MANAGEMENT PRACTICES TO IMPROVE ADOPTION AND EMPLOYEE WELL-BEING DURING ORGANIZATIONAL CHANGES IN THE AEC INDUSTRY

By

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ABSTRACT

The business world is in a continuous state of change. Changes create opportunities for businesses to enhance their processes and create challenges to survive in the market. For organizations to survive and remain competitive in the fast-changing business world, they need to be adept at adopting changes. That also applies to the architecture, engineering, and construction (AEC) industry. The AEC industry is pushed to adopt new changes due to a range of competitive dynamics, including strains in the supply chain, the need to adjust to new delivery methods, increased demands for workforce development programs, the need to increase productivity, safety, and quality, and a variety of further market pressures including pandemics and recessions. However, change adoption is a challenging and complicated task for any organization to do. Moreover, it often ends with failure; It is argued that more than half of change efforts fail to meet their intended goals and outcomes. This high failure rate is due to multiple hindrances and barriers that the AEC industry faces, including the lack of a clear and structured change management process, employee resistance to change, and scarcity of time and resources needed to implement the change, to name a few. Throughout the literature, previous studies have investigated management practices that could overcome adoption barriers; many management practices were proposed to overcome adoption barriers. However, organizations have been using inconsistent mixtures of practices across the AEC industry that have created a variation in the achieved adoption outcomes between organizations adopting the exact change. This study aims to identify and analyze a set of change management practices that adopting organizations in the industry can learn, use, and develop to achieve desired goals and outcomes of any type of change. To achieve this goal, the study had to have a data that represent the AEC industry and covers a wide variety of changes that the industry is adopting, identify a set of most common and most effective change

management practices, and analyze the effectiveness of that set in overcoming significant change adoption barriers; high failer rate, employee resistance, and lack of proper time and training rresourcesRespectivelyy, the study first identified a set of practices that are most prominent in the literature of organizational behavior and AEC. Second, the study collected 633 change adoption cases from all different types of firms in the industry (architecture, engineering, contractor, and owner organizations) for a wide variety of change types (technology, management, and business changes). Third, the study analyzed the importance of using the set of practices to overcome the high failure rate of change adoptions, reduce employee resistance to change by increasing employee well-being during the change process, and successfully implement the change under a shorter timeline. The study has analyzed the data using simple and advanced statistical methods, including descriptive, univariate, bivariate, regression, and content analyses.

The study results emphasized the importance of using all six identified change management practices to overcome change adoption barriers and achieve the best possible outcomes of the change. Furthermore, the result identified the essential practices of the six that should be emphasized not only to avoid main change adoption barriers but also to achieve the highest levels of desired adoption outcomes.

This study contributes an industry-wide view of change management practices and different levels of change adoption success, employee well-being, and adoption timeline using a broad spectrum of change types. The study can assist practitioners in the AEC industry to better manage, strategize, and allocate resources to avoid change adoption failure and achieve all its desired goals and benefits. Additionally, it can assist in supporting the adoption process under specific time restrictions.

DISSERTATION FORMAT

This dissertation follows the three-journal-paper format. Chapter 1 consists of a brief introduction of the research, overall research background, gap in the literature, research questions and objectives, data sample, and research outline. Chapters 2, 3, and 4 are formed as three journal papers. More precisely, Chapter 2 of this dissertation identifies the most common organizational change management (OCM) practices in the literature that drive the successful adoption of change initiatives in the architecture, engineering, and construction (AEC) industry. Then, the chapter analyzes and models the relationship between OCM practices and different levels of change adoption success. The findings shown in Chapter 2 of this dissertation were published in a special collection on "Re-thinking the Benefits of Adopting Digital Technologies in the AEC Industry" in the ASCE *Journal of Management in Engineering*. Chapter 3 of this dissertation analyzes one of the new topics of interest in the AEC industry regarding employee well-being (EWB). The chapter models the relationship between OCM practices and EWB in the context of organizational change management. Chapter 4 of this dissertation builds on previous chapters and explores the absence of one of the most significant OCM practices and its relationship with successful change adoption. The chapter identifies the best OCM practices when implementing organizational changes under an accelerated timeframe. Finally, Chapter 5 provides a cohesive conclusion, contributions, limitations, and recommendations for future research of this dissertation. Additional information related to this research was provided in the Appendices. Specifically, Appendix A includes definitions of the main research variables. Appendix B presents the factor loading analysis performed in this study. Appendix C shows a sample of respondents' comments. Appendix D includes a power analysis of regression models of Chapters 2 and 3. Finally, Appendix E shows the moderation and mediation analysis of EWB on the relationship of OCM practices and CAC.

TO MY WIFE, FAMILY, AND ADVISOR

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LIST OF ABBREVIATIONS

AEC – Architecture, Engineering, and Construction

OCM – Organizational Change Management

PCA – Principal Component Analysis

CAC – Change Adoption Construct

EWB – Employee Well-Being

MNLR – Multinomial Logistic Regression

CHAPTER 1: INTRODUCTION

BACKGROUND

In today's rapidly changing market, effective management of organizational change adoption has become a core competency for many industries, including the Architecture, Engineering, and Construction (AEC) industry, to remain competitive in a constantly evolving marketplace. However, many barriers and hindrances stand in the way of successfully adopting an organizational change initiative. Using organizational change management best practices can overcome change adoption challenges and help organizations realize the benefits of the change by successfully implementing it. In this context organizational change management (OCM) is defined as the management strategies used to adopt new or different processes from the organization's current process to achieve organization-wide goals (Burnes 2009; Rogers 2003; Shea et al. 2014).

Previous research has indicated that more than half of change management efforts fail to meet their intended goals (De la Boutetière et al. 2018). As a result, change management has become an essential organizational skill set in the AEC industry; in fact, this topic was added as a part of the Project Management Professional (PMP) certification by the Project Management Institution (PMI) at the beginning of the year 2021.

The AEC industry is noted as being both highly competitive and yet slow to change (Gholizadeh et al. 2018). Meanwhile, the AEC industry faces numerous pressures to improve productivity, safety, and sustainability (Loosemore 2014). To cope with this market pressure, the industry is rapidly adopting innovations in various areas such as technology, innovative management processes, and alternative business structures. However, adopting an organizational change is a complicated task (Rogers 2003) that often ends with organizations failing to successfully adopt the change (Ahn et al. 2004). This suggests the opportunity to leverage interdisciplinary insights that can improve the ability of AEC firms to adopt changes – such as

changes related to the adoption of new technologies and other innovative modes of operation – with greater speed and success. In theory, this improvement can be accomplished by identifying organizational change management practices that organizations can utilize to achieve the desired benefits of change.

GAP IN THE LITERATURE

Although previous studies have addressed change adoption in the AEC industry, past research designs have primarily focused on the functionality and benefits of adopting the change itself rather than the management process required to overcome hindrances and barriers of the change adoption process.

Based on a thorough literature review, the following gaps were found in the AEC literature related to OCM:

- *Limited types of change*: studies often limited their scope of inquiry to a single type of change, such as technological changes in general, or on a specific change such as Building Information Modelling (BIM), Augmented Reality / Virtual Reality, and so on.
- *Limited organizational contexts*: studies were often limited data collection to a specific population or sector of the AEC industry, such as electrical contractors, owners, general contractors, or design firms separately.
- *Limited sample sizes*: research designs were often limited to case studies of ten or fewer organizations.
- *Many OCM Practices*: many OCM practices have been presented throughout the literature. The variation in adoption levels may be caused by studies investigating

different OCM practices which have a relatively varied association with change adoption success. Limited research has focused on a collective set of OCM practices that are applicable for use across the AEC industry.

- *Lack of nuance in measuring outcome variables*: while the use of different OCM practices is directly proportional to successful change adoption, there is no current research that analyzed various levels of successful change adoption (for example, what is distinct about the most successful cases of change adoption when compared to other cases?) Most studies have limited their analysis to the correlation between OCM practices and successful change adoption.
- *Lack of connection between OCM practices and employee well-being (EWB)*: no current research analyzed the relationship between OCM practices and their effect on employee well-being (EWB) in the AEC industry. In the context of an organizational change event, EWB can be defined as a range of observable behaviors from resistant to supportive behaviors. This is a vital variable given that resistance to change is among the most often cited barriers to successful change outcomes.
- *Lack of analysis when one or more OCM practices are inapplicable to implement*: realistic timeframe is one of the key important OCM practices to achieve successful change adoption, as found in the literature and this research. Also, a realistic time frame is the only OCM that is not always available for organizations to utilize. Many organizations adopt change initiatives under a tight timeframe due to specific constraints. There is no current research that analyzed the absence of a realistic timeframe as one of the OCM practices while adopting organizational change initiatives in the AEC industry.

RESEARCH OBJECTIVES

The objective of the dissertation was to identify and analyze a set of OCM practices that can be learned, used, and developed to overcome adoption barriers, avoid adoption failure, and more consistently achieve the desired goals and outcomes of change initiatives in the AEC industry. To achieve this objective, the dissertation identified a set of common OCM practices using an interdisciplinary literature review and pursued three research objectives to analyze the set of OCM practices as follows:

- Research Objective #1: to model the relationship between OCM practices and the different achieved levels of successful change adoption. The intent is to understand (a) how organizations can avoid unsuccessful adoption outcomes and (b) the distinctive OCM practices that achieve the highest levels of successful change adoptions.
- Research Objective #2: to model the relationship between OCM practices and the levels of employee resistance (in the context of EWB). The intent is to understand (a) employee resistance as one of the key barriers to change implementation and (b) foster a better work environment that will positively impact the change adoption.
- Research Objective #3: to study the relationship of OCM practices under fast-tracked or "accelerated" change implementation timelines. This will help practitioners emphasize specific practices that will support the fast adoption rate of change and avoid adoption failure.

