   3.511 0.000446 ***
Q9_1_ext_structured_approach1                                                   0.409227   0.313984   1.303 0.192460
Q9_2_ext_resources1                                                             0.460603   0.311118   1.480 0.138746
Q9_3_ext_leadership1                                                            0.833135   0.361887   2.302 0.021324 *
Q9_4_ext_clear_understanding1                                                   0.201294   0.333736   0.603 0.546406
Q9_5_ext_timescale1                                                             0.590879   0.325353   1.816 0.069353 .
Q9_6_ext_workload_adjustment1                                                   0.371802   0.335777   1.107 0.268169
Q9_7_ext_personal_benefits1                                                     0.372277   0.303577   1.226 0.220086
Q9_8_ext_change_agent1                                                          1.270905   0.330907   3.841 0.000123 ***
Q9_9_ext_communication1                                                         0.333802   0.319628   1.044 0.296326
ext_reactionpositive                                                            0.231292   0.278326   0.831 0.405967
`Q4_space_typeMultiple buildings in multiple locations.`                       -0.350160   0.456836  -0.766 0.443385
`Q4_space_typeMultiple buildings in one location.`                             -0.351406   0.518741  -0.677 0.498139
`Q4_space_typeMultiple buildings in one location. Specify number of buildings` -0.525043   0.912120  -0.576 0.564865
`Q4_space_typeSpace within a building`                                         -0.361319   0.572012  -0.632 0.527606
`Q5_own_leaseOwn and lease to others`                                          -0.296915   0.456473  -0.650 0.515399
`Q5_own_leaseOwn and occupy`                                                    0.256762   0.358980   0.715 0.474452
`Q28_facility_settingCentral Business District`                                -0.326644   0.444864  -0.734 0.462793
`Q28_facility_settingIndustrial park`                                           0.300048   0.669537   0.448 0.654050
`Q28_facility_settingRural Area`                                               -0.385374   0.949196  -0.406 0.684742
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`      -0.055331   0.494245  -0.112 0.910863
`Q28_facility_settingSuburban area`                                             0.668589   0.516064   1.296 0.195129
`Q30_primary_useEducation (Education/Training/Classrooms)`                     -0.034768   0.783513  -0.044 0.964606
Q30_primary_useIndustrial                                                      -0.037398   0.877143  -0.043 0.965991
Q30_primary_useJudicial                                                         0.389251   1.627869   0.239 0.811015
Q30_primary_useLaboratories                                                     2.963742   1.535153   1.931 0.053535 .
Q30_primary_useOffice                                                          -0.008356   0.675181  -0.012 0.990126
Q30_primary_useOther                                                            0.478190   0.722814   0.662 0.508248
occupants_range.L                                                              -0.139503   0.420116  -0.332 0.739845
occupants_range.Q                                                              -0.489581   0.414015  -1.183 0.237000
occupants_range.C                                                              -0.022178   0.359937  -0.062 0.950869
`occupants_range^4`                                                            -0.345301   0.363850  -0.949 0.342610
area_range.L                                                                    0.797882   0.578206   1.380 0.167609
area_range.Q                                                                    1.003874   0.541236   1.855 0.063628 .
area_range.C                                                                    0.599157   0.543148   1.103 0.269975
`area_range^4`                                                                 -0.075287   0.540532  -0.139 0.889226
`area_range^5`                                                                 -0.721993   0.574856  -1.256 0.209132
`area_range^6`                                                                 -0.720632   0.513404  -1.404 0.160428
four_IndustriesManufacturing                                                   -0.082844   0.432986  -0.191 0.848266
four_IndustriesServices                                                         0.120768   0.317547   0.380 0.703711
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

2.3 Logistic regression model results for long-term change adoption

```
Coefficients:
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                    -1.042909   0.850466  -1.226 0.220093
`Q7_ext_changeModifications in Facility Operations & Maintenance Activities`   -0.314423   0.525903  -0.598 0.549925
`Q7_ext_changeOther:`                                                          -0.738486   0.952468  -0.775 0.438139
`Q7_ext_changeTransition to Hybrid Working Model (mix of virtual and physical)` -0.239074   0.284356  -0.841 0.400485
`Q7_ext_changeTransition to Remote Working Model (100% virtual)`               -0.084558   0.347943  -0.243 0.807987
Q8_involvement1                                                                 0.073940   0.252760   0.293 0.769881
Q9_1_ext_structured_approach1                                                   1.022797   0.264150   3.872 0.000108 ***
Q9_2_ext_resources1                                                             0.130033   0.283078   0.459 0.645981
Q9_3_ext_leadership1                                                            0.194076   0.326842   0.594 0.552652
Q9_4_ext_clear_understanding1                                                   0.118723   0.294728   0.403 0.687079
Q9_5_ext_timescale1                                                             0.502177   0.283209   1.773 0.076201 .
Q9_6_ext_workload_adjustment1                                                   0.667170   0.271093   2.461 0.013854 *
Q9_7_ext_personal_benefits1                                                     0.750468   0.258332   2.905 0.003672 **
Q9_8_ext_change_agent1                                                          0.548445   0.296914   1.847 0.064726 .
Q9_9_ext_communication1                                                         0.317832   0.276990   1.147 0.251196
ext_reactionpositive                                                            0.182732   0.243450   0.751 0.452898
`Q4_space_typeMultiple buildings in multiple locations.`                        0.178074   0.351335   0.507 0.612262
`Q4_space_typeMultiple buildings in one location.`                              0.541936   0.441012   1.229 0.219130
`Q4_space_typeMultiple buildings in one location. Specify number of buildings`  2.377957   1.064592   2.234 0.025504 *
`Q4_space_typeSpace within a building`                                         -0.196399   0.445293  -0.441 0.659172
`Q5_own_leaseOwn and lease to others`                                          -0.519123   0.411792  -1.261 0.207437
`Q5_own_leaseOwn and occupy`                                                   -0.007002   0.319061  -0.022 0.982492
`Q28_facility_settingCentral Business District`                                -0.453525   0.400447  -1.133 0.257404
`Q28_facility_settingIndustrial park`                                          -0.202877   0.580538  -0.349 0.726741
`Q28_facility_settingRural Area`                                               -0.188651   0.812159  -0.232 0.816318
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`      -0.090571   0.429749  -0.211 0.833080
`Q28_facility_settingSuburban area`                                            -0.442676   0.423722  -1.045 0.296146
`Q30_primary_useEducation (Education/Training/Classrooms)`                     -0.816852   0.751972  -1.086 0.277356
Q30_primary_useIndustrial                                                      -0.484794   0.823119  -0.589 0.555880
Q30_primary_useJudicial                                                         0.814153   1.633803   0.498 0.618260
Q30_primary_useLaboratories                                                    -0.497870   1.000898  -0.497 0.618891
Q30_primary_useOffice                                                          -0.432727   0.670712  -0.645 0.518813
Q30_primary_useOther                                                           -0.276194   0.687628  -0.402 0.687933
occupants_range.L                                                               0.111211   0.378518   0.294 0.768905
occupants_range.Q                                                              -0.163622   0.343957  -0.476 0.634285
occupants_range.C                                                              -0.250901   0.312536  -0.803 0.422097
`occupants_range^4`                                                            -0.494000   0.329144  -1.501 0.133391
area_range.L                                                                    0.481545   0.488544   0.986 0.324293
area_range.Q                                                                    0.368166   0.451104   0.816 0.414418
area_range.C                                                                   -0.238059   0.488762  -0.487 0.626212
`area_range^4`                                                                 -0.656811   0.464950  -1.413 0.157759
`area_range^5`                                                                 -0.033449   0.540462  -0.062 0.950651
`area_range^6`                                                                  0.166444   0.489594   0.340 0.733884
four_IndustriesManufacturing                                                   -0.529761   0.368862  -1.436 0.150945
four_IndustriesServices                                                         0.493099   0.284035   1.736 0.082555 .
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
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CHAPTER 3:
COMPARATIVE ANALYSIS BETWEEN ORGANIZATIONAL LEADERSHIP AND EMPLOYEES TO STUDY THE DISPARITIES IN EXTERNAL CHANGE ADOPTION: A COVID-19 CASE STUDY

3.1 INTRODUCTION

Historically, wide-scale pandemics have been a low occurrence emergency scenario. Prior to the COVID-19 Pandemic, the H1N1 pandemic in 2009 claimed 9,820 lives amid 47 million infections (Bass et al., 2010). Most pandemic plans relied heavily upon pharmacological interventions, and the literature rarely mentioned countermeasures such as social distancing, isolation, and quarantine. Likewise, many facility emergency management plans did not fully address or prepare for the challenges currently being presented by COVID-19. While there exists significant literature on disaster preparedness in healthcare facilities, including pandemic preparations, the lack of relevant research on other facility types across different industries highlights the need to conduct this research study (Hollingworth, 2011; Garg et al., 2020).
The COVID-19 pandemic forced facility management (FM) professionals throughout the world to rapidly alter operations for the organizations they served. Guidelines from the World Health Organization (WHO) stated the need to implement "work from home practices," including alternating workdays and shifts with essential staff. The overall uncertainty associated with the pandemic put tremendous pressure on facility managers (FMs) to ensure their organization's ability to meet business or stakeholder obligations as well as in light of meeting the new and urgent needs of individuals throughout the organization.

Accordingly, the unique conditions of COVID-19 directly impacted facility professionals and stakeholders in ways that were mostly unanticipated. The primary objective of this study was to assess FM readiness to implement various change initiatives in response to the COVID-19 pandemic, sought through feedback from FM leaders and company stakeholders. In particular,

the disparities between change implementation and adoption success were studied through feedback from the organizational leaders responsible for leading change implementation, as well as the employees that were directly impacted by the same change.

Research Objective

The aim of the study was to evaluate disparities between the perceptions of organizational leaders versus the perceptions of employees for the same change initiative, analyzed through various descriptive and statistical analyses. In addition, this study examines the impact of the most important parameters on successful change adoption through random forest and logistic regression models. The successful implementation of change initiatives was studied based on three change adoption measures – 1.) overall change adoption, 2.) change benefits achieved, and 3.) long-term or sustainable adoption.

3.2 LITERATURE REVIEW

According to Cotts (2010), facility managers can be referred to as business managers that share a similar philosophy about their organizational facility and are positioned at the same level as human relations or information technology departments within the organizational hierarchy. Over the 21st century, the profile of facility managers has broadened from a technician or technical expert to a business leader or strategic planner, responsible for enhancing the productivity while mitigating risks for an organization, and achieved through various strategic initiatives (Cott, 2010). The roles and responsibilities carried out by facility managers encompasses a wide range of services to support the built environment of an organization, and these services have a direct impact on the success or partial failure of the organization

(Chotipanich, 2004; Nutt, 1999; Barrett, 1995). In particular, the key to informed decision-making and effective FM is understanding the needs of an organization, its employees, and providing support services to enhance the organizational goals (Chotipanich, 2004). Based on more than 100 identified responsibilities carried out by facility managers, Cott (2010) helped to narrow these responsibilities by grouping them into 16 key functions, categorized as i) management of the organization, ii) facility planning and forecasting, iii) lease administration, iv) space planning, allocation, and management, v) architectural/engineering planning and design, vi) workplace planning, allocation, and management, vii) budgeting, accounting, and economic justification, viii) real estate acquisition and disposal, ix) sustainability, x) construction project management, xi) Move, Add, Change (MAC) management, xii) operations, maintenance and repair, xiii) technology management, xiv) facility emergency management, xv) security and life-safety management, and xvi) general administrative services.

Space Planning and Management for FMs

One of the key functions of FM includes oversight of the physical dimensions of a facility (i.e., space), and requires facility managers to develop space strategies to address the current needs of the employees and accommodate for future growth within an organization (Cotts, 2010; Pennanen, 2005). Forecasting, planning, allocation, and management of the space are some of the core components that help to determine the success of a facility manager's role in an organization (Cotts, 2010). Figure 3.1 illustrates the key aspects of space planning and management from the FM perspective.