DATA SAMPLE

The study collected 633 cases of change adoption across the AEC industry in North America. Each case represents a planned, intentional, and group-wide effort to adopt a single change into the organization's long-term operations. The collected data includes the following variables that will help achieve the overall research objectives:

1. Organizational change management practices
2. Measurement of change adoption success
3. A spectrum of employee reactions during the adoption process
4. Change type
5. Organization demographics
6. Participant's demographics
7. Participant's feedback and comments

In terms of change types, three major types of organizational changes were captured:

1. Adoption of new technologies (represented 44% of the collected cases), which included the adoption of new software (for example, AR/VR, estimating, project management, BIM, and so forth) and hardware technologies (for example, remote sensors, mobile solutions, Internet of Things (IoT), drones, and so forth).
2. Adoption of changes in company business processes (41% of cases), such as the introduction of quality management, alternative procurement, alternative delivery, and so forth.
3. Adoption of changes in organizational structure (15% of cases), such as mergers, acquisitions, reorganizations, and new market entry.

For a summary of the data sample, please refer to Table 2 in Chapter 2.

SUMMARY OF SUBSEQUENT CHAPTERS

Subsequent chapters of this dissertation follow a 3-paper format and a concluding chapter. This section summarizes the three research papers in Chapters 2 to 4 that will achieve the overall research objectives.

Chapter 2 of this dissertation was published in a special collection on "Re-thinking the Benefits of Adopting Digital Technologies in the AEC Industry" in the ASCE Journal of Management in Engineering. The full reference for the published paper is provided below:

Maali, O., Kepple, N., and Lines, B. (2022). "Strategies to Achieve High Adoption of Organizational Change Initiatives within the AEC Industry." *Journal of Management in Engineering*, 38(4), 04022021.https://doi.org/10.1061/(ASCE)ME.1943-5479.0001051. The summary of this paper is provided below:

- **Objective:** The objective of this study was to model the relationship between change management strategies and different levels of change adoption success (high, medium, and low or unsuccessful adoption). Previous research has not differentiated between levels of adoption; therefore, this study contributes to the body of knowledge by identifying the strategies needed to achieve high levels of change adoption.
- **Method of Analysis:** The study used multinomial logistic regression (MNLR) to model the relationship of OCM strategies as the predictors of the three levels of change adoption. The MNLR model was structured to indicate which OCM practices have the most remarkable association with achieving a very successful change adoption compared to other successful and unsuccessful change adoptions. As shown in appendix A, additional statistical tests were used to build up to perform MNLR, including descriptive analysis, reliability analysis, factor reduction, zero-order correlation analysis, missing data analysis,

multiple linear regression, combining dependent categories, and the eight assumptions of regression.

- **Results:** The (MNLR) results found several differences in the OCM strategies used by cases that achieved low, moderate, high adoption:
  - Five OCM strategies must be used effectively together to avoid low adoption. This suggests that multiple strategies must be used together to adopt changes successfully. Otherwise, adoption failure is likely high.
  - The most successful cases were distinguished by highly effective change agents and selecting a more realistic timeframe for the adoption process. This finding is important because it pinpoints two strategies that enable organizations to move from an acceptable to a great adoption.
  - Another interesting finding is that training resources did not have any effects on change adoption, which has several implications for practitioners.
- **Contributions**: This study contributes to the body of knowledge by applying an interdisciplinary approach to study OCM strategies from the field of organizational behavior within the context of the AEC industry. Findings from the MNLR model provide practitioners with insight regarding strategies associated with the highest levels of successful change adoption. In addition, the diverse sample of a spectrum of firms and change types suggests the findings are broadly applicable across a variety of new changes and technologies in the AEC industry.

Chapter 3 of this dissertation presents a research paper titled "Modelling the Relationship Between Management Practices and Employee Well-Being during Organizational Changes in The AEC Industry.". The summary of this paper is provided below:

- **Objective:** The objective of this study was to model the relationship between key management practices and employee well-being in the context of organizational changes that are prominent in the AEC industry. Results can help practitioners better understand which management practices should be prioritized to foster greater EWB and, consequently, achieve more successful organizational change.
- **Method of Analysis:** The study used Multinomial Logistic Regression (MNLR) to model the relationship of the key OCM practices with the continuum of EWB. The MNLR model was structured to indicate which management practices fostered the greatest EWB compared to organizational changes that achieved relatively lower levels of EWB. As shown in appendix B, additional statistical tests were used to build up to perform MNLR, including descriptive analysis, reliability analysis, zero-order correlation analysis, missing data analysis, multiple linear regression, combining dependent categories, and the eight assumptions of regression models.
- **Results:** The (MNLR) results found several differences in the OCM strategies used by cases with low, moderate, high EWB:
    - Organizational changes with the lowest levels of EWB were distinguished by leadership's lack of provision of effective training resources. This finding implies that leadership may avoid poor EWB outcomes by successfully helping employees adapt to the change within their job functions.

- To understand the most effective pedagogical approaches for delivering training resources, the study further investigated eight methods of training resource delivery that are prevalent in organizational changes. The results showed that organizational changes with the highest levels of EWB emphasized interactive simulation-based workshops and on-the-job training; conversely, changes that overly relied on speeches, memos, and electronic newsletters corresponded with the lowest levels of EWB.
- Organizational changes with the highest levels of EWB were characterized by strong leadership in three primary areas. The single most prominent management practice linked with high EWB was the establishment of a realistic timeframe for the change. The following two most important management practices were visible senior leadership commitment and delivery of effective training resources.

- **Contributions:** The study contributes to the body of the knowledge by applying an interdisciplinary approach to study management practices from the field of organizational behavior, psychology, and management within the context of organizational changes in the AEC industry. Findings from the MNLR model provide practitioners with insight regarding management practices that most improve employee well-being during organizational change efforts. Further, the data set suggests that these findings are broadly applicable across various organizational changes that are common in the AEC industry.

Chapter 4 of this dissertation presents a research paper titled "Managing Organizational Change under Tight Time Constrains: Practices for Accelerated Adoption Rates". The summary of this paper is provided below:

- **Objective:** The objective of this study was to identify best management practices for implementing changes under an accelerated timeframe. Results can help practitioners better understand which management practices should be prioritized when adopting change in a tight and restricted duration without jeopardizing the ability to adopt that change successfully.
- **Method of Analysis:** A database of 92 organization-wide cases of accelerated change adoptions in the AEC industry were identified. The time constraints in these cases ranged from accelerated timeframes to significantly accelerated timeframes. The study used descriptive, inferential, and content analyses to understand the differences between successful and unsuccessful cases under fast-tracked adoption rates. Additional content analysis of participant feedback was used to identify the most significant barriers encountered during accelerated changes and how they were overcome.
- **Results:** results found several differences in the OCM strategies used by cases across two levels of fast-tracked timeframes; accelerated and hyper-accelerated time:
    - The collected data has 61 cases of unsuccessful change adoption, 31 cases of successful change adoption, and no single case of very successful change adoption.
    - All five OCM practices were significant to avoid unsuccessful change adoption while fast-tracking the adoption rate.

        - To avoid unsuccessful change adoption while accelerating the adoption process, leadership should focus on one OCM practice, communicating the benefits of change.
        - To avoid unsuccessful change adoption well hyper-accelerating the adoption process, leadership should focus on three OCM practices, communicating the benefits of change, effective change agents, and measuring benchmarks of the change process.
    - **Contributions:** The study contributes to the body of the knowledge by analyzing one of the key OCM practices that have been identified in the two previous studies, a realistic timeframe for the change process. The unfortunate reality in the AEC industry is that a realistic timeframe is not always available; sometimes, a rapid timeline is necessary, and the organization is unable to adjust this constraint. Therefore, this study builds upon the first two papers and aims to provide practitioners with practical tips for managing change adoption under tight time constraints.

Lastly, **Chapter 5** presents the conclusion, contributions, limitations, and recommendations for future research for this dissertation.

End of Chapter 1

CHAPTER 2: STRATEGIES TO ACHIEVE HIGH ADOPTION OF ORGANIZATIONAL CHANGE INITIATIVES WITHIN THE AEC INDUSTRY

Strategies to Achieve High Adoption of Organizational Change Initiatives within the AEC Industry

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ABSTRACT

Organizations must be adept at managing the adoption of change initiatives. However, it is argued that more than half of change adoption efforts fail to reach their objectives. This study aims to model the relationship between six change management strategies and three identified levels of change adoption outcomes (unsuccessful, moderately successful, and very successful). A total of 633 cases of organizational change adoption were collected from architecture, engineering, and construction (AEC) firms across the United States and Canada, where almost half of the cases represent the adoption of digital technologies. Multinomial logistic regression analyses showed that at least five change management strategies must be used effectively in combination to avoid failed change adoption outcomes. Very successful adoption cases have additionally used two strategies (Change Agents, Realistic Timeframe) in a highly effective manner. This study contributes to the body of knowledge of management in engineering by defining three levels of change adoption outcomes and identifying the most effective change management strategies among the different levels.

INTRODUCTION

Organizational change management is a vital skill set for businesses to survive, cope, and stay competitive in a fast-changing world. The architecture, engineering, and construction (AEC) industry is driven to adopt new changes due to a range of competitive dynamics, including strains in the supply chain, the need to adjust to new delivery methods, increased needs for workforce development programs, and a variety of other market pressures including pandemics and recessions (Loosemore 2014). Yet even when the motivations for change are strong and possible advantages are apparent, change can still be difficult to accomplish (Rogers 2003). Years of research on change adoption have shown that change adoption's success rate is consistently low, and it is even lower for adopting digital technologies (De la Boutetière et al. 2018).

There are several types of organizational change initiatives that are common to the AEC, including changes related to digital technologies, management processes, and business approaches. For example, adoption of the Internet of Things (Yeo et al. 2020), sensing technology (Anwer et al. 2021), augmented and virtual reality (Choi et al. 2020b; Tayeh and Issa 2020), construction robots (Pan and Pan 2020), unmanned aerial vehicles (drones) (Jiang and Bai 2020), or BIM (Zhou et al. 2019) are examples of technological change initiatives. Adoption of alternative project delivery methods, quality improvement programs, and alternative procurement methods are examples of management process change initiatives. Changes in business approaches include mergers, acquisitions, reorganizations, and entering new markets. Although all types of change can be difficult to adopt it is noted that the AEC industry's adoption rate for digital technologies tends to be slower when compared to other industries (Edirisinghe 2019; Gholizadeh et al. 2018). The AEC industry's relatively slower pace of adopting change has been theorized as a primary reason for the productivity decline over the past 50 years (Crew 2017).

To overcome the industry's historical challenges with change adoption, both practitioners and researchers have increasingly investigated organizational change management strategies associated with successful adoption outcomes. Organizational Change Management (OCM) strategies are defined as the management practices used to adopt processes that are new or different from the organization's current processes to achieve organization-wide goals (Burnes 2009; Rogers 2003; Shea et al. 2014). However, using a variety of OCM strategies across AEC organizations has created a variation in the successful adoption of change initiatives, specifically when adopting the same type of change initiative. For example, in adopting digital technologies (Chong et al. 2016; Lee and Yu 2016; Liu et al. 2017).

LITERATURE REVIEW

The literature review leveraged studies from the field of organizational behavior as well as the AEC body of knowledge. Both areas included numerous studies regarding hindrances, barriers, drivers, strategies, and recommended frameworks to implement organizational changes. For example, in the organizational behavior literature, several studies have developed organizational change models, which highlight the importance of having a well-planned process to successfully implement organizational changes (Burnes 2009; Kotter 1995; Lewin 1947; Luecke 2003; Rosenbaum et al. 2018). Researchers have also recommended several strategies to overcome barriers and achieve the full benefits of change adoption, including the use of change agents to lead the change process (Brandi and Elkjaer 2012; Kanter 1983; Martin and Hrivnak 2009; Wolpert 2010; Wynn 2019), effective communication of the change's goals and vision (Bourne et al. 2002; Cameron and Quinn 1999; Magsaysay and Hechanova 2017), monitoring the progress of change (Kotter 1995; Magsaysay and Hechanova 2017), top management involvement and

commitment during the change (Armenakis et al. 1999; Beer and Eisenstat 1996; Emiliani and Stec 2005), and providing change-related training (Alvesson 2002; Galpin 1996; Schneider et al. 1994).

The nature of the AEC industry generates several barriers to the change adoption process (Harty 2005; Harty 2008; Lines et al. 2015). To overcome such barriers to change adoption, researchers in the AEC literature have developed a well-planned process using frameworks to better adopt changes (Migliaccio et al. 2008; Price and Chahal 2006). Change management has become so crucial in the AEC industry that it was recommended to be part of the project management professional (PMP) certification by Project Management Institution (Hornstein 2015), which was added to the certification at the beginning of the year 2021.

Previous studies have investigated change initiatives in the AEC industry. However, such studies have primarily focused on the functionality and benefits of the change itself, with a narrow focus on organizational change management strategies (OCM strategies) needed to overcome hindrances and barriers of the change adoption process. This limitation has been noted as a gap in the literature by (Aldossari et al. 2021b; Lines and Smithwick 2019). For example, studies investigating the use of virtual reality (VR) technology to improve safety awareness for machinery operators, (Choi et al. 2020b), testing the reliability and validity of wearable sensors in monitoring worker's physical fatigue (Anwer et al. 2021), the potential applications of unmanned aerial vehicles (drones) technology in site surveying activities (Jiang and Bai 2020; Jiang et al. 2020), measuring the effectiveness of using IoTs technologies in preventing accidents (Yeo et al. 2020), analyzing the effectiveness of interactive holograms as a visualization technique for exporting building models (Tayeh and Issa 2020), examining future applications of construction robots (Pan

and Pan 2020), or the potential benefits and functions of using BIM (Hwang et al. 2019; Liu et al. 2017) to mention a few.

A number of OCM strategies for organizations to achieve successful change adoption have been identified in the AEC literature (Lines and Smithwick 2019). This study used six OCM strategies, including *Senior Leadership Commitment*, *Training Resources*, *Communicated Benefits*, *Realistic Timeframe*, *Change Agent Effectiveness*, and *Measured Benchmarks*. The research methodology section provides specific definitions of each OCM strategy and examples of where these strategies have been used in both the AEC and organizational behavior literature.

Most studies on OCM strategies in the AEC industry were limited by study designs that focused on a single type of change initiative. For example, several studies have considered technological changes (Choi et al. 2020a; Gan et al. 2019; Maali et al. 2020; Sepasgozar et al. 2018a; Sepasgozar et al. 2018b; Yuan et al. 2021) or even individual types of technology, including studies of adopting prefabricated construction technology (Yuan et al. 2021), BIM (Liu et al. 2019; Zhou et al. 2019) and or AR/VR (Carreira et al. 2018; Davila Delgado et al. 2020). In the area of management-related changes, for example, studies have typically focused on specific types of change, including alternative project delivery methods (Aldossari et al. 2021a; Aldossari et al. 2021b), Six Sigma (Siddiqui et al. 2016), and safety management (Nnaji et al. 2019), to name a few. Additionally, other studies were limited in their study parameters by focusing on one specific type of organization within the AEC industry. For example, there are studies that have only focused on change management within general contractor organizations (Vass and Gustavsson 2017) or specifically within the context of electrical contractor organizations (Lines and Smithwick 2019) rather than the AEC industry as a whole.

POINT OF DEPARTURE

The literature review identified several gaps in the AEC literature. First, a limited number of studies focus on OCM strategies to achieve successful adoption of change; rather, most studies have focused on the functionality and beneficial outcomes of adopting a particular change. Second, no current research has measured and identified different levels of successful change adoption and compared them together regarding OCM strategies; researchers focused either on successful or unsuccessful change adoption (Aldossari et al. 2021b; Lines and Smithwick 2019). Third, the existing literature on OCM is limited by study parameters. For example, focusing on a specific type of change, a specific type of organization, using only case studies, or using limited data samples. All limited the ability to represent or generalize the results for the AEC industry.

RESEARCH OBJECTIVES

To address the gaps in the literature, the objective of this study was to model the relationship between six change management strategies (OCM strategies) and three identified levels of successful change adoption (unsuccessful, moderately successful, and very successful) in the context of various change initiatives across all types of organizations in the AEC industry (architects, engineers, general contractors, subcontractors, owners). The intent of this design was to provide an understanding of the unique association of each OCM strategy in achieving different levels of successful change adoption.

RESEARCH METHODOLOGY

To achieve the study objective, an interdisciplinary literature review of the organizational behavior and AEC literature was performed to identify the most common OCM strategies to

achieve successful change adoption along with commonly used measures of change adoption outcomes. The literature review identified six OCM strategies and three measurements of successful change adoption. Second, a survey questionnaire was developed to measure the effectiveness of using the six OCM strategies and achieving successful change adoption. The survey was designed to collect cases of organizational changes within the AEC industry. The following subsections summarize the interdisciplinary literature review that was used to identify the main study variables (OCM strategies as independent variables and successful change adoption as the dependent variable) and then cover the survey structure, distribution, and summary of the collected data sample.

Six OCM Strategies as Independent Variables

The interdisciplinary literature review approach identified the following six OCM strategies commonly presented in the organizational behavior and AEC bodies of knowledge.

Senior Leadership Commitment: Involvement of top management during the adoption process is one of the commonly cited strategies to build and maintain momentum for a change initiative. Senior leadership should be involved and committed during the entire change adoption process (Armenakis et al. 1999) to enforce and support the adoption (Emiliani and Stec 2005). Top management support is a crucial factor in enhancing the performance of the change adoption process (Aranyossy et al. 2018; Eskerod et al. 2017). The crucial role of senior leadership in supporting the change management process has also been demonstrated in the AEC industry directly (Cheng and Teizer 2013; Lu et al. 2015; Xu et al. 2014). For example, the early commitment of senior leadership commitment was identified as a critical strategy to achieve successful adoption of BIM technology (Liao and Teo 2018; Ozorhon and Karahan 2017) and enterprise risk management solutions (Zhao et al. 2015). For this study, the independent variable

of *Senior Leadership Commitment* was defined as: "the organization's senior leaders were committed to making the change a success (i.e., they 'walked the talk')."