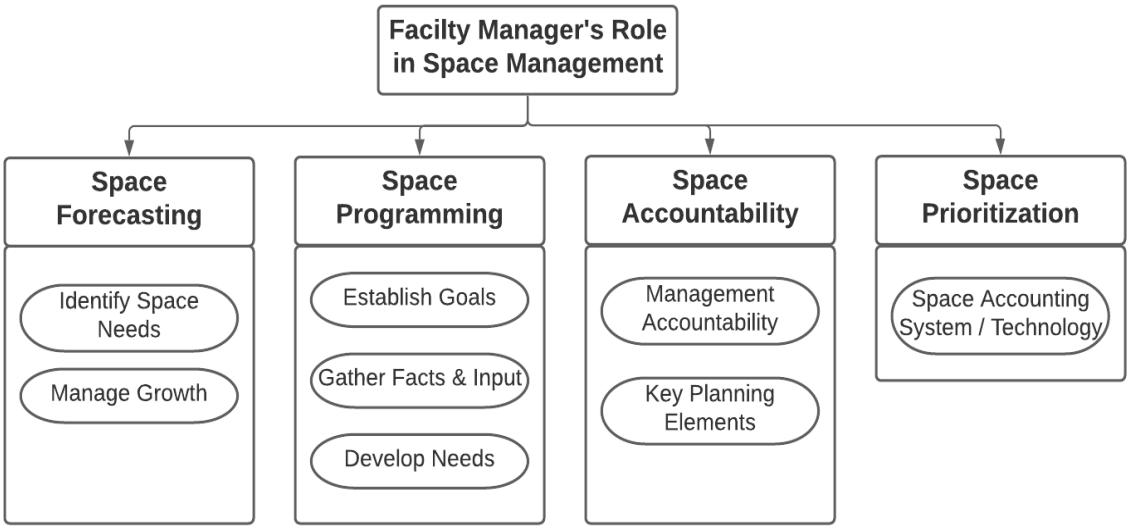

Figure 3.1: Key aspects of space planning and management from FM's perspective, adopted from Cotts (2010)

Space forecasting methods are generally adopted by large international organizations to identify new space requirements and determine whether to re-allocate or dispose of available unneeded space (Cotts, 2010). Based on the two common types of space ownership, owned or leased, facility managers experience varying degrees of control and flexibility in developing the strategies for available space (Cotts, 2010). In the space programming phase, organizations aim to enhance the execution of developed forecasting strategies through establishing goals, gathering facts and inputs, and developing required needs (Cotts, 2010). Once the goals are clearly identified, facility managers should aim to gather necessary information to differentiate between what organizations desire and what is essential for the required space (Cotts, 2010). Cotts (2010) recommends two approaches for facility managers to hold management accountable for the utilized space. First, the use of floor plans to differentiate the departments in an organization and then assign operational costs based on the employee utilization rate. Secondly, the use of key plans to monitor occupancy rate for each department can be critical to track the

changes and manage unassignable space (Cotts, 2010). The space is prioritized according to the associated intrinsic value. Features such as proximity to senior management, windows, or higher floor-levels can add to the value to the space (Cotts, 2020). Additionally, the functions and activities associated with the space can also add value to it. For efficient space prioritization, Cotts (2010) recommends implementing a space accounting system that defines available spaces, assigns responsibilities, and tracks changes.

Facilities, Healthcare, and Emergency Management

Emergency management is a process of risk management and serves to ensure that institutions are both ready and prepared for an unlikely but catastrophic event (Lusby, 2006). Cotts (2010) defined emergency management as "the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters." Davenport (2004) suggests that organizations can be better prepared to respond to emergencies by having policies and procedures in place, aimed to increase the awareness on key issues, identify areas of improvement, highlight causes of issues, and assign leadership responsibilities to individuals with adequate knowledge on facility preventive measures. Emergency management literature denotes an important distinction between these two terms, ready and prepared, though they may seem synonymous. Lusby (2006) suggests that readiness is a "state of mind" that comes from engaging in preparedness activities, which can be classified either as physical or mental preparedness. Physical preparedness involves activities related to the physical environment, such as stockpiling supplies, and physical alterations to the facility. Mental preparedness involves cognitive/behavioral activities, such as "planning activities, training, drills/exercises, and evaluation to identify deficiencies" (Lusby, 2006). Both aspects of

preparedness are essential and contribute to a state of readiness, which can be achieved by having the knowledge and belief in ones' ability to be prepared. Lusby (2006) proposes seven steps and a series of questions to help FMs assess their Emergency Preparedness Plans and move from preparedness to readiness. According to Cotts (2010), facility managers are deeply involved in any emergency or disaster that may have an impact on a built environment, which can result in loss of life, income, or business. Such emergencies can range from natural disasters or violent shootings to an overflowing toilet (Cott, 2010). Some of the common concerns held by facility shareholders include, but are not limited to, terrorist attacks, natural disasters, workplace violence, operational accidents, healthcare crises (such as epidemic or pandemic), among others (Davenport, 2004).

Goldman (2020) and Cotts (2010) asserted that streamlined communication channels, coordination, information logs, and the role of leadership are critical for an enhanced emergency response team. According to Cotts (2010), FM departments should maintain an independently operated emergency center focused only on FM related activities during an emergency. Figure 3.2 provides a structural breakdown of the proposed independent facility emergency operations center (Cotts, 2010). Based on the proposed FM emergency center model, facility managers are responsible to lead the center, communicate with senior management, and coordinate efforts with the members of other departments involved in the process (Cotts, 2010). The wide range of skills and diverse responsibilities makes facility managers most suitable and equipped to develop these strategies and deliver changes during an emergency in a built environment. As shown in Figure 3.2, the FM emergency center should consist of members from maintenance, resources management, engineering, response, and planning teams.

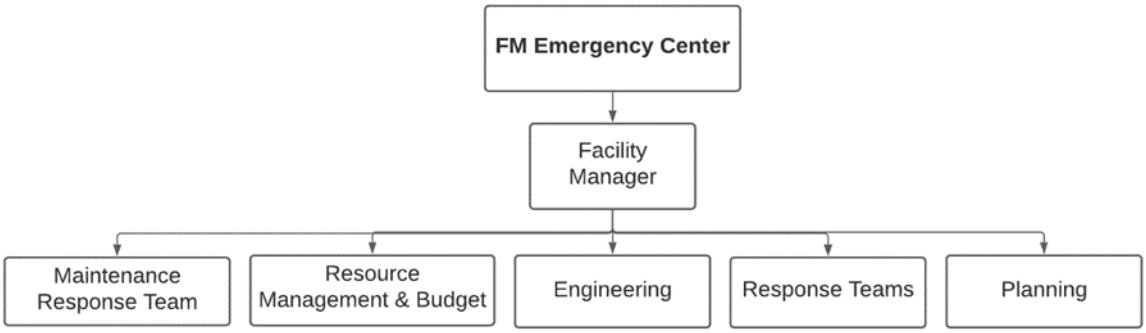

Figure 3.2: FM emergency operations center structure, adopted from (Cotts, 2020)

Organizational Change Management

Smith (2014) defines organizational change management (OCM) as an emergent, interdisciplinary profession. With organizational demands rapidly changing throughout existing environments, researchers have identified a range of factors that are responsible for ensuring the success of change initiatives across various industries, while recognizing the existence of numerous unknowns that account for failures in change implementation and adoption processes (Smith, 2004). Smith (2014) refers to the OCM profession to be in its "adolescent" phase and requiring additional research efforts to attain its desired "maturity". Research shows that the change initiative failure rate has been recorded as high as 70% to 80% (King and Peterson, 2007); meanwhile, some of the top-performing organizations have managed to achieve a success rate of over 80 percent; IBM, 2008). Hughes (2011) asserts that the recorded high variance in success and failure rates of change implementation can be accounted for by various unknown factors that are difficult to accurately quantify; however, research practitioners in the field have found significant evidence of the positive impact of well-established OCM practices on the success rate of change initiatives.

Lines (2017) and Maali (2020) derived seven key OCM practices using relevant academic literature, taken from AEC and organizational behavior fields, to assist organizations with the successful implementation of change initiatives in an interdisciplinary environment. Based on the recommendations from various researchers, these seven key OCM practices focused on leadership, training resources, communication, timeframe, change agent, benchmarks, and workload adjustments. Figure 3.3 illustrates the key seven OCM practices and three change adoption measures utilized to study the successful implementation of a technology in the AEC industry.

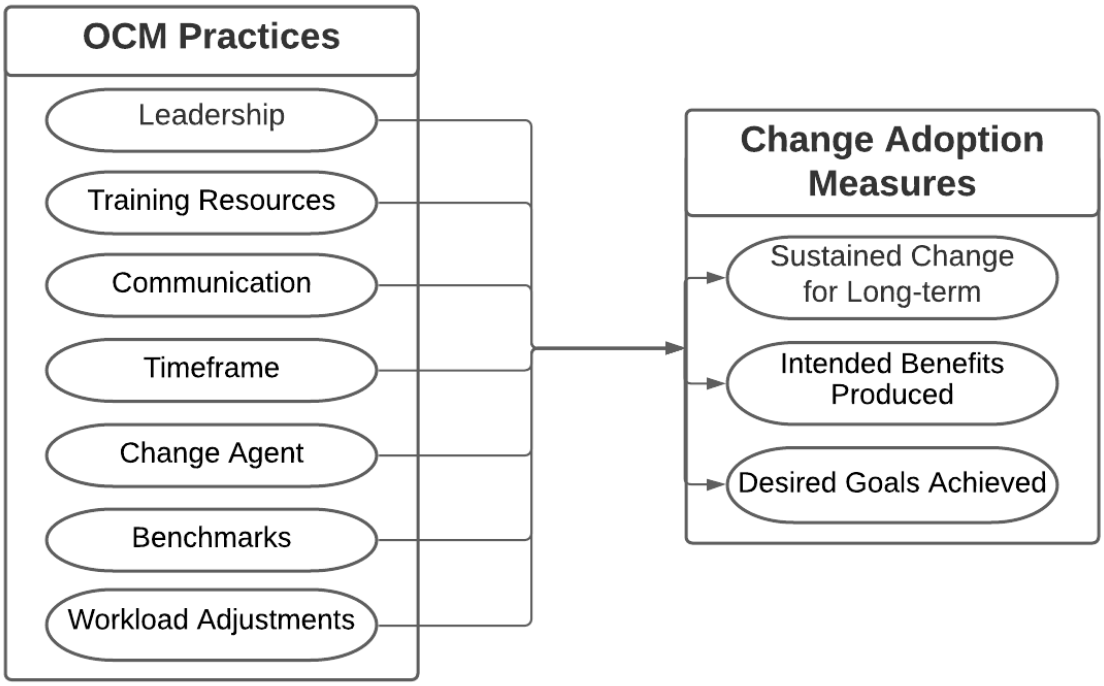

Figure 3.3: Key OCM practices and change adoption measures, adopted from Maali (2020) and Lines (2017)

The consistent support and commitment of the senior leadership team during the change implementation process aids to strengthen the importance of the change for organizational success (Armenakis et al, 1999). For changes associated with technology, availability of

adequate resources has supported successful implementation (Peansupap and Walker, 2006). In addition to effectively communicating the benefits of change, researchers have found out that sharing the drawbacks of change with the end-users can help to alleviate resistance (Cameron and Quinn, 1999). The speed or timeline of the change implementation phase can also be a critical factor towards employees' ability to learn and adopt to the change (Sullivan, 2011). According to numerous research publications, the appointment of an individual or a team of individuals to navigate and lead the change implementation process has the most significant impact on the outcome (Wolpert, 2010; Maali, 2020). Other important strategies that govern the outcome of a change initiative include adjustment of employee workloads and establishment of short and long-term benchmarks to record the performance of the change implementation process.

The successful adoption of any change initiative may vary based on the organizational goals. Maali (2017) utilized three major factors to study the outcome of the implemented change. As shown in Figure 3.3, the successful adoption of any change initiative can be studied through overall success, benefits or performance gains, or long-term adoption of the change initiative.

3.3 RESEARCH METHODOLOGY

This research follows a unique research methodology, where a survey-questionnaire was developed to collect employee feedback from multiple organizations on the change management efforts they experienced during the COVID-19 pandemic. This was a follow-up study from the original research that aimed to evaluate organizational readiness to successfully implement change initiatives in response to the COVID-19 pandemic. Per Figure 3.4, the original study was based on the 800+ responses recorded from organizational leaders or FM professionals that were

responsible for leading the change initiative. For this study, 32 out of those 800+ organizations agreed to participate in this study and share employee feedback on the OCM practices used by the leaders to implement the change initiative. A total of 354 responses from the 32 organizations were collected using a survey questionnaire similar to the original study, which mainly recorded feedback on the nine OCM strategies and three change adoption measures.

While the data for most of the organizations was collected throughout the month of May 2021, one of the world's largest FM services provider volunteered to participate in a detailed case study to share their experiences with change implementation during the COVID-19 pandemic. The FM organization, identified as Organization X, accounted for 56 of the 354 employee responses and included six responses from leaders that were highly involved in the change implementation process. Typically, other organizations had only submitted one response from leadership.