Training Resources: The organizational behavior literature has identified the lack of change-related training and education as being a significant barrier to the successful adoption of change (Alvesson 2002; Galpin 1996; Schneider et al. 1994). In the AEC industry, investing in and providing change-related training was identified as one important factor to avoid adoption failure and achieve successful adoption of communication technology (Lu et al. 2015) and BIM (Ahn et al. 2016; Chang et al. 2017; Liu et al. 2019; Matthews et al. 2018; Ozorhon and Karahan 2017). For this study, the independent variable of *Training Resources* was defined as: "employees had a clear understanding of the action steps to implement the change in their job functions."

Communicated Benefits of the Change: Communicating the advantages and disadvantages of the change to employees within their job functions is essential to overcome change resistance (Bourne et al. 2002; Cameron and Quinn 1999). In the AEC industry, employees are more likely to resist change due to the lack of clearly communicated benefits (Ayinla and Adamu 2018). Arayici et al. (2011) and Peansupap and Walker (2006) stressed the importance of identifying clear benefits and communicating them to employees to achieve successful change adoption. For this study, the independent variable of *Communicated Benefits* was defined as: "Employees clearly understood how the change would benefit them in their job functions."

Establishing a Realistic Timeframe for the Change Adoption Process: The rate of adoption is one of the critical aspects of managing organizational changes. It is defined as the relative speed with which change is adopted by members of an organization (Rogers 2003). An organization may encounter resistance to change by the employees if they feel that the timeframe and rate of adoption required to adopt the change is unrealistic (Smollan 2011). In the AEC

industry, long-term implementation plans based on the rate of implementation are one of the critical factors to overcome barriers to successfully implementing organizational changes (Li and Becerik-Gerber 2011; Loosemore and Cheung 2015; Peansupap and Walker 2006; Sullivan 2011; Tan et al. 2012; Zhou et al. 2019). For this study, the independent variable of *Realistic Timeframe* was defined as: "the speed at which the organization implemented the change was appropriate."

Effective Change Agents: One of the most cited OCM strategies to achieve successful change adoption is the use of change agents. Change agents are individuals who are assigned to guide and support the change adoption process and are often known as the "internal champions of change" (Hunsucker and Loos 1989; Kanter 1983). Change agents can support change adoption because they increase knowledge transfer, offer personal growth opportunities, and ultimately set forth a model to support novice employees (Martin and Hrivnak 2009; Wolpert 2010). An important aspect of change agent effectiveness is selecting the right individuals to serve in this role because their knowledge level determines their capacity to support the change process (Brandi and Elkjaer 2012). Wynn (2019) discussed the struggles that organizations may encounter when change agents leave the change process even when otherwise strong change management strategies are in place. Similarly, in the AEC industry, identifying a team of champions that is open to change and ready to drive and support the adoption process has been shown to enhance the acceptance and adoption of that change (Ahn et al. 2016; Lee and Yu 2016). For this study, the independent variable of *Change Agent Effectiveness* is defined as: "the change agents (transition team) responsible for managing the change in the organization were effective."

Establish Clear and Measured Benchmarks of the Change Process: Identifying clear goals for the change and executing careful planning with measured benchmarks were among the top strategies performed by well-managed change initiatives (Magsaysay and Hechanova 2017).

Identifying short-term successes and celebrating them during the adoption process will reward involved employees and foster the change process (Kotter 1995). In the AEC industry, establishing clear and measured benchmarks of the change process is an important strategy to support successful change adoption outcomes (Lines and Reddy Vardireddy 2017). On the other hand, the lack of clear and measured benchmarks may cause employees to be more reluctant to change and revert to old methods (Liao and Teo 2018). For this study, the independent variable of *Measured Benchmarks* was defined as: "the organization established clear benchmarks to measure the success of the change adoption process."

Measuring the Level of Change Adoption

Successful adoption of change is the goal of any change initiative. This goal has been measured in different ways throughout the literature. For this study, three variables (*Implemented into Operations, Benefits Achieved, and Long-Term Sustainability*) were used to measure the success of change adoption and were based on previous AEC literature (Aldossari et al. 2021b; Lines and Smithwick 2019). These three variables (defined in Table 1) were used to construct one single variable representing the overall success of change adoption (*Change Adoption Construct,* CAC). CAC is a reliable indicator of successful change adoption in the AEC industry (Aldossari et al. 2021b). Due to the significant difference in the levels of change adoption between organizations in the AEC industry (Chong et al. 2016; Lee and Yu 2016; Liu et al. 2017), the CAC was categorized into three distinguished levels of successful change adoption as listed in Table 1.

Table 1. Measurement of successful change adoption

Change Adoption Variables	Definition
Implemented into Operations	The organizational change was successfully adopted in the organization's operations as intended.
Benefits Achieved	The organization achieved benefits through implementing the change.
Long-Term Sustainability	The organization has sustained the change in its long-term operations (or is on track to sustain the change).
Change Adoption Construct (CAC)	The overall organizational change adoption is measured as the linear composite of the optimally weighted change adoption variables. (The obtained variable encompasses the above three measures of successful change adoption)
Success Levels of Change Adoption	Three levels of adoption levels were identified based on the three change adoption measurements as reported by respondents. The three levels are unsuccessful, moderately successful, and very successful change adoption.

Survey Design, Distribution, and Data Collection

The survey was designed to gather responses where each response represented an organizational change initiative implemented by a single organization in the AEC industry. The survey was defined to collect a range of change adoption outcomes from unsuccessful to very successful. The survey was designed using an online tool that reached participants via e-mail distribution.

The survey had three sections. In the first section, participants were asked to identify and describe one organizational change that their firm had experienced and the respondent was personally involved in. For the second section of the survey, participants were asked to rate their agreement or disagreement with six statements regarding the effective use of OCM strategies (independent variables) and three statements regarding successful adoption outcomes of that change (dependent variables), all using a 7-point Likert-type ordinal scale (7 = *strongly agree* to 1 = *strongly disagree*). Such ordinal scales use fixed responses to measure the opinions and attitudes of respondents (Bowling 1997; Burns and Groves 1997). The third and final section of the survey was designed to collect demographics about participants and their organizations, including organization type and respondents' years of professional experience.

A purposive sample of more than 20 professional groups was selected to be included in the survey distribution. Three selection criteria were used. First, the study sought well-recognized groups that represented all different types of firms in the industry (architecture, engineering, contractor, and owner organizations). Second, these groups were selected with the intent that they would include firms of all different sizes (for example, covering both general and specialty contractors of all sizes). Third, national and international groups were included to assure a broad geographical coverage of the responses. Based on the selection criteria, a number of professional groups were selected, including Associated Builders and Contractors (ABC), American Council of Engineering Companies (ACEC), Associated General Contractor (AGC), American Institute of Architects (AIA), Construction Owners Association of America (COAA), International Facility Management Association (IFMA), National League of Cities (NLC), and National Society of Professional Engineers (NSPE) to name a few, as well as readership from Engineering News-Record (ENR). Although many professional organizations agreed to participate, the research team

was not given direct access to all membership contact lists. Therefore, survey distribution was mediated through regional and local chapter managers from the participating groups. The survey instrument was distributed to the chapter managers, who were then asked to distribute it directly to their members. In this manner, the snowball technique was used to expand the outreach of the survey instrument within these groups; recipients of the survey instrument were asked to participate and complete the survey if they have been involved in an organizational change case and or to forward it to other individuals within their group or any other organizations within the AEC industry who have been involved in an organizational change adoption case.

In total, 633 cases of organizational change adoption were collected. Each case represents a single organizational change initiative that an AEC organization had experienced. However, none of the collected cases have been addressed multiple times for the same organization by different participants. Hence, each response represents a single perspective of one specific change adoption case for an organization within the AEC industry.

The collected data represents a broad spectrum of change types and organizations in the AEC industry, as shown in Table 2. Based on the collected change cases, three major types of change were identified using participants' descriptions of the change they were involved in. The first identified change type was technological changes (technology as listed in Table 2), which included the digital or software changes (examples include AR/VR, estimating, project management, and BIM) and hardware technological changes (examples include remote sensors, mobile solutions, Internet of Things, and drones). The second change type was for changes in the company's management processes (management process listed in Table 2), including the introduction of alternative project delivery methods (DB, CMAR, PPP, and IPD) and business process improvements (examples include quality management and alternative procurement).

Table 2. Summary of the data sample (N=633)

Change Type	**Frequency**	**Percentage**
Technology	229	36.2%
Management Process	217	34.3%
Business	80	12.6%
No answer /Not applicable	107	16.9%
Organization Type	**Frequency**	**Percentage**
Owner/operator	271	42.8%
EPC/general contractor	36	5.7%
Subcontractor/specialty contractor	178	28.1%
Architecture/engineering consultant	53	8.4%
Facilities management and operation	17	2.7%
Other	41	6.5%
No answer /Not applicable	37	5.8%
Respondent Years of Professional Experience	**Frequency**	**Percentage**
Less than five years	15	2.4%
5–9 years	24	3.8%
10–19 years	89	14.1%
20–29 years	192	30.3%
30–39 years	177	28%
40 or more years	71	11.2%
No answer /Not applicable	65	10.3%

The third change type was for changes in organizational structure and business approach (business as listed in Table 2); examples include mergers, acquisitions, hierarchical reorganizations, and entering new markets. The grouping of three main change types was based on previous literature that categorized change into different types based on the change purpose, main impacted processes, and required changes to implement the change (De la Boutetière et al. 2018). To complement the snowball technique, not all survey questions were required to be answered (not all questions were forced-response questions). While no significant missing data were found for both the independent and dependent variables (less than a total of 3% for both variables), there were some non-responses to individual questions in the data. However, missing data analysis showed that all missing data appeared to be missing at random, and the likelihood of bias arising from the missing data was therefore concluded to be low.

METHOD OF ANALYSIS

Data analysis was performed in six steps. First, descriptive statistics and univariate analysis were performed to confirm the suitability of the data to conduct further statistical analysis. Second, to obtain a single measurement for successful change adoption, Cronbach's alpha and Principal Component Analysis (PCA) were performed to produce one dependent variable (*Change Adoption Construct,* CAC) that represented a construct of the three measurements of successful change adoption. Third, bivariate analysis was performed to assess the relationship between the six OCM strategies and CAC as the change-adoption measurement. Fourth, multiple linear regression was performed by regressing CAC on OCM strategies to model the relative, unique contribution of each OCM strategy towards successful change adoption. Fifth, three levels of successful change adoption were categorized based on respondents' descriptions of the change they were involved in

(unsuccessful, moderately successful, and very successful change adoption cases). To confirm the distinguishability of the three levels of successful change adoption, the Wald test for combining dependent categories was performed (Anderson 1984). Sixth and finally, multinomial logistic regression (MNLR) was performed to model the relationship between OCM strategies and the three different levels of successful change adoption by comparing two success levels with the third level as the reference category. The MNLR model was selected over ordinal logistic regression models to avoid the potential bias of assuming parallel regression across all CAC levels and ultimately to improve the decision-making process of which strategies to focus on during the change adoption process to achieve higher levels of successful change adoption (Long and Freese 2014).

Bivariate relationships analysis of the controlling variables (change type, organization type, and respondent years of prof. experience) using one-way ANOVA and post hoc test showed statistically non-significant differences in successful change adoption between different groups of change types and respondent years of professional experience. For example, there were statistically non-significant differences in successful change adoption between different change types, including technology, management process, and business changes. This means that the type of change does not significantly influence successful change adoption.

For groups of the organization type variable, one-way ANOVA and post hoc testing showed that successful change adoption was statistically significantly different between its groups $F(5, 516) = 2.6$, $p = .025$. Tukey's post hoc analysis revealed a statistically significant difference ($p < 0.05$) between groups of (EPC or general contractors) and of (subcontractors or specialty contractors), but not between any other group combinations. A possible explanation is that specialized organizations (for example, roofing contractors and plumbing contractors) have greater

expertise in a specific area than do more broadly focused organizations (for example, general contractors and EPC organizations), and such specialization may ease the process of implementing technologies that are related to the firm's area of expertise.

However, adding any of the controlling variables (change type, organization type, and respondent years of prof. experience) to the multivariate analysis did not significantly contribute to the model (the model did not explain any of the controlling variables). The results supported excluding these controlling variables from the multivariate models. Also, it allowed the data sample to be treated as a single dataset, which could be used to represent any of the three change types in the AEC industry.

RESULTS

Univariate Analysis

All research variables (independent and dependent variables) can be considered to be approximately normally distributed based on univariate analysis, including skewness and kurtosis (George and Mallery 2010).

Internal Reliability of Change Adoption Measurements and PCA

To produce a single reliable measurement of successful change adoption, three variables were used (*Implemented into Operations, Benefits Achieved, and Long-Term Sustainability*). These three variables were shown to have high internal consistency based on a Cronbach's alpha value of 0.853, which is above the acceptable threshold of 0.7 (DeVellis 2003).

To produce one dependent variable (CAC), Principal Component Analysis (PCA) was performed. The suitability of PCA was assessed before the analysis. Inspection of the correlation matrix showed that all variables had a correlation coefficient greater than 0.3. The overall Kaiser-

Meyer-Olkin (KMO) measure was 0.704, with all individual KMO measures greater than 0.6. A KMO value of 0.704 is classified as good according to Kaiser (1974) classification. Bartlett's test of sphericity was statistically significant ($p < .0005$), indicating that the data was likely factorizable. Visual inspection of the scree plot indicated that one component should be retained (Cattell 1966). Also, the one-component solution met the interpretability criterion. PCA revealed one component with an eigenvalue greater than 1, explaining 77.4% of the total variance. The extracted component was named the Change Adoption Construct (CAC).

Bivariate Relationships between OCM Strategies and Change Adoption Construction

The bivariate results showed a statistically significant positive correlation between all OCM strategies and CAC. Table 3 shows the bivariate results of Zero-order correlation using Pearson's correlation between OCM strategies and CAC. The bivariate analyses and visual inspection of scatter plots showed approximate linearity. Based on (Cohen 1988), this means that all six OCM strategies were statistically significant and should be included in multivariate models.

Table 3. Pearson's results between OCM strategies and CAC (N=621)

ID	Variable	A	B	C	D	E	F
A	Senior Leadership Commitment	1.000	-	-	-	-	-
B	Training Resources	0.457*	1.000	-	-	-	-
C	Communicated Benefits	0.476*	0.669*	1.000	-	-	-
D	Realistic Timeframe	0.478*	0.629*	0.569*	1.000	-	-
E	Measured Benchmarks	0.489*	0.553*	0.499*	0.503*	1.000	-
F	Change Agent Effectiveness	0.535*	0.599*	0.592*	0.629*	0.595*	1.000
1	CAC	0.537*	0.548*	0.604*	0.606*	0.575*	0.685*

* Correlation is significant at the 0.01 level (2-tailed).

Multivariate Analysis

Multiple linear regression and multinomial linear regression were conducted to ascertain and model the relationships between OCM and CAC. The results of each model are based on the final adjusted model that has the best fit and alignment with the associated regression model assumptions. For the multivariate analysis stage, case-wise deletion was performed to ultimately remove seven outliers (Allison 2014).

Multiple Linear Regression

Table 4 shows regression coefficients and standard errors of the final adjusted model of the multiple linear regression. The results indicated that the regression model significantly predicted change adoption as measured by CAC (F (6, 588) = 153.73, $p < .001$). The final model explained 61.1% of the observed variance in CAC ($R^2 = 0.611$).

Table 4. Multiple regression results for CAC (N= 595)

OCM strategies	B	SE B	95% CI (LL, UL)	R^2	Adj. R^2
Model				.611	.607
Constant	-3.411**	.131	(-3.67, -3.15)		
Senior Leadership Commitment	.127**	.024	(.079, .174)		
Training Resources	-0.18	.026	(-.07, .033)		
Communicated Benefits	.162**	0.25	(.114, .211)		
Realistic Timeframe	.099**	0.24	(.052, .147)		
Measured Benchmarks	.083**	.021	(.043, .124)		
Change Agent Effectiveness	.188**	.024	(.140, .236)		

** Statically significant, $p < .001$

Training Resources did not significantly add to the prediction model, $p = .482$. In contrast, the other five OCM strategies each significantly contribute to the explained variance in the prediction model, $p < .001$. The results indicated that a one-unit increase in the reported *Change Agents'* effectiveness (from strongly disagree to strongly agree on seven point-Likert scale) is associated with a positive increase in CAC score (toward a more successful score) by a factor of .188, holding all other variables constant. In comparison, the CAC score increased by .162 for every unit increase in *Communicated Benefits*, by .127 for *Senior Leadership Commitment*, by .099 for *Realistic Timeframe*, and by .083 for *Measured Benchmarks* (when all other variables in the model are held constant).

Multinomial Logistic Regression (MNLR)

Multinomial logistic regression (MNLR) was performed to overcome the challenges of interpreting the increase or decrease in CAC scores. Using the obtained scores of CAC, three levels of successful change adoption were identified (*Unsuccessful, Moderately Successful, and Very Successful)* based on the three reported measurements of successful change adoption (*Implemented into Operations, Benefits Achieved, and Long-Term Sustainability*). Cases that contain low ratings (in the disagreement range) for these measurements were identified as *Unsuccessful* cases of change adoption. Cases that contain the highest levels of agreement in all three measurements were identified as *Very Successful* cases of change adoption (all responses were "strongly agree"). In comparison, all the other remaining cases contained moderate levels of agreement and were identified as *Moderately Successful* cases of change adoption. The groupings of change adoption scores resulted in 133 (22.4%) *Unsuccessful* cases, 396 (66.6%) *Moderately Successful* cases, and 66 (11.1%) *Very Successful* cases of change adoption.

Wald test for combining dependent categories was conducted to support the groupings of three successful change adoption levels statistically. The results were significant, demonstrating that we can reject the null hypothesis that the groups can be combined for more efficient estimation. Therefore, the results show that the three groups of levels of successful change adoption are distinguishable (Anderson 1984), demonstrating unique conditions associated with each level of successful change adoption.