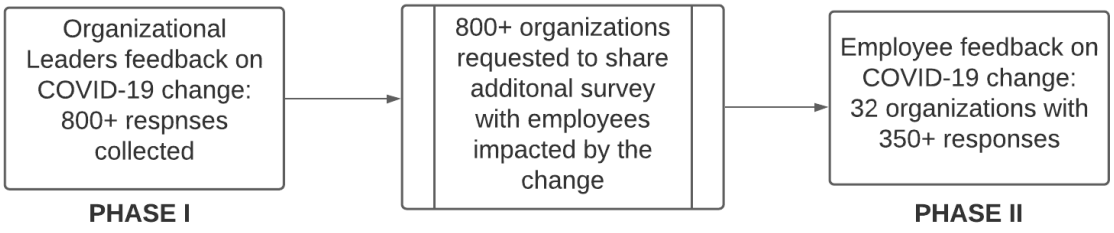

Figure 3.4: Research Methodology

Data Description

For this study, two datasets were created to capture feedback from leadership teams, as well as employees, to study their relative experiences on the same change implementation process, in response to the COVID-19 pandemic. The datasets included details on organizational characteristics, OCM practices, and change adoption measures. The OCM practices and change

adoption measures were recorded on an ordinal scale of 1 to 7, with 1 representing a response of strongly disagree, and 7 representing strongly agree responses. Most of the organizational characteristics (e.g., facility location, space type, industry served, etc.) were recorded on a nominal scale.

3.4 DATA ANALYSIS AND RESULTS

The descriptive and statistical analysis were conducted to explore the available data, compare the performance of organizations across different categories, and examine the significance of established relationships between various factors. The research team used the RStudio platform to perform Mann-Whitney U, random forest, and logistic regression analysis. The Mann-Whitney U test was performed to examine the difference in distribution of two parameters. The random forest and logistic regression models were developed to identify the top parameters responsible for successful change adoption.

Descriptive Analysis

In this section, the employee feedback on the OCM strategies and the change adoption success was visually analyzed based on organizational characteristics and the type of change implemented during the COVID-19 pandemic. To further investigate the disparities in the feedback between leadership and their employees, the responses were depicted on the same graph. Since Organization X recorded the highest number of responses and provided additional details as compared to any other organization, it was studied independently in the descriptive analysis. Meanwhile, the feedback on OCM strategies and change adoption measures from a total of 298 responses, representing 31 organizations, were studied across the types of industry

served and the change initiatives executed during the COVID-19 pandemic. The feedback on OCM practices and successful change adoption was reported as a percentage of agreement based on an ordinal scale, where responses were originally recorded on a scale of 1 to 7 (1 as high disagreement and 7 as high agreement).

The feedback from employees and change leaders was compared across three major industries, where 19 organizations represented the institutional sector, nine from the services sector, and three belonged to the manufacturing industry. Figure 3.5 compares the feedback from leaders and employees, based on the various OCM strategies utilized. Figure 3.6 represents the feedback on the change adoption success for the institutional industry. As shown in Figures 3.5 and 3.6, the feedback was consistent from both groups (i.e., employees and leadership) on most of the OCM practices; however, leadership responses overestimated the overall adoption and change benefits achieved, as compared to the employee responses.

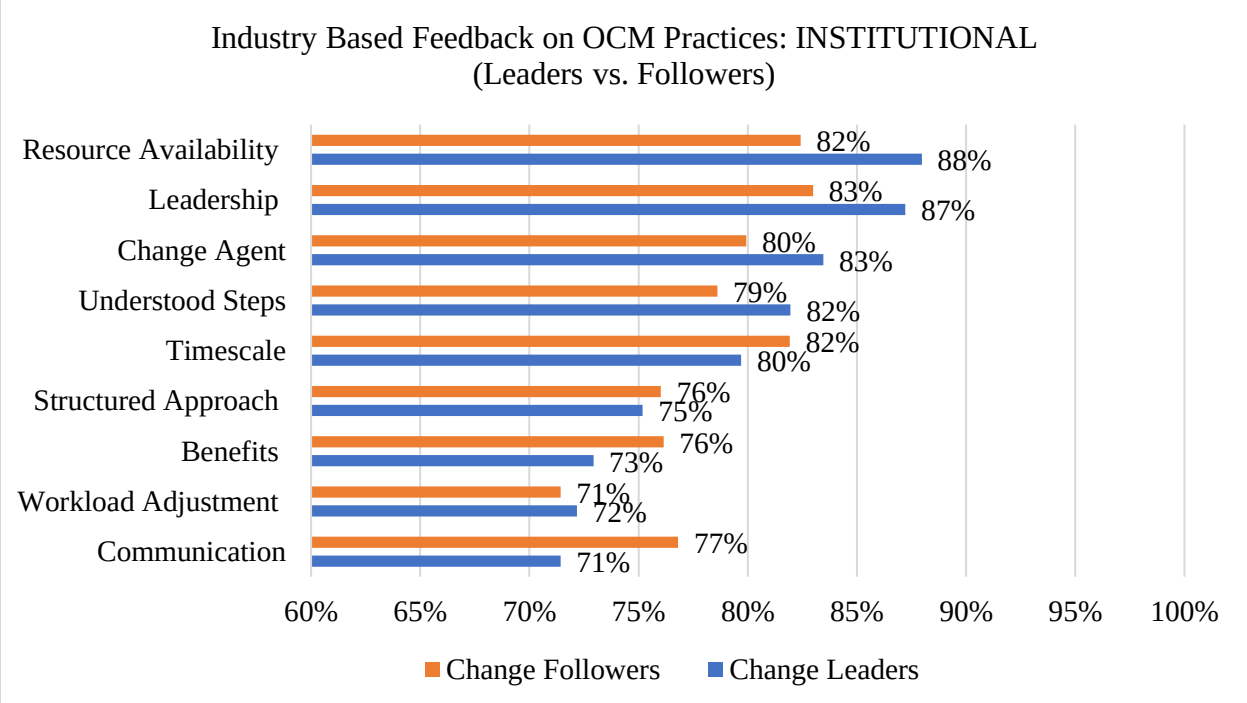

Figure 3.5: Feedback score on OCM practices for Institutional industry sector

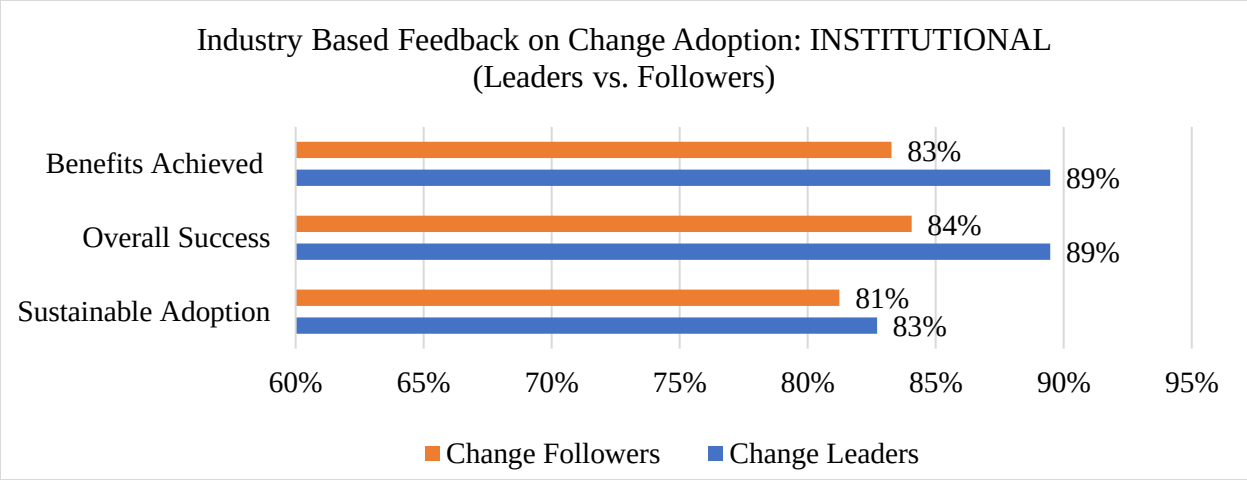

Figure 3.6: Feedback score on change adoption measures for Institutional industry sector

The feedback on OCM practices and change adoption measures from the services industry is presented in Figures 3.7 and 3.8. Compared to the institutional industry, the feedback on most of the OCM practices (8 out of 9) recorded significantly higher disparities between leaders and employees. In particular, areas like availability of resources, communication of change details, perceived benefits of the change, and leadership commitment were among the top factors. Meanwhile, the feedback on change adoption success was consistent across all three measures investigated in this study.

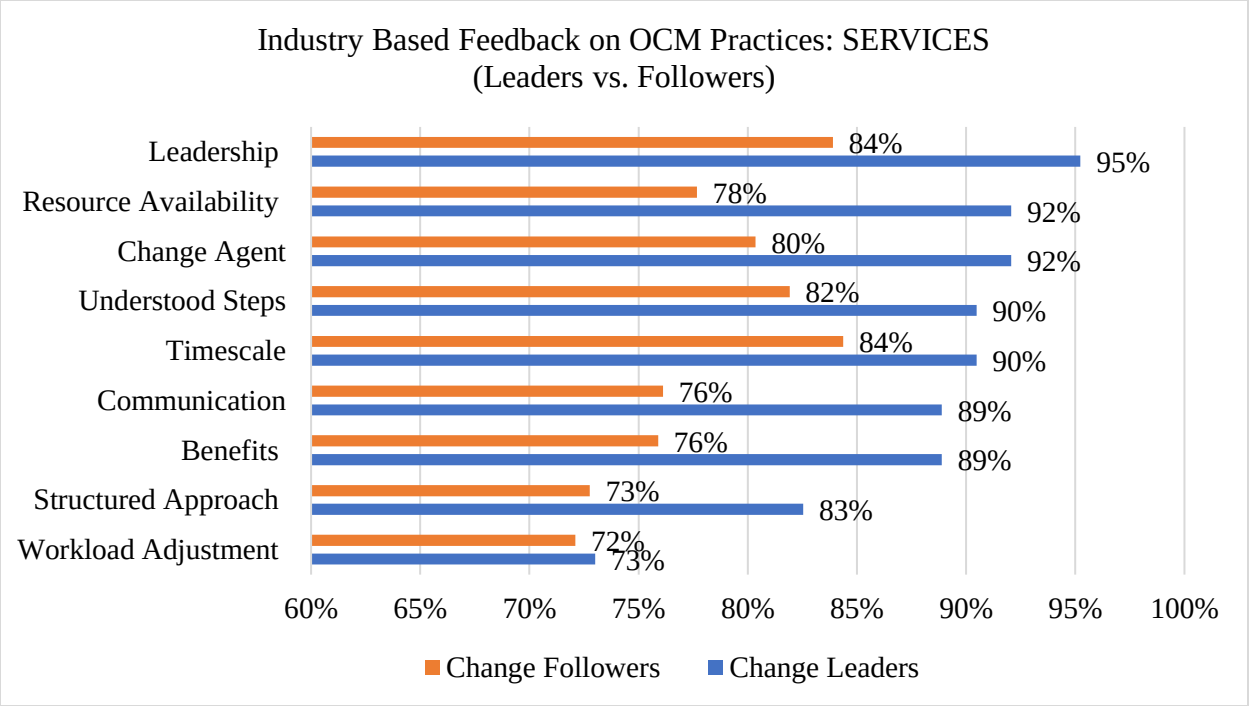

Figure 3.7: Feedback score on OCM practices for Services industry sector

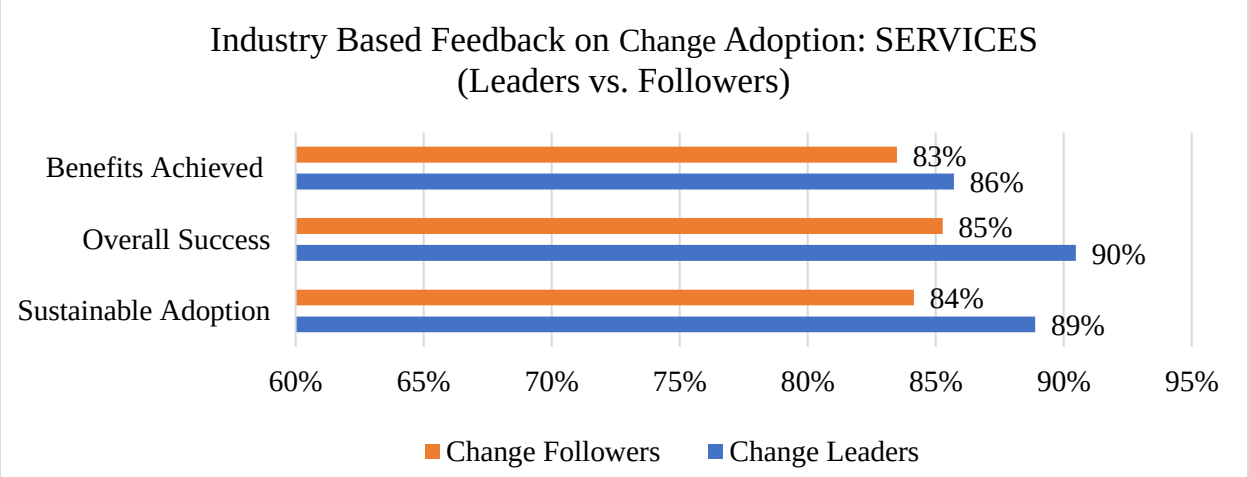

Figure 3.8: Feedback score on change adoption measures for Services industry sector

Finally, the feedback from the organizations representing the manufacturing industry is depicted in Figures 3.9 and 3.10. While the disparities in the feedback on OCM practices were similar to the services industry, the organizations within the institutional sector also recorded high variation between the overall adoption and achievement of benefits from the change

initiatives. Generally, the perception between employees and leaders with respect to successful change implementation and adoption highly varied across the three industry types, where individuals within the services industry seemed most aligned; conversely, the responses from members of the manufacturing industry reflected high disparities.

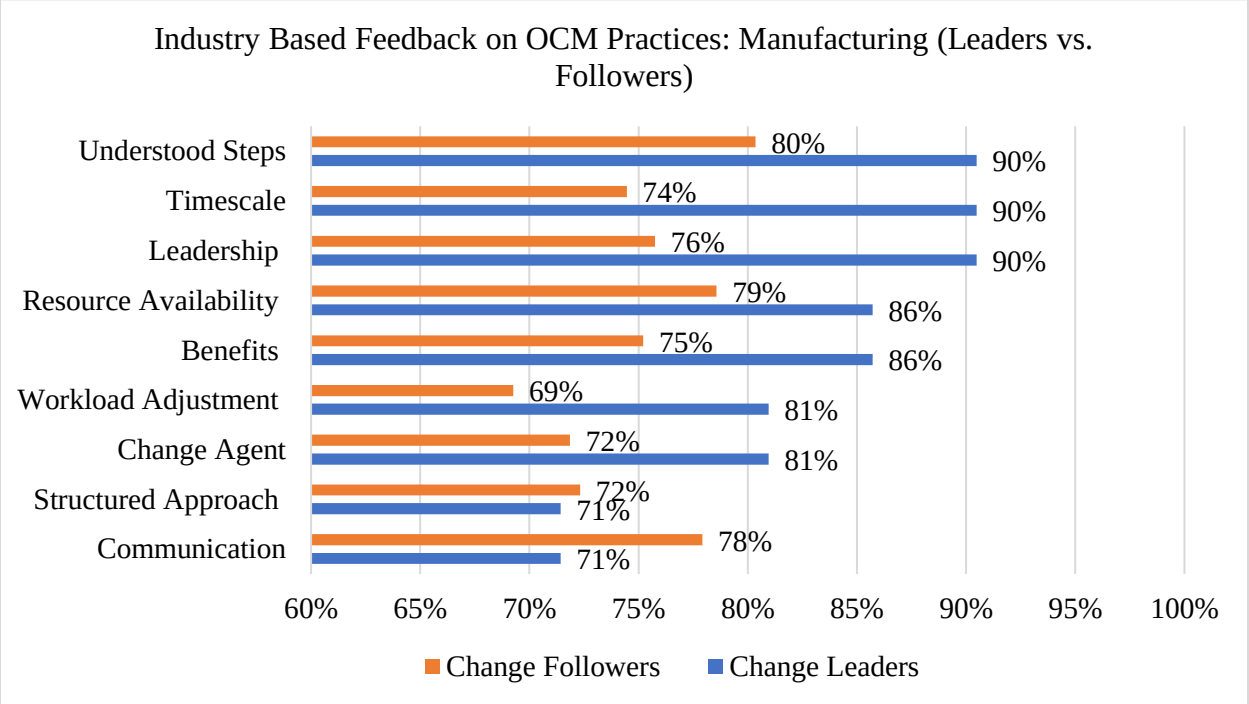

Figure 3.9: Feedback score on OCM practices for Institutional industry sector

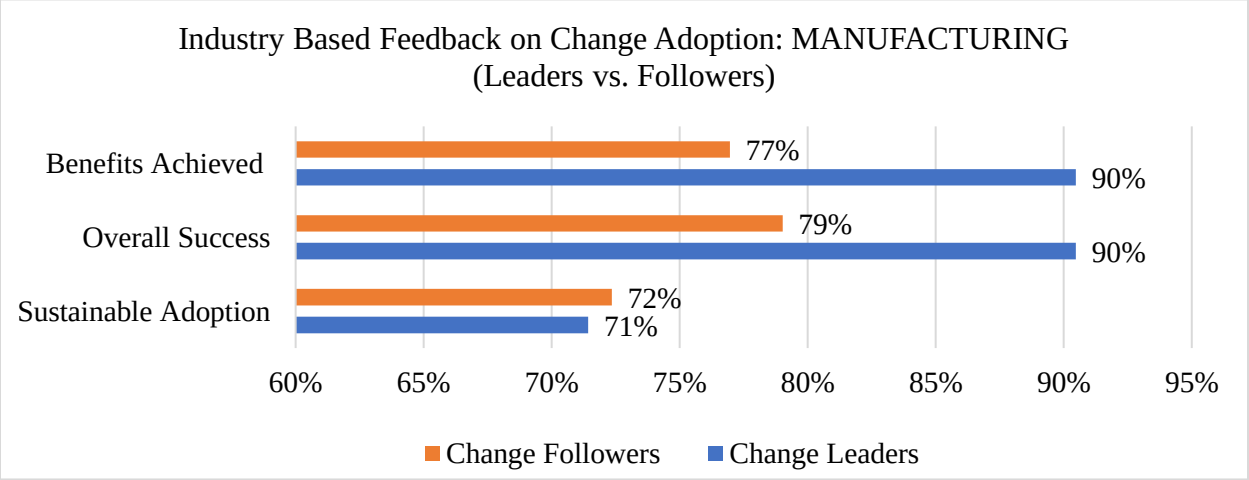

Figure 3.10: Feedback score on OCM practices for Institutional industry sector

The feedback on OCM practices and change adoption measures was also studied across three major change initiatives, implemented in response to the COVID-19 pandemic, among 31 organizations. A total of nine organizations (66 employees) reported on the modification in facility operations, nine organizations (81 employees) reported on the implementation of a hybrid working model, and the remaining 13 organizations (151 employees) reported on the adoption of a remote working model, representing the three most significant change initiatives.

Figures 3.11 and 3.12 summarize the feedback on OCM practices and change adoption measures for organizations that modified facility operations to overcome challenges imposed due to COVID-19. Both figures show positive disparities were recorded between the feedback from employees and leaders on the OCM practices utilized to modify facility operations. In other words, organizational leaders underrated their efforts to implement the changes as compared to the employees; however, the feedback on the three change adoption measures was consistent and high for the reported change initiative.

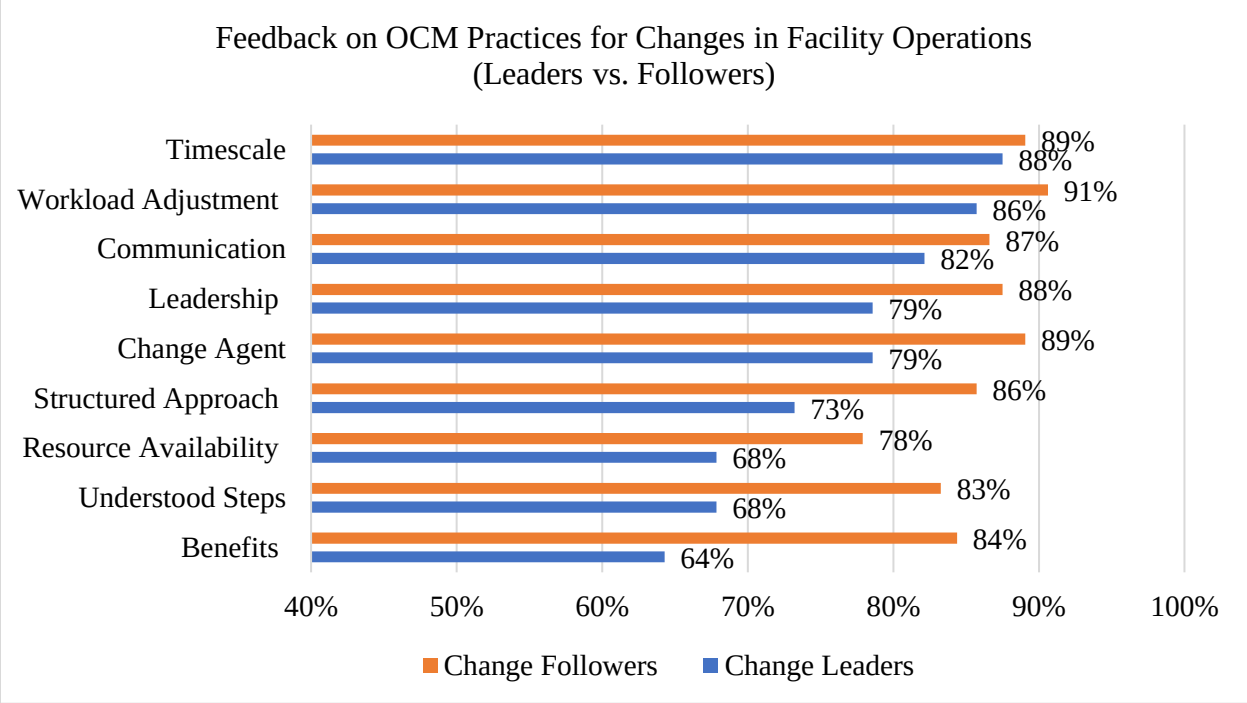

Figure 3.11: Feedback score on OCM practices for modifications in facility operations

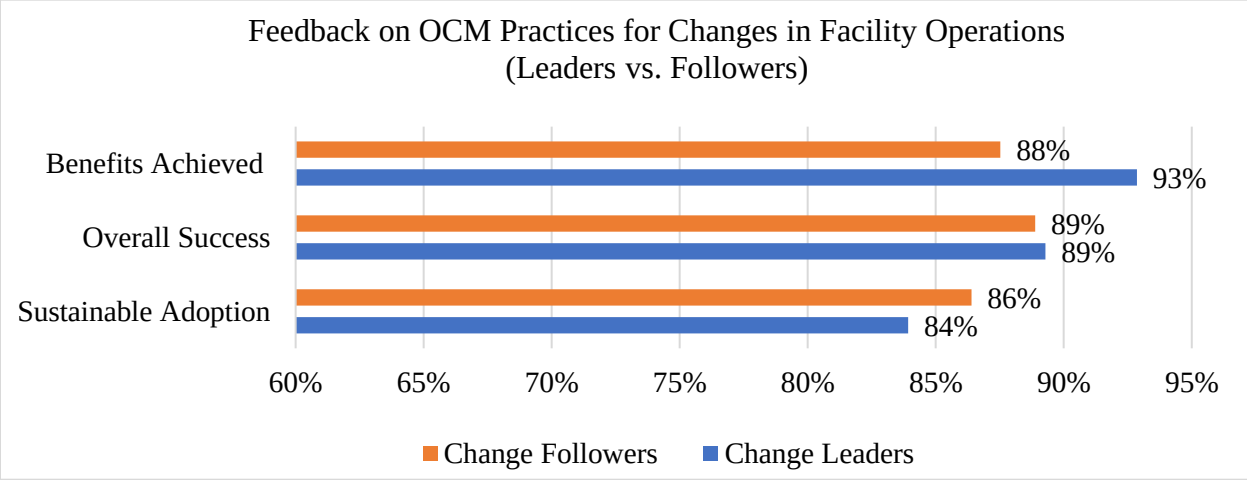

Figure 3.12: Feedback score on change adoption measures for modifications in facility operations

In response to the COVID-19 pandemic, most organizations throughout the world moved to remote working or hybrid working. Figures 3.13 and 3.14 illustrate the feedback on the OCM practices and adoption success with the implementation of hybrid working models (i.e., a mixture of remote and in-person work). Comparatively, Figures 3.15 and 3.16 evaluate the feedback from organizations that transitioned to remote working. For the hybrid working model, the feedback on all the OCM strategies and change adoption measures were consistent as well as high. In support of this feedback, Figures 3.13 and 3.14 provide evidence that employees and leaders were highly aligned during the implementation process and had similar perceptions of successful implementation, particularly in the hybrid work context.