Table 5 shows the parameter estimates for each of the six OCM strategies of the final adjusted model. For the final multinomial regression, the reference group was *Unsuccessful* change adoption. The first model compares the *Moderately Successful* group to the reference group, and the second model compares the *Very Successful* group to the reference group. It is worth noting that the very successful group represents the top 11% of overall reported adoption cases.

Table 5. Parameter estimates for multinomial regression model (N = 595)

OCM strategies	**Moderately Successful change adoption** (n = 396)			**Very Successful change adoption** (n = 66)		
	Odds Ratio	95% CI (LL, UL)	P-Value	Odds Ratio	95% CI (LL, UL)	P-Value
Intercept			< .001			< .001
Communicated Benefits	1.575	(1.25, 1.98)	< .001	2.559	(1.50, 4.36)	.001
Senior Leadership Commitment	1.386	(1.01, 1.75)	.006	1.243	(.792, 1.95)	.344
Realistic Timeframe	1.296	(1.04, 1.61)	.020	2.321	(2.32, 3.93)	.002
Training Resources	1.014	(0.80, 1.29)	.909	.926	(0.57, 1.51)	.757
Change Agent Effectiveness	1.535	(1.23, 1.92)	< .001	6.666	(3.71, 11.98)	< .001
Measured Benchmarks	1.215	(0.99, 1.50)	.062	1.459	(1.03, 2.07)	.034

Note: Both CAC levels are compared to the "reference" group of Unsuccessful change adoption (n = 133).

The final multivariate model significantly improved the prediction of CAC levels in comparison to the intercept-only model ($\chi^2(12) = 353.05$, $p < .001$). The final model also indicated a good model fit based on goodness-of-fit tests (Long and Freese 2014). Based on Cox and Snell, Nagelkerke, and McFadden pseudo R^2 measures, the model explained between 35.9% and 54.8% of the variance in CAC. The model correctly classified 78.1% of the cases.

When comparing Successful versus Unsuccessful cases, the results indicated that when an organization increased its focus on *Communicated Benefits* (by one unit on a scale of 7), the odds of having a successful change adoption case approximately increased by 60%, all else being equal. Furthermore, the odds between the same groups increased by 50% for *Change Agent Effectiveness*, 40% for *Senior Leadership Commitment*, and 30% for *Realistic Timeframe* when all other variables in the model are held constant. On the other hand, *Training Resources* and *Measured Benchmarks* were not statistically significant for this comparison.

Similarly, when comparing groups of *Very Successful* cases with *Unsuccessful* cases of change adoption, the results indicated that when an organization increased its focus on *Change Agent Effectiveness* (by one unit on a scale of 7), the odds of having a *Very Successful* change adoption case increased by 570% (a factor of 6.7), all else being equal. In comparison, the odds of having a *Very Successful* change adoption case increased by 160% (a factor of 2.6) for *Communicated Benefits*, by 130% (a factor of 2.3) for *Realistic Timeframe*, and by 50% (a factor of 1.5) for *Measured Benchmarks*, when all other variables in the model are held constant. For this comparison, neither *Training Resources* nor *Senior Leadership Commitment* was statistically significant.

When the reference group was changed to *Moderately Successful* change adoption, the results of comparing against the *Very Successful* group showed that only two OCM strategies (*Change Agent Effectiveness, Realistic Timeframe*) were statistically significant $p < .05$, with an odds ratio of 4.3 and 1.8, respectively. This means that these two strategies are the key differentiable strategies between *Very Successful* and *Moderately Successful* change adoption cases. In other words, organizations can elevate the success level of change adoption by utilizing an exceptionally high level of *Change Agent Effectiveness*, which increased the odds by 330% (a factor of 4.3), along with a highly *Realistic Timeframe*, which increased the odds by 80% (a factor of 1.8).

DISCUSSION

The positive bivariate correlations between all six OCM strategies and successful change adoption across all types of change initiatives and organizations are consistent with previous findings in the literature on organizational change management within the AEC industry (Aldossari et al. 2021b; Lines and Reddy Vardireddy 2017; Maali et al. 2020). This shows the importance of using organizational change strategies to successfully adopt a wide variety of change initiatives across the AEC industry.

The insignificant difference in successful adoption levels between different types of change (technology, management processes, business) shows that no specific type of change is more challenging to adopt than other types in the AEC industry. This opposes the claims of some studies that adopting digital technologies are much harder to implement when compared to other types of change (De la Boutetière et al. 2018). In other words, this result shows that adopting digital technologies is roughly equivalent in difficulty as adopting other types of change within the AEC

industry. Moreover, it shows again that achieving successful change adoption does not rely on the type of adopted change but instead relies more heavily on the management strategies used to implement the change.

The results of the multinominal logistic regression model identified two sets of critical strategies that practitioners can use to (1) avoid unsuccessful adoption of change and (2) achieve the highest possible levels of successful adoption of change.

Avoiding Unsuccessful Change Adoption Outcomes

Based on the results of the MNLR regression models, *Unsuccessful* change adoption cases were distinguished from *Moderately* and *Very Successful* cases by a lack of using five of the OCM strategies in combination (*Change Agent Effectiveness, Realistic Timeframe, Communicated Benefits, Measured Benchmarks, and Senior Leadership Commitment*). This implies that organizations must conjointly implement all OCM strategies (excluding *Training Resources*) with at least a moderate level of effectiveness to avoid an *Unsuccessful* change adoption outcome.

The fact that *Training Resources* was not critical in avoiding *Unsuccessful* change adoption outcomes was surprising. Previous studies have indicated the importance of *Training Resources* for adopting digital technologies (Chang et al. 2017; Liu et al. 2019; Lu et al. 2015). Future research is recommended to explore how significant factors may mediate the relationship between *Training Resources* and change adoption.

Achieving the Highest Levels of Successful Change Adoption

Based on the MNLR results, cases with the *Very Successful* change adoption were distinguished from *Moderately Successful* cases by the effective use of two OCM strategies (*Change Agent Effectiveness, Realistic Timeframe*). This implies that an organization can elevate the adoption success level by applying these two OCM strategies with extremely high levels of

effectiveness. First, assigning a dedicated team of "change agents" who are open to, have been trained on, and have clear organizational goals of the change is critical. To be successful, their role should include responsibility for leading, supporting, communicating the goals, and engaging in all aspects of the implementation process. Both the organizational behavior and AEC literature have stressed the importance of change agents (Hunsucker and Loos 1989; Kanter 2003). For example, the use of change agents increased the acceptance and adoption of technologies BIM in the AEC industry (Ahn et al. 2016; Gu and London 2010; Lee and Yu 2016). Also, previous studies showed that organizations struggle with many difficulties when change agents depart during the adoption phase (Wynn 2019).

Second, since time is a unique resource, organizations should be sensible about identifying the required time and speed to adopt the change and strive to utilize a *Realistic Timeframe*. The adoption timeframe should consider the time required for employees to learn, implement, and adapt to the change in their daily processes. Underestimating the required time will typically create obstacles to the adoption process (Li and Becerik-Gerber 2011; Loosemore and Cheung 2015; Peansupap and Walker 2006; Sullivan 2011). Furthermore, an impractical or unrealistic timeframe may generate resistance among employees (Smollan 2011).

In summary, when AEC organizations embark on a new change initiative, they must ensure that all five OCM strategies noted in the previous sub-section are implemented with a moderate degree of effectiveness to avoid an unsuccessful change adoption out. The chances of a very successful outcome additionally depend upon the highly effective implementation of change agents and a timeframe that is highly realistic for the organization to adopt the change.

CONCLUSION

The objective of this study was to model the relationship between key change management strategies and the three identified levels of successful change adoption. An industry-wide approach was taken to collect 633 cases of organizational change adoption from AEC firms across North America. Almost half of the collected cases represent the adoption of new technologies. The study identified three success levels of change adoption (*Unsuccessful, Moderately Successful, Very Successful*). Then the six OCM strategies were modeled via MNLR to identify the association of OCM strategies with achieving each success level of adoption. The study shows that the effective use of five OCM strategies was crucial to avoiding *Unsuccessful* change adoption. Although it is imperative for organizations to avoid unsuccessful adoption, most organizations intend to achieve the highest possible levels of successful change adoption (and therefore reap the greatest benefits from the initiative). The study shows that achieving the Very Successful levels of adoption relies specifically upon the highly effective use of two OCM strategies (*Change Agent Effectiveness, Realistic Timeframe*). Furthermore, the study shows that achieving successful adoption does not rely on the type of adopted change, whether digital technology, management process, or business process. Instead, successful change adoption relies heavily on the effective use of key change management strategies.

Claimed Contribution

The overall contribution of this study to the body of knowledge of management in engineering and practitioners was by providing a more specific understanding of the unique association of using each OCM strategy to achieve different levels of change adoption outcomes. There are multiple aspects of this contribution that are worth highlighting. First, the MNLR analysis results showed that at least five of the six OCM strategies must be effectively implemented

to avoid *Unsuccessful* adoption outcomes. In other words, if an organization does not adequately implement any single one of those strategies, the initiative would likely yield unsuccessful outcomes. Furthermore, the MNLR analysis showed that to achieve the *Very Successful* levels of change adoption, two OCM strategies (*Change Agent Effectiveness*, *Realistic Timeframe*) must be executed with extreme effectiveness relative to all other OCM strategies. Second, the methodology and approach used to define and measure the three levels of successful change adoption contribute to the body of knowledge by providing a measurement frame that future researchers may utilize. Another contribution of this study is that the study collected an industry-wide and purposive sample of 633 cases of organizational change adoption within the AEC industry, which enables the results to be broadly generalizable. Therefore, these contributions are likely to be of interest to a wide range of engineering professionals, given that the data set represents change cases collected from a range of organization types across the AEC industry, including architects, engineers, general contractors, EPC firms, specialty contractors, and owners. Furthermore, the study results will assist practitioners in better strategizing the implementation of each OCM strategy based on their measured association with successful change adoption.