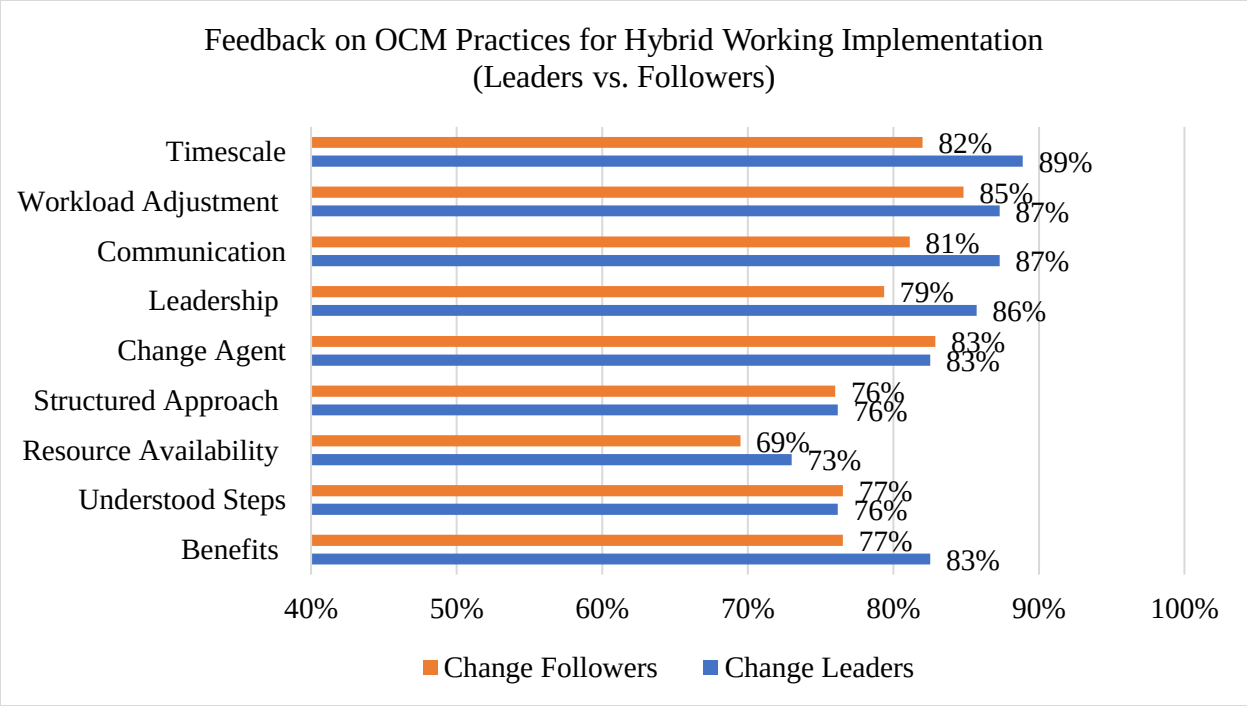

Figure 3.13: Feedback score on OCM practices for implementation of hybrid working model

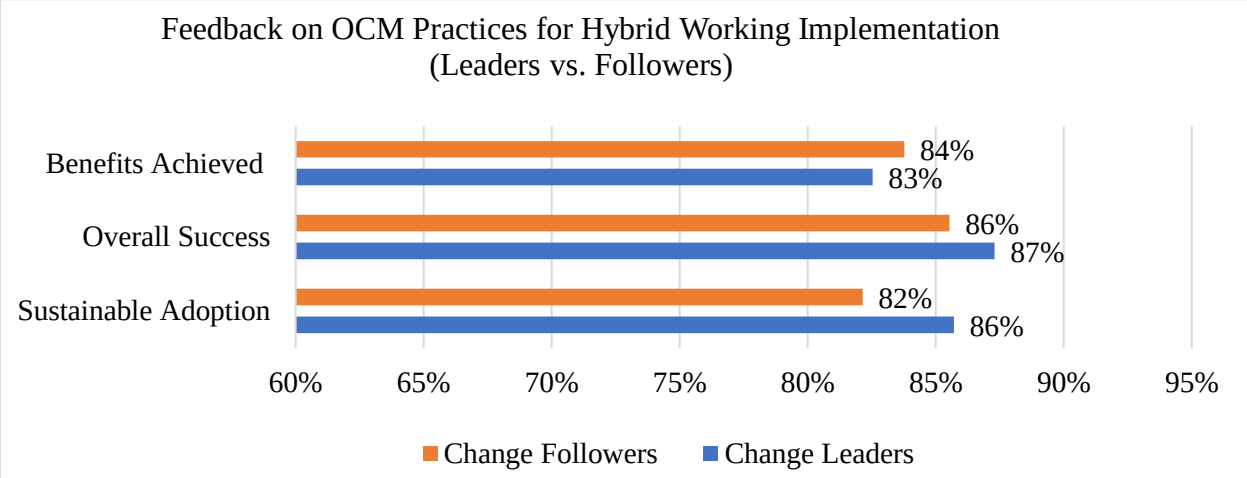

Figure 3.14: Feedback score on change adoption measures for implementation of hybrid working model

In contrast to hybrid working models, organizations were not as highly aligned for the implementation of a remote working model based on the feedback on OCM practices and overall change adoption measures. As shown in Figures 3.15 and 3.16, the implementation strategies like timescale/speed of change, workload adjustment, appointment of change agent, and

communication of change benefits recorded high disparities, whereas the adoption measures for overall adoption and benefits achieved also recorded high disparities.

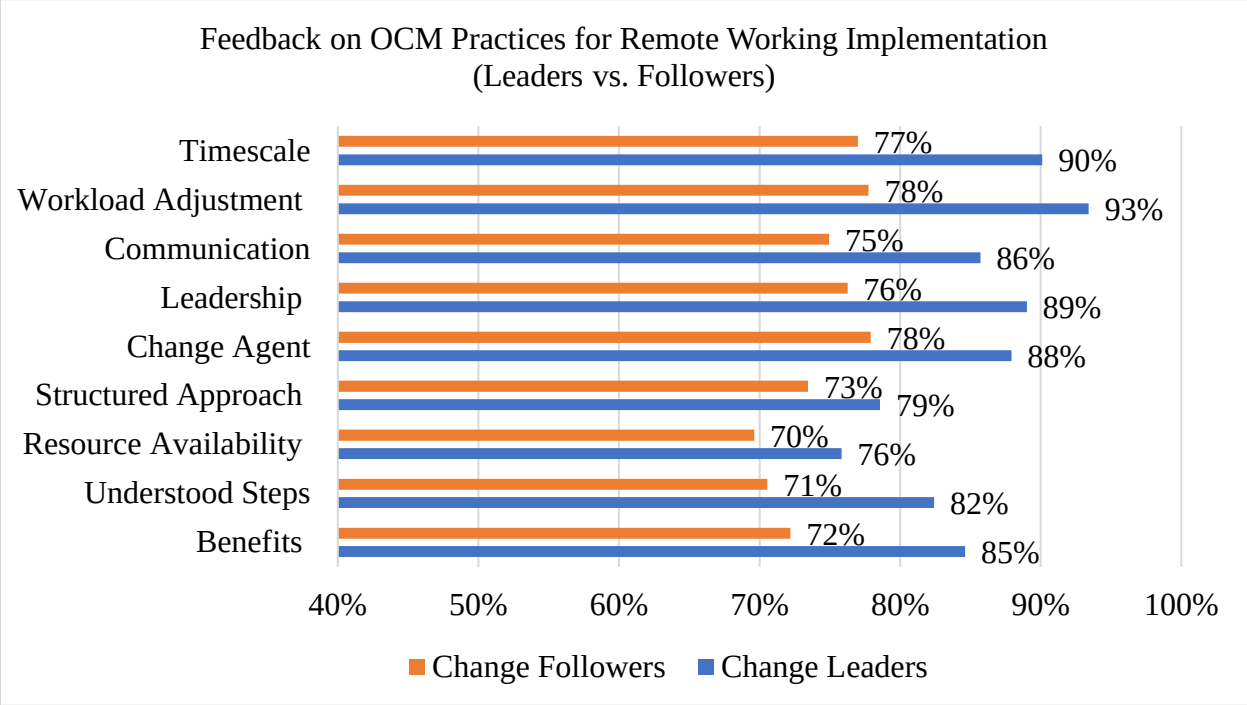

Figure 3.15: Feedback score on OCM practices for implementation of remote working model

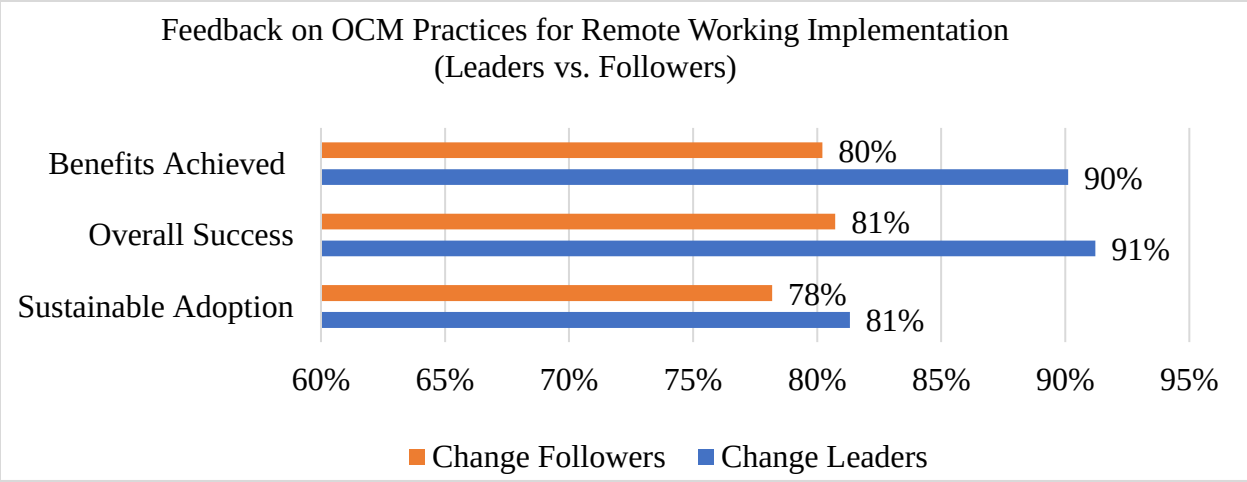

Figure 3.16: Feedback score on change adoption measures for implementation of hybrid working model

Case Study: Organization X

Organization X accounted for a total of 62 responses (6 leaders and 56 employees) on two major change initiatives - implementation of safety protocols and transition to hybrid working model - in response to the COVID-19 pandemic, and on behalf of six different facilities. Figure 3.17 provides the overall satisfaction score for the employees and leaders across the nine major OCM strategies utilized to implement the change initiatives, whereas Figure 3.18 compares the change adoption success across three major categories between employees and leadership.

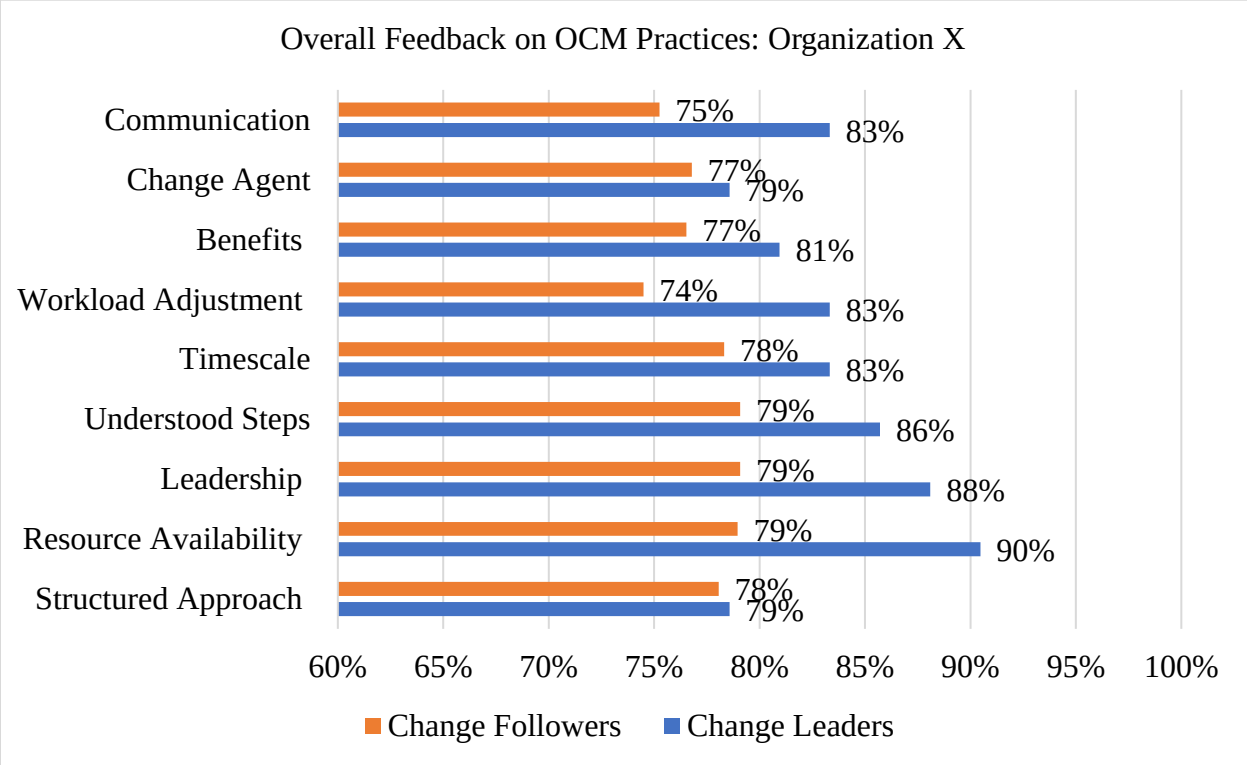

Figure 3.17: Overall feedback score on OCM strategies for Organization X

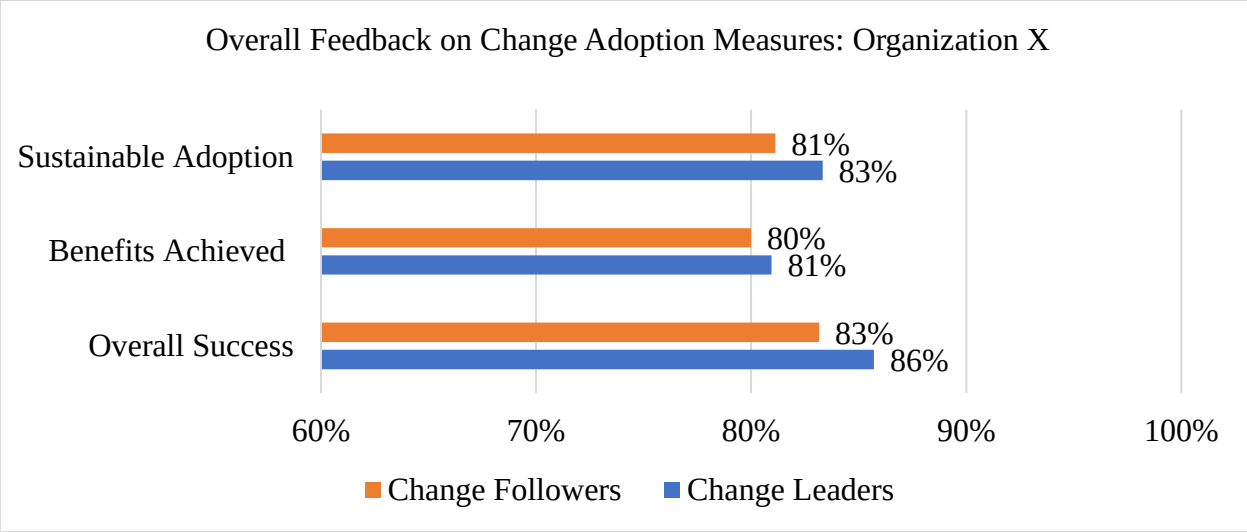

Figure 3.18: Overall feedback score on change adoption measures for Organization X

Figures 3.19 and 3.20 investigate the feedback from the employees and leaders of Organization X on the implementation of safety protocols at its various facilities. Figure 3.19 provides the feedback score on OCM practices, whereas Figure 3.20 summarizes the feedback on three major change adoption measures. Based on Figures 3.19 and 3.20, it was evident that there existed high disparities in the feedback scores for OCM strategies, while the change adoption scores were consistent between the leaders and employees.

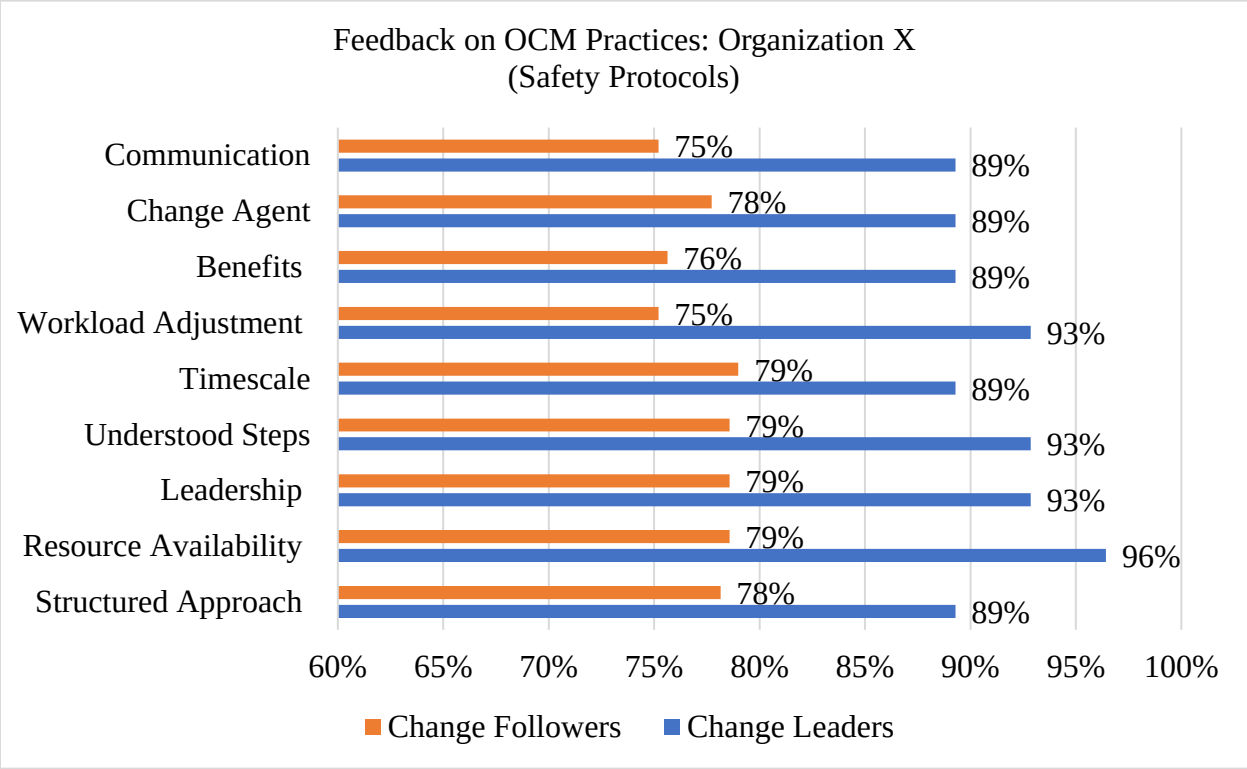

Figure 3.19: Feedback score on OCM strategies for implementation of safety protocols model at Organization X.

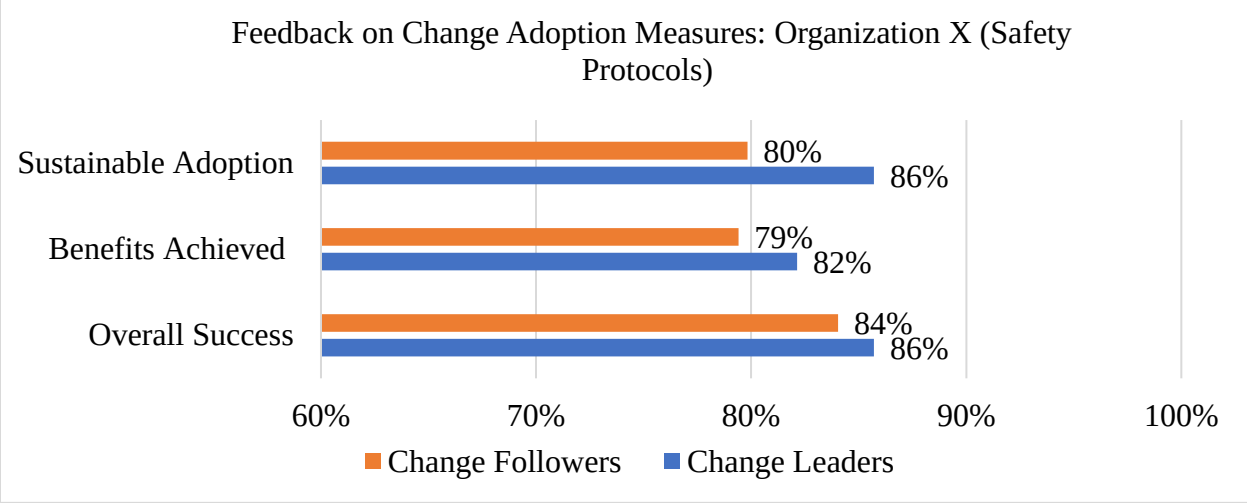

Figure 3.20: Feedback score on change adoption measures for implementation of safety protocols at Organization X

Similarly, Figures 3.21 and 3.22 illustrate the feedback score across OCM practices and change adoption measures for the implementation of a hybrid working model, respectively. While the feedback on change adoption measures was consistent for both types of change, the

feedback scores for OCM practices utilized to implement the change recorded drastic differences. In particular, feedback from the hybrid working model included positive disparities, where organizational leaders undervalued their efforts to implement the change initiative.

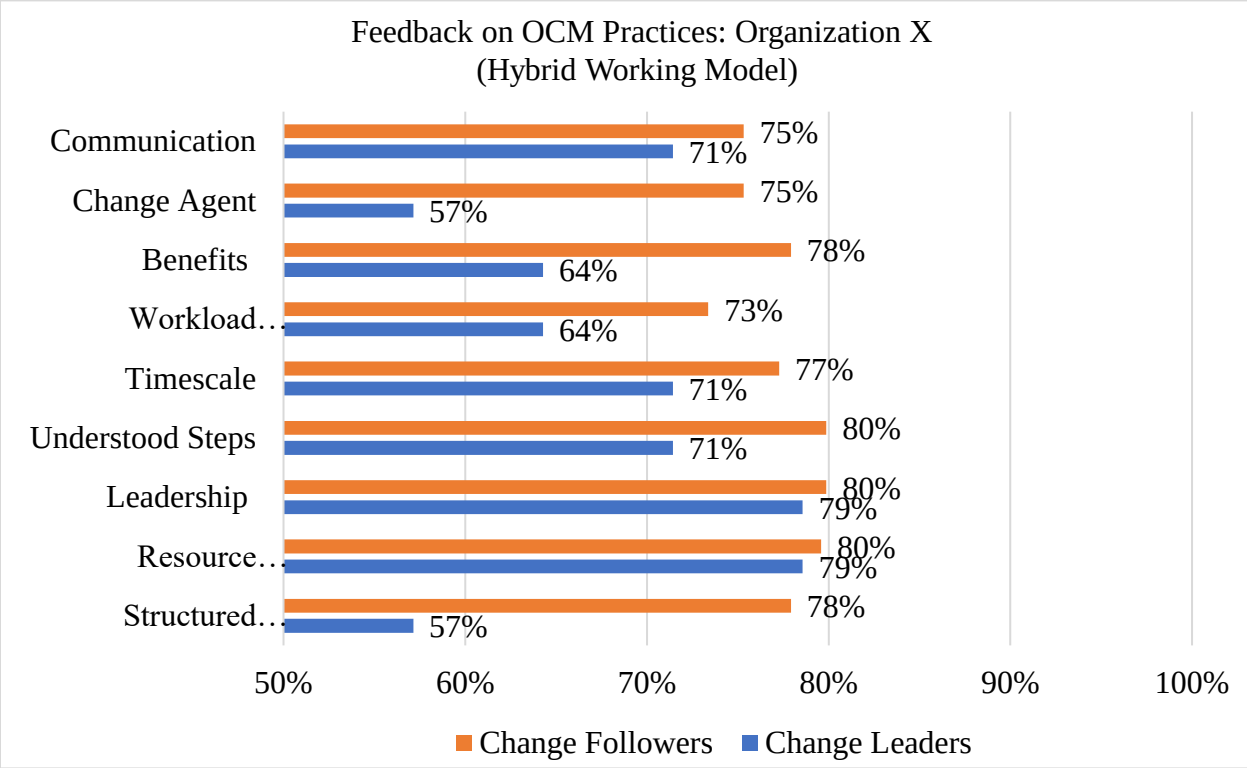

Figure 3.21: Feedback score on OCM strategies for implementation of hybrid working model at Organization X.