Limitations and Recommendations for Future Research

Several study limitations were identified. First, the study is limited to the six predominant OCM strategies identified in the literature. Second, the cross-sectional data does not provide any information about the timing and sequence of each OCM strategy; a longitudinal collection of data will help explain the insignificant results and avoid any distilled factors that can be mediated. Third, each change adoption case presents a single point of view regarding OCM strategies and observed outcomes; therefore, the data may have been influenced by respondent bias or inaccurate recall of the change process. Finally, the demographic groups were unevenly distributed, which

limited the findings of the differences between groups. Sixth, the data were collected from members of the AEC industry only in the United States and Canada. Finally, the study is limited regarding factors that may correlate with the levels of successful change adoption; for example, industry trends, underlying motivations, the organization's level of initial investment, and employees' reaction to change were not considered in this study. Besides covering the limitations mentioned earlier, future researchers are recommended to investigate OCM strategies under an accelerated timeframe (when a realistic timeframe is not applicable). Finally, future studies are recommended to investigate the characteristics of change agents and their effectiveness.

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End of Chapter 2

CHAPTER 3: MODELING THE RELATIONSHIP BETWEEN MANAGEMENT PRACTICES AND EMPLOYEE WELL-BEING DURING ORGANIZATIONAL CHANGES IN THE AEC INDUSTRY

Modeling The Relationship Between Management Practices and Employee Well-Being during Organizational Changes in The AEC Industry

ABSTRACT

Employee well-being (EWB) affects the ability of architecture, engineering, and construction (AEC) companies to successfully execute organizational changes. During changes, EWB can be observed in resistance to supportive employee behaviors. However, the relationship of change management practices and their effect on EWB as a major outcome of organizational changes has not been studied at scale in the AEC industry. To address this gap, the study collected EWB data from 517 cases of organizational change across the industry in North America, including the adoption of new technologies and other innovative modes of operation. Multinomial logistic regression results provide practitioners with insights to improve EWB during organizational changes. The results identified management practices that can avoid poor EWB outcomes during changes, such as providing sufficient training resources and emphasizing on-the-job training. Additionally, several change management practices were found to be associated with high levels of EWB. The study highlights the importance of treating EWB as a major outcome of organizational change and contributes an interdisciplinary approach to studying management practices and EWB in the context of organizational changes.

INTRODUCTION

The field of employee well-being has seen growth over the past decades (Diener et al. 2018) and spans different areas of psychology (Tov et al. 2020). In addition, other fields such as

organizational behavior, leadership, and construction have increasingly studied well-being due to many discoveries of its beneficial outcomes (Lingard and Turner 2017; Vincent-Höper et al. 2017). The importance of employee well-being (EWB) is related to its association with the health status of individuals (Diener et al. 2017), career success of individual employees (Lyubomirsky et al. 2005; Walsh et al. 2018), and overall organizational performance (Gratton 2007; Lawler 2003; Sirota and Klein 2013; Sisodia et al. 2007).

Similarly, the interest in studying the relationship between management behavior and EWB has increased dramatically over the past years (Vincent-Höper et al. 2017). The proven beneficial outcomes of EWB and its significant relationship with management practices (Arnold and Connelly 2013; Kuoppala et al. 2008; Vincent-Höper et al. 2017), motivated managers from all fields to identify and adjust their leadership practices to foster higher EWB (Grant et al. 2007).

The architecture, engineering, and construction (AEC) industry is characterized as a demanding, stressful, and dangerous industry to work in (Lingard and Turner 2017). Additionally, the AEC industry is going through numerous changes; in recent years, organizations started to rapidly adopt innovations, changes, and changes to maintain their edge in such a highly competitive and evolving market (Lines and Reddy Vardireddy 2017). Different types of changes are being implemented by organizations in the industry, for example, the adoption of new technological innovations such as the Internet of Things IOTs, mobile technology, sensing technology, augmented and virtual reality, BIM, and many more. Other types include the change in a company's management processes or business approaches, such as the use of alternative project delivery methods, alternative procurement methods, or management systems. A third type includes changes in the organizational structure such as mergers, reorganization, or entering a new market.

Since organizational change is a highly complicated, demanding, and stressful task to execute (Rogers 2003) and often ends with failures (Ahn et al. 2004), researchers have identified management practices that organizations in the AEC industry can use to effectively and successfully implement changes and achieve its outcomes (Aldossari Khaled et al. 2020; Lines and Reddy Vardireddy 2017; Lines and Smithwick 2019; Maali et al. 2020). However, most of those studies have focused on the successful adoption of change as the major outcome and measurement of management performance, whereas EWB was excluded, treated as a secondary outcome, or as a mediator for management performance during the change process (Inceoglu et al. 2018; Montano et al. 2017). This showcases the need for the AEC industry to focus more on EWB as a major outcome of management and measurement of management performance during organizational changes.

To address this need and gap in the AEC industry, the study used an interdisciplinary approach to analyzing the literature on psychology, organizational behavior, and leadership. The objective of this study was to analyze the relationship between management practices and different levels of achieved employee well-being (EWB) in the context of organizational changes. The study further investigated the most effective andragogical approaches for delivering change-related training that are prevalent in organizational changes.

LITERATURE REVIEW

The literature review was conducted with an interdisciplinary approach by studying EWB in psychology and management literature and by identifying the most common organizational change management practices in both organizational behavior and the AEC literature.

Employee Well-Being (EWB)

Defining well-being is hard, and there is no universal definition for it (Burke 2017; Tov et al. 2020; Vincent-Höper et al. 2017; Wright et al. 2017) since well-being is subjective and influenced by people's feelings, emotions, and experiences (Burke 2017) it includes a span of psychological study areas such as personality, emotions, and perception. However, early researchers defined it as the absence of illness or disease. Current research has identified various dimensions and facets to define well-being, such as satisfaction, emotions, experiences, and happiness (Burke 2017), where happiness is one of the most used terms by researchers when defining well-being to the public (Burke 2017; Diener and Biswas-Diener 2008; Layard 2005; Lyubomirsky 2008; Seligman 2004).

Numerous studies have indicated the benefits of well-being for the success of both individuals and organizations (Burke 2017). At the individual level, increased well-being can produce beneficial outcomes for an individual's health (Diener et al. 2017), career success (Lyubomirsky et al. 2005; Walsh et al. 2018), and social relationships (Kansky and Diener 2017).

The use of both self and non-self-reported measures of well-being has proven its validity to obtain useful and consistent information about initial well-being (Eid and Diener 2004; Schimmack and Oishi 2005; Scollon 2018; Tov et al. 2020; Yap et al. 2017). Van De Voorde et al. (2012) and other researchers measured EWB based on workers' happiness and found that it was associated with organizational performance (Gratton 2007; Lawler 2003; Sirota and Klein 2013; Sisodia et al. 2007). Rath et al. (2010) have identified multiple elements to measure overall well-being; career, social, financial, physical, and community. Then they highlighted the association between lower productivity levels, increased health costs, and higher turnover rates with low overall well-being (Cotton and Hart 2003; Rath and Harter 2010; Sears et al. 2013). Kelloway et

al. (2012) measured EWB through general health, trust, and pleasure. In the construction industry, EWB was explained using stress, working hours, pressure, and deadlines (Haynes and Love 2004; Lingard and Turner 2017).

The literature shows that EWB can be measured using different terms such as happiness, job satisfaction, stress, burnout, depression, physical health, and mental health (Sang et al. 2004). Since well-being tends to be associated with the individual's reactions to events (Eid and Diener 2004; Luhmann et al. 2012; Schimmack et al. 2008), EWB and their behavioral reactions respond to the change process are interconnected phenomena (Cummings and Huse 1989; Tavakoli 2010). This study uses observable employee behavior (e.g., reaction, response, participation, and commitment) as the measurement for EWB during organizational change.

Employee reactions to the change process as an observable "displayed" behavior have been identified in several studies in the organizational behavior and AEC literature. The organizational behaviors literature identified a continuum of employee reactions to the change process (Coetsee 1999; Herscovitch and Meyer 2002), ranging from supportive "championing" reactions (Fedor et al. 2006; Herscovitch and Meyer 2002; Jaros 2010; Kim et al. 2011) to unsupportive "resistant" reactions (Bareil et al. 2007; Giangreco and Peccei 2005; Hultman 2006; Piderit 2000; Smollan 2011). Others have categorized employee reactions into passive or active and overt or covert (Bovey and Hede 2001b). Herscovitch and Meyer (2002) categorized employee reactions into favorable or unfavorable reactions, and (Lines 2005) categorized the reactions from negative to positive based on their valence and from weak to strong based on their strength. Similarly, the AEC industry has identified a spectrum of behavioral reactions of employees involved in organizational changes ranging from a 5-point continuum (Lines et al. 2016) to 8–point continuum (Aldossari et al. 2021c). Aldossari et al. (2021c) have analyzed the impact of employee reaction

on successfully implementing alternative project delivery methods. Based on the interdisciplinary literature review, this study used a continuum of eight observable employee behaviors toward the change process to measure EWB during organizational changes.