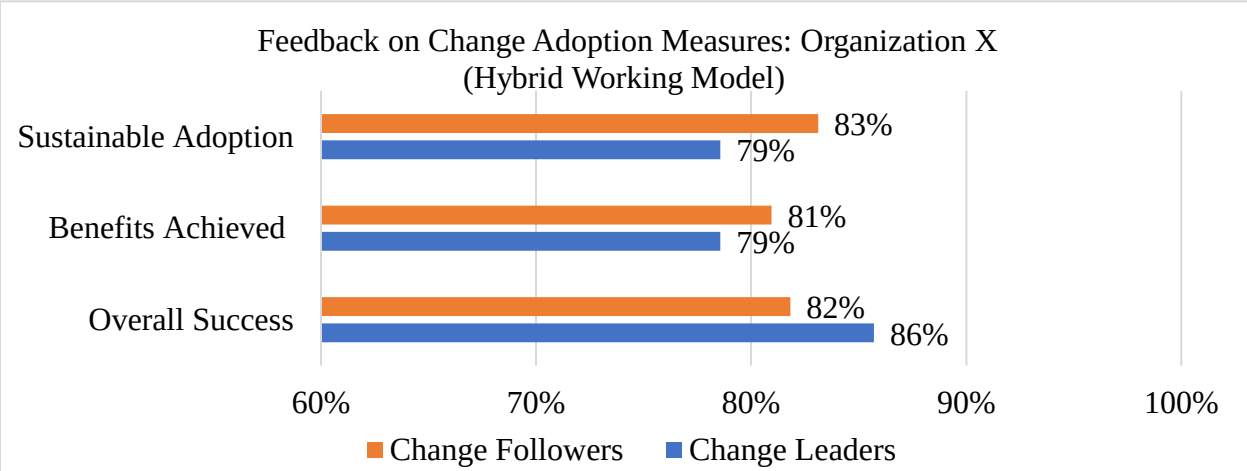

Figure 3.22: Overall feedback score on OCM strategies for implementation of hybrid working model at Organization X

Compared to the ambiguity of the disparate responses of other organizations, it is apparent that Organization X recorded high disparities based on the OCM practices and adoption feedback for different types of change implemented. While the feedback on adoption measures for the hybrid working model was consistent between Organization X and all other organizations, the feedback on OCM practices demonstrated positive disparities for Organization X, whereas other organizations recorded consistent feedback. On the other hand, Organization X observed high feedback disparities among OCM practices for the implementation of safety protocols, while other organizations recorded high disparities for the implementation of the remote working model.

Statistical Analysis

The research team used various statistical analysis techniques to further investigate the findings from the descriptive analysis and conducted additional tests to identify the key factors responsible for successful change implementation based on the feedback from individuals that were directly impacted by the change. In particular, the research team performed Mann-Whitney Tests to evaluate the difference in distribution between leaders and employees on the nine OCM practices and three change adoption measures. Additionally, the classification models were developed using the random forest and logistic regression methods to identify key factors to determine the successful adoption of change initiatives.

Table 3.1 provides the results of the Mann-Whitney U test, where the difference in the distribution of feedback scores between organizational leaders and employees was tested across nine OCM practices and three change adoption measures. As shown in Table 3.1, three out of

nine OCM practices and two out of three change adoption measures had statistically significant differences in the distribution of the feedback score.

Table 3.1: Mann-Whitney U test results

Category	**Key Parameters**	**P-value**
Organizational Change Management Practices	Benefits	0.5276
	Change Agent	**0.0391**
	Communication	0.5253
	Leadership	**0.0212**
	Resource Availability	0.0368
	Structured Approach	0.7480
	Timescale	0.6314
	Understood Steps	**0.0732**
	Workload Adjustment	0.5837
Change Adoption Measures	Overall Success	**0.0472**
	Benefits Achieved	**0.0265**
	Sustainable Adoption	0.4814

Figures 3.23 and 3.24 illustrate the disparities in feedback scores between leadership and employees. According to Figure 3.23, the observed differences between OCM practices were statistically significant in the areas of leadership involvement, knowledge of necessary steps to execute the change, and appointment of an individual to lead the change effort. Based on the results, leadership was shown to have overestimated their performance for all three statistically significant OCM strategies utilized. Similarly, Figure 3.24 helps to corroborate the difference in successful change adoption from employees as well as leaders' perspective among two out of three change adoption measures. As shown in Figure 3.24, organizational leaders recorded higher adoption success as compared to the employees for the overall change adoption and benefits achieved from the change.

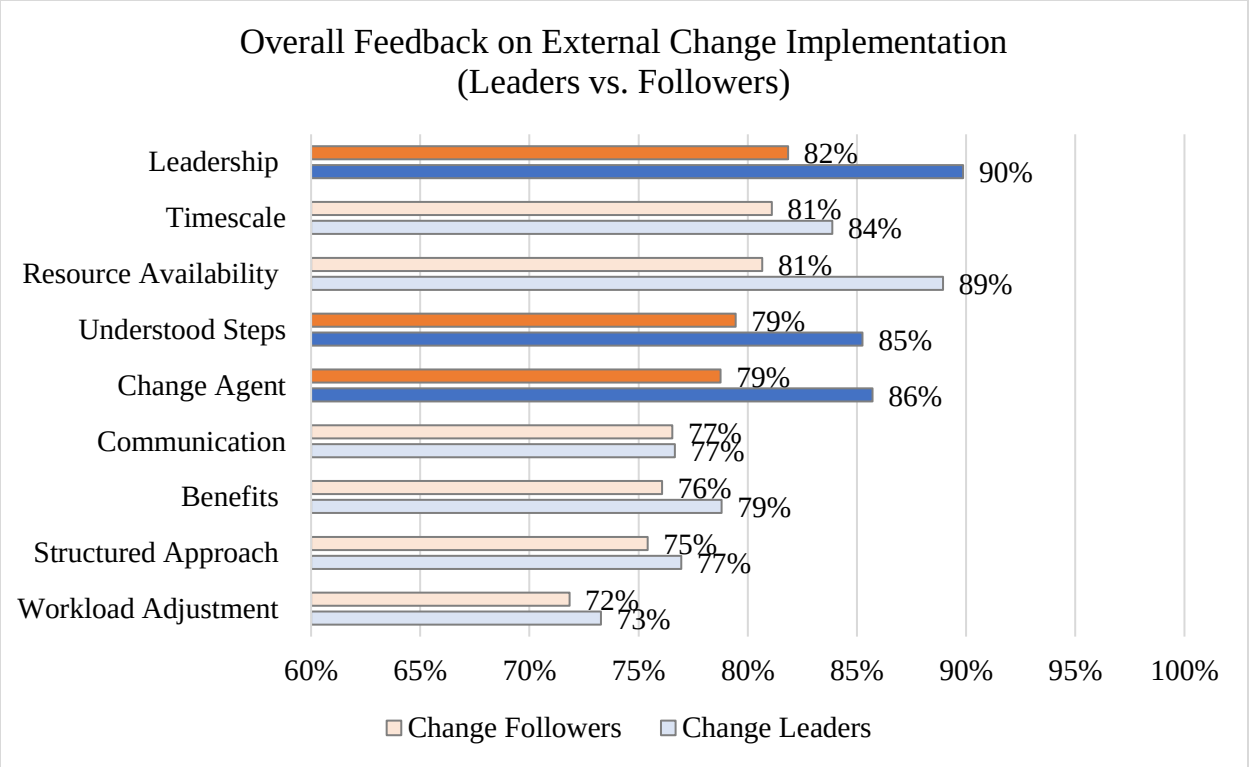

Figure 3.23: Overall feedback score for statistically significant OCM practices, based on Mann-Whitney U test results

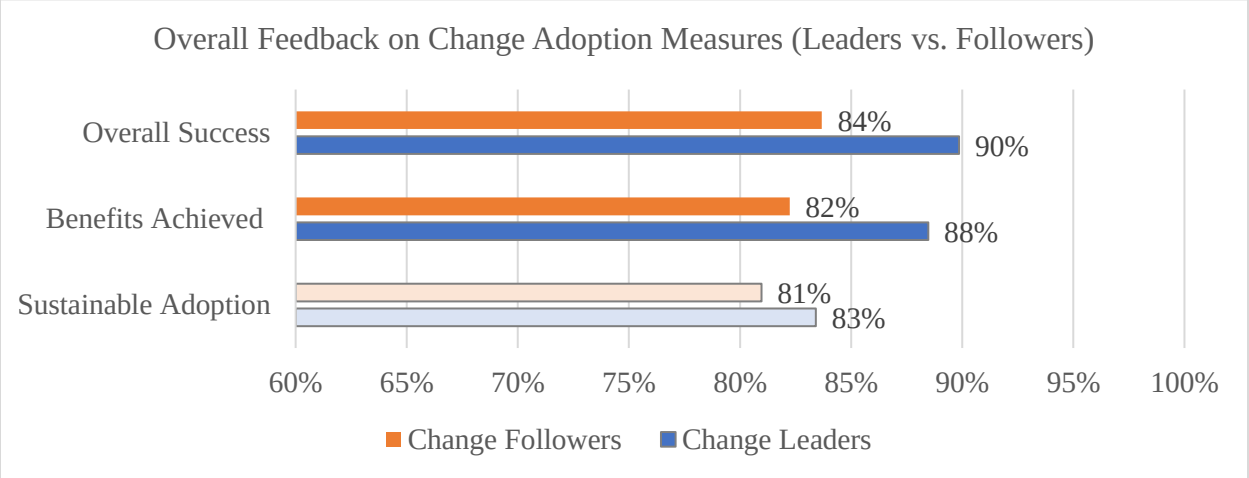

Figure 3.24: Overall feedback score for statistically significant change adoption measures, based on Mann-Whitney U test results

Three random forest models were developed to identify the top governing factors that drive change adoption measures, whereas three logistic regression models helped to identify the relationship between the top factors and the adoption outcome. Random forest is a highly robust

analysis technique that overcomes common issues like collinearity and bias, which also makes it one of the most used classification analysis methods. Since the final model is a combination of multiple decision tree models, this method tends to perform much better than other classification analysis techniques like KNN, LDA, logistic regression, among others (James, 2013). Like other machine learning and deep learning algorithms, it is difficult to interpret the results of a random forest model. Hence, this study used a logistic regression method to interpret the findings more accurately. Logistic regression is another popular classification method, which uses sigmoid curves to classify observations based on the calculated probability (James, 2013).

For this study, a total of 270 records were available to train and test the statistical models. Both models, random forest and logistic regression, were developed using a random selection of 70% of the available data and tested or validated against the remaining 30% of data. A total of six statistical models, three logistic regression and three random forest models, were created for each change adoption measure as an outcome parameter. For the random forest model, a combination of 1,000 decision trees (ntree) were used to develop each model. Since one of the random forest models aimed at assessing overall change adoption was statistically insignificant, only the remaining two classification models were discussed in this study. Table 3.2 provides the results of the two random forest models (Model 1 and Model 2), which were developed to study the achievement of change benefits and long-term change adoption. For the classification analysis, the change adoption measures and OCM practices were converted from ordinal to binary parameters. Both the models were statistically significant at a 95% confidence level, where Model 1 recorded a P-value of 0.028 and Model 2 recorded a P-value of 0.05 (see Table 3.3).

Table 3.2: Random Forest results – Model 1 and Model 2

Model 1: Change Benefits Achieved		Model 2: Long-term Change Adoption	
Parameters	**Importance**	**Parameters**	**Importance**
Leadership Support	100	Timescale	100
Change Agent	96	Leadership Support	86
Structured Approach	93	Change Agent	86
Timescale	82	Clear Understanding	81
Personal Benefits	80	Structured Approach	75
Clear Understanding	75	Resource Availability	73
Resource Availability	75	Communication	72
Workload Adjustment	65	Personal Benefits	64
Communication	65	Workload Adjustment	62
Facility Location: Rural	49	Primary Use: Other	46
Change: Facility Operations	49	Change: Safety Protocols	45
Change: Remote Working	48	Change: Remote Working	38
Space: Within a Building	39	Primary Use: Laboratories	36
Primary Use: Office	38	Change: Hybrid Working	35
Primary Use: Other	36	Facility Location: Rural	33

Table 3.3: Random Forest models performance

	Model 1	**Model 2**
Accuracy	81.25%	77.97%
95% CI	70.97%, 89.11%	72.13%, 83.08%
P-Value	0.028	0.05

As shown in Table 3.2, the results of Model 1 identify the top 15 parameters based on the order of their importance, in order to classify the outcome of successful or unsuccessful achievement of the benefits from employees' perspective. Similarly, the results of logistic regression were used to validate the relationship between the top 15 parameters and the achievement of intended change benefits (see Appendix 3.1). Based on the results, the support of

senior leadership had the most significant positive impact on the achievement of change benefits. The appointment of a dedicated leader to navigate the change and follow a structured approach during the change implementation process had a significant positive impact toward achieving the intended benefits.

As shown in Table 3.2, the top nine out of 15 parameters that governed the outcome of benefits achieved were OCM practices, where the communication of the change details and availability of financial resources were the only factors that did not have a positive impact on the outcome. Other OCM practices, like timescale or speed of the change implementation process, and the communication of personal benefits from the change, also had a significant positive impact on the outcome.

In addition to the OCM practices, other organizational characteristics also had an impact on the achievement of change benefits. The location of the facility, its primary use, and the type of change implemented at the facility were among the top 15 factors. Organizations with facilities located in rural areas struggled to achieve the intended benefits from the change, whereas facilities primarily used for offices were more successful in achieving the benefits from the change, as compared to facilities used for educational, industrial, assembly, and other primary use types. Among the major change initiatives, organizations that modified their facility operations were more successful in achieving benefits than other change initiatives. As shown in Table 3.3, Model 1 recorded an excellent performance with the ability to correctly predict the outcome of 82% from the test data and based on the key identified parameters.

The second random forest model (Model 2) was developed to identify key factors responsible for the long-term change adoption. Similar to Model 1, the top nine factors that governed the outcome of long-term change adoption included OCM practices. While the top nine

practices were similar to Model 1, the order of arrangement was different for the OCM practices identified in the Model 2. Additionally, the organizational characteristics identified in Model 2 were different from Model 1. The relationship between the top 15 parameters and successful long-term change adoption was determined using the logistic regression model (see Appendix 3.2).

For successful long-term change adoption, the timescale or speed of the change implementation process was the most important factor that positively impacted the outcome. Other critical OCM parameters that positively impacted long-term change adoption included commitment from leadership, appointment of a leader to manage the change, and understanding the necessary steps for successful implementation. The communication of the change details and how it would personally benefit everyone did not positively impact the long-term adoption. Organizations that were located within rural areas or implemented changes at facilities that were primarily used as laboratories may struggle to sustain the change in the long-term. Finally, the implementation of a hybrid working model was on track for successful long-term adoption, whereas organizations that implemented safety protocols as a response to the COVID-19 pandemic may have only short-term adoption.

In summary, organizations are recommended to involve senior leadership and vocalize their support during the implementation of an unplanned change. As per the results, leadership support was only the most important factor for successful change adoption, but it also recorded the highest disparities between employees and leadership. Organizations should also be conscious of the type of unplanned change initiative based on the desired goals, where changes like implementation of safety protocols may not be sustainable but transition to remote working can lead to long-term adoption.

3.5 CONCLUSION

During the COVID-19 pandemic, FM professionals were tasked with implementing various changes to ensure the functionality of their organization and the safety of their stakeholders. These changes had a direct or indirect impact on the employees or stakeholders of the organization. This study investigates the disparities between employees and organizational leaders, pursuant the change management practices utilized, as well as the overall success with the change adoption. Additionally, this paper evaluates the impact of OCM practices and organizational characteristics on the outcome of an unplanned change initiative, based on the feedback from end users. Using a survey questionnaire, the feedback on nine OCM practices and three change adoption measures was recorded from 32 organizational leaders, as well as 354 employees that were impacted by the changes at the same organization.

Based on the Mann-Whitney U test, the difference between the distribution was statistically significant for three out of nine OCM practices and two out of three change adoption measures. The results showed that the organizational leaders overestimated their performance among all three OCM strategies, including leadership support, appointment of a dedicated change agent, and understanding the necessary steps to navigate the change. The organizational leaders also overestimated the success with overall change adoption and benefits achieved from the change as compared to the employees. In addition, three random forest models were developed to identify significant factors responsible to predict the outcome for each change adoption measure, and three logistic regression models were created to determine the relationship between the significant factor identified through the random forest model and the change adoption measures. Two out of three random forest models were statistically significant at a 95% confidence level and recorded an accuracy of approximately 80%. Based on the results,

almost all nine OCM practices had the most significant and positive impact on the successful achievement of benefits and long-term change adoption.

The constant support from senior leadership, the appointment of a dedicated individual to lead the change effort, and a timescale of the change implementation phase were among the most critical factors that led to a successful outcome. Organizations that were primarily used as office spaces were able to gain the intended benefits from the change and those that implemented a hybrid working model were on track for the long-term change adoption. Meanwhile, organizations located in rural areas struggled with achieving desired benefits and the implemented safety protocols recorded short-term adoption.

Finally, this study will be instrumental toward arming change leaders with the ability to recognize the areas with significant disparities, particularly those disparities between change leaders and employees, based on the same change initiatives. In addition, this study further restores the importance of OCM practices for successful change adoption, based on the perspectives of end users or workers at the forefront of such changes. Going forward, organizational leaders can benefit from this study by utilizing it as a reference to help effectively apply a structured change management approach whenever implementing changes due to unforeseen conditions, and can assist with aligning their strategic performance with the expectations of end users.

3.6 REFERENCES

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3.7 APPENDICES

3.1: Logistic regression model results for achievement of change benefits

```
> summary(logit_binary_2)

Call:
NULL

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.68133  -0.28353   0.05391   0.19119   2.15906

Coefficients: (2 not defined because of singularities)
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                      10.2158  1610.3962   0.006  0.99494
`changeImplementation of Safety Protocols (Social distancing, Sanitation, etc.)` -17.9761  2399.5458  -0.007  0.99402
`changeModifications in Facility Operations & Maintenance Activities`            4.1075     1.5689   2.618  0.00884 **
changeSafety                                                                         NA         NA      NA       NA
`changeTransition to Hybrid Working Model (mix of virtual and physical)`        -0.4273     1.3675  -0.312  0.75468
`changeTransition to Remote Working Model (100% virtual)`                            NA         NA      NA       NA
structured_approach_OCM1                                                         1.8309     0.9726   1.883  0.05976 .
resource_avail_OCM1                                                             -0.2911     0.7109  -0.409  0.68219
leadership_OCM1                                                                  1.2786     0.7291   1.754  0.07947 .
understand_steps_OCM1                                                            0.4097     0.8231   0.498  0.61864
timescale_OCM1                                                                   0.8710     0.7610   1.145  0.25240
workload_adjustment_OCM1                                                         2.5126     1.0497   2.394  0.01668 *
benefits_OCM1                                                                    1.1817     0.7713   1.532  0.12553
change_agent_OCM1                                                                2.0056     0.8737   2.295  0.02171 *
communication_OCM1                                                              -1.0219     0.9639  -1.060  0.28908
`Q4_space_typeSingle Building`                                                  -1.5491     1.3721  -1.129  0.25889
`Q4_space_typeSpace within a building`                                           2.2503     2.0469   1.099  0.27162
`Q28_facility_settingCentral Business District`                                 -0.4006     2.0108  -0.199  0.84211
`Q28_facility_settingIndustrial park`                                            0.9490     3.4431   0.276  0.78284
`Q28_facility_settingRural Area`                                                -0.8166     3.2863  -0.248  0.80376
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`       -1.8165     2.0119  -0.903  0.36657
`Q28_facility_settingSuburban area`                                              0.4972     1.8037   0.276  0.78281
four_IndustriesManufacturing                                                    -1.6715     3.3128  -0.505  0.61387
four_IndustriesServices                                                         -1.6887     1.4284  -1.182  0.23712
`Q30_primary_useEducation (Education/Training/Classrooms)`                      -14.3655  1610.3947  -0.009  0.99288
Q30_primary_useLaboratories                                                     -12.4895  1610.3958  -0.008  0.99381
Q30_primary_useOffice                                                           -12.5046  1610.3951  -0.008  0.99380
Q30_primary_useOther                                                             -8.4052  1610.3958  -0.005  0.99584
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 228.638  on 189  degrees of freedom
Residual deviance:  88.109  on 164  degrees of freedom
AIC: 140.11

Number of Fisher Scoring iterations: 15
```

3.2: Logistic regression model results for long-term change adoption

```
> summary(logit_binary_3)

Call:
NULL

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.5903  -0.4404   0.2843   0.5487   2.1504

Coefficients: (2 not defined because of singularities)
                                                                                Estimate Std. Error z value Pr(>|z|)
(Intercept)                                                                     14.78801 1435.09188   0.010   0.9918
`changeImplementation of Safety Protocols (Social distancing, Sanitation, etc.)` -17.45019 1487.49610  -0.012   0.9906
`changeModifications in Facility Operations & Maintenance Activities`           -0.92206    1.19281  -0.773   0.4395
changeSafety                                                                        NA         NA      NA       NA
`changeTransition to Hybrid Working Model (mix of virtual and physical)`         0.24816    0.86184   0.288   0.7734
`changeTransition to Remote Working Model (100% virtual)`                           NA         NA      NA       NA
structured_approach_OCM1                                                         0.57464    0.61410   0.936   0.3494
resource_avail_OCM1                                                              0.47899    0.63233   0.758   0.4488
leadership_OCM1                                                                  0.54342    0.58298   0.932   0.3513
understand_steps_OCM1                                                            1.23692    0.65211   1.897   0.0579 .
timescale_OCM1                                                                   1.36131    0.65060   2.092   0.0364 *
workload_adjustment_OCM1                                                         1.48880    0.64294   2.316   0.0206 *
benefits_OCM1                                                                   -0.19033    0.60563  -0.314   0.7533
change_agent_OCM1                                                                0.47640    0.71780   0.664   0.5069
communication_OCM1                                                              -0.83912    0.69864  -1.201   0.2297
`Q4_space_typeSingle Building`                                                  -0.35960    1.07789  -0.334   0.7387
`Q4_space_typeSpace within a building`                                           0.39178    1.43460   0.273   0.7848
`Q28_facility_settingCentral Business District`                                 -0.36689    1.54985  -0.237   0.8129
`Q28_facility_settingIndustrial park`                                           -1.42154    2.28033  -0.623   0.5330
`Q28_facility_settingRural Area`                                                -0.99405    2.28020  -0.436   0.6629
`Q28_facility_settingSecondary downtown location (uptown, midtown, etc.)`       -0.09722    1.32953  -0.073   0.9417
`Q28_facility_settingSuburban area`                                             -0.52577    1.28508  -0.409   0.6824
four_IndustriesManufacturing                                                     0.02952    1.84515   0.016   0.9872
four_IndustriesServices                                                          1.24677    1.01277   1.231   0.2183
`Q30_primary_useEducation (Education/Training/Classrooms)`                      -15.79920 1435.09102  -0.011   0.9912
Q30_primary_useLaboratories                                                     -18.85017 1435.09180  -0.013   0.9895
Q30_primary_useOffice                                                           -16.79473 1435.09134  -0.012   0.9907
Q30_primary_useOther                                                            -15.18189 1435.09151  -0.011   0.9916
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 226.82  on 189  degrees of freedom
Residual deviance: 136.63  on 164  degrees of freedom
AIC: 188.63

Number of Fisher Scoring iterations: 15
```

OVERALL CONCLUSION

The three studies comprised in this dissertation investigate the change management process from three distinct perspectives within the facilities management (FM) industry: planned change from leaders' perspective, unplanned change from leaders' perspective, and unplanned change from employees' perspective. All three studies utilized some of the key organizational change management strategies and three change adoption measures to assess organizational readiness for the successful implementation of a change initiative. The first study evaluates the organizational readiness to implement a planned strategy to improve existing practices, the second investigates the implementation of an unplanned change initiative, and the third paper studies the performance of the implementation of an unplanned change initiative from the perspective of end users. The research used the implementation of flexible workplace solutions as a planned change initiative, whereas changes implemented at facilities in response to the COVID-19 pandemic were considered as unplanned changes. Based on three datasets of more than 1,500 responses received from around the world, the research team developed various machine learning algorithms to identify some of the critical factors responsible for successful change adoption measures.

Overall, the results of these studies emphasize the importance of a structured change management process on the ability to achieve successful outcomes. While the impact of change management strategies may vary based on the type of change or intended outcome, the impact of a formal change management process was most dominant among all three studies, unlike other aspects considered, such as organizational characteristics, the type of change, or motivational factors. The findings of these studies provide FM professionals and other organizational leaders with a customized change management reference guide, with solutions to help increase the

likelihood of successful implementation based on the desired outcome or type of change initiative. Future research studies can expand on the strategies utilized within the change management process. Likewise, it would be beneficial to identify the key factors responsible for successful adoption of a planned change initiative, according to the perspectives of end users.

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