Leadership and EWB

The research-proven beneficial outcomes of EWB have attracted researchers to analyze the effect of management behaviors on EWB (Vincent-Höper et al. 2017). Various management perspectives, including change management during organizational change and its link to EWB, have received much attention from researchers (Arnold and Connelly 2013; Skakon et al. 2010), and have found an association between change management and EWB (Liu et al. 2010).

Studies have shown a significant impact of management behaviors on EWB (Inceoglu et al. 2018) for a telecommunication organization in Canada (Kelloway et al. 2012), Health workers in Germany (Gregersen et al. 2014), and through meta-analysis of previous studies (Judge and Piccolo 2004). Grant et al. (2007) recommended that management should pay more attention to EWB and how their management practices are impacting EWB to adjust these practices to increase EWB. Also, Tov et al. (2020) have recommended organizations to measure EWB and use it as a metric of organizational success.

Management Practices During Organizational Change

Organizational change is defined in this study as a multi-level process of modifying organizations' old practices by replacing or adding new practices that have an organization-wide impact (Burnes 2009; Levy and Merry 1986; Rogers 2003).

Numerous researchers have studied organizational change management (OCM) practices in the AEC industry. However, they are generally limited by study focus, such as focusing only on technological changes (Gan et al. 2019; Hong et al. 2019; Maali et al. 2020), management changes

such as alternative project delivery methods (Aldossari et al. 2021b), Six Sigma (Siddiqui et al. 2016), and so forth. At the same time, other studies analyzed OCM practices for a specific industry sector, such as electrical contractors (Lines and Smithwick 2019).

The interdisciplinary literature review approach identified the following six OCM practices that were commonly identified in literatures of organizational behaviors and the AEC industry: Senior-leadership commitment; organization's senior leaders were committed to making the change a success (Armenakis et al. 1999; Emiliani and Stec 2005; Lu et al. 2015; Xu et al. 2014), Training resources; employees had a clear understanding of how to implement the change in their job functions (Alvesson 2002; Matthews et al. 2018), Communicating the benefits of change; employees had a clear understanding of how the change would benefit them in their job functions (Ayinla and Adamu 2018; Bourne et al. 2002), Realistic timeframe for the change process; the speed at which the organization implemented the change was appropriate (Smollan 2011; Zhou et al. 2019), Change agents; effectiveness of the "transition team" responsible for managing, leading, and supporting the change process (Ahn et al. 2016; Kanter 1983; Lee and Yu 2016; Wolpert 2010), and Establish clear and measured benchmarks of the change process; the organization established clear benchmarks to measure the success of the change process (Liao and Teo 2018; Magsaysay and Hechanova 2017).

These six identified OCM practices (shown in table 6) align with practices used in previous studies within the AEC industry (Aldossari et al. 2021b; Lines and Reddy Vardireddy 2017; Lines and Smithwick 2019; Maali et al. 2020).

Table 6. Summary of Study Variables

OCM practices (Independent Variables)	Employee Reactions (EWB) (Dependent Variable)	Methods of training delivery (Controlling Variable)	Respondent Demographics (Controlling Variables)
Senior-leadership commitment	Championing	Speeches	Change Type
Training resources	Actively Supporting	Informational Presentations	Organization Sector
Communicating the benefits	Passively Supporting	Memos & Emails	Organization Type
Realistic timeframe	Reluctantly Complying	Instructional Videos	Organization Size
Change agents	Passively Avoiding	Instructional manuals	Respondent Job Position
Establish measured benchmarks	Openly Not Participating	Interactive Workshops / Simulations	Respondent Years of Experience
	Covertly Opposing	Phone Calls & Meetings	Respondent Generational Affiliation
	Overtly Opposing	On-the-Project or On-the-Job Support	

Methods of Change-Related Training.

Many studies have emphasized the importance of effectively communicating change-related training and information during the change process to reduce employee stress, fear, uncertainty, and resistance to the change effort in the organizational behavior literature (Alvesson 2002; Armenakis et al. 1999; Balogun and Hailey 2008; Holt et al. 2003; Proctor and Doukakis 2003; Walker et al. 2007) and the AEC industry literature (Lai et al. 2011; Pheng and Hui 2004; Singh and Shoura 1999). To understand the most effective andragogical approaches for delivering

training resources, the study further investigated eight methods of delivering training resources that are prevalent in organizational changes literature and are shown in Table 6.

Based on the interdisciplinary literature review, several gaps in the AEC literature were identified. First, no studies analyzed the link between management practices during organizational change and employee all being a major outcome and measurement of management performance. Second, the limited number of studies that have analyzed employee behaviors and their association with organizational changes were also limited by study parameters such as the type of change, type of organization, and data size. Third, previous studies have treated employee reaction as a mediator between management practices and successful implementation of changes. Forth, studies have used stress and workload as the primary measure of EWB.

RESEARCH METHODOLOGY

The overall objective of this study was to model the relationship between the use of key management practices and different levels of employee well-being in the context of organizational changes that are prominent in the AEC industry. To achieve the study objective, literature review and surveys as the most used methods to explore change management in the AEC industry (Wang et al. 2013) were used. The study first conducted a literature review using an interdisciplinary examination of the organizational behavior literature. To successfully implement organizational changes, key management practices were identified (OCM practices). Measures of EWB in the context of organizational changes were also found in the organizational behavior literature. The EWB measure used in this study was ultimately grounded on observable behavioral responses by employees during the organizational change effort. These responses were measured on a continuum ranging from resistive to supportive reactions. Second, a survey questionnaire was

developed to measure the effectiveness of using the six OCM practices and achieving EWB during changes. The survey was designed to collect cases of organizational-wide changes within the AEC industry.

This study contributes to the body of knowledge by modeling the effect and influence of using key OCM practices on EWB during organizational changes, using a data sample of 517 cases of organizational changes that represent an industry-wide view of changes in the AEC industry. Additionally, this study may assist practitioners in better understanding and managing changes while considering EWB as a major outcome.

Research Variables

Table 6 provides a summary list of all variables used in this study, including independent, dependent, and control variables. Table 7 shows the employee reaction variable, which was used to measure the most prevalent behavioral responses among the organization's employees involved with each organizational change initiative, and ultimately as the measure for EWB for this study. Employee reactions were measured on an 8-point scale representing a continuum of supportive, resistive, passive, active, overt, and covert behaviors. The scale used in this study was based on several studies from the organizational behavior literature and the AEC literature.

Survey Design, Distribution, and Data Collection

The survey was designed to gather responses where each response represented an organizational change initiative implemented by an organization in the AEC industry. The survey was designed using an online tool that helped reach participants via email distribution. The survey had five sections. In the first section, participants were asked to identify and describe one organizational change their firms had experienced and were involved in.

Table 7. Measurements of employee well-being (EWB)

Scale	Employee Reaction	EWB Category	Definition of Observable Employee Reaction
8	Championing	High EWB	Initiating and embracing the change in the organization
7	Actively Supporting	High EWB	Supporting the change within the organization
6	Passively Supporting	Moderate EWB	Accepting the change
5	Reluctantly Complying	Poor EWB	Just going with the change
4	Passively Avoiding	Poor EWB	Ignoring, withdrawing, avoiding the change
3	Openly Not Participating	Poor EWB	Refraining, waiting, observing the change
2	Covertly Opposing	Poor EWB	Stalling, dismantling, undermining the change
1	Overtly Opposing	Poor EWB	Obstructing, opposing, arguing the change
-	EWB Score	-	An average score of the reported reactions

In the second section, participants were asked to rate their management's use of OCM practices using a 7-point Likert-type ordinal scale (7 = strongly agree to 1 = strongly disagree). Third, participants were asked to identify the most prevalent employee reactions among involved employees by selecting a maximum of three reactions of the eight listed reactions shown in Table 7. The fourth section of the survey was designed to collect information about the participants' demographics, including their job position, years of professional experience, generational affiliation, and organization's demographics, including sector, type, and size. In the fifth and final section, the survey asked participants to provide comments and feedback greatest drivers of that

change and barriers they encoloured, and how it did they overcome them. The Snowball technique was used to gather a wide range of architecture, engineering, construction, and owner representatives.

The study collected 517 individual responses to the survey, representing a wide spectrum of organizational change cases and organizations across the AEC industry in North America. Three major types of changes were captured in the data set. The first was technological changes, such as adopting administration, estimating, and project management software, building information modeling, remote sensors, mobile and paperless solutions, or drones. The second type was changes in the company's management processes, such as alternative project delivery methods, knowledge management systems, quality management programs, or alternative procurement methods. The third type was for changes in organizational structure, such as mergers, acquisitions, reorganizations, the establishment of prefabrication and modular construction departments, or entering a new market. Table 8 summarizes the collected data regarding change types, organization demographics, and respondents' demographics.

Table 8. Summary of The Data Sample (N=517)

Change Type	Frequency	Percentage
Technology	183	35.4%
Management Process	204	39.5%
Business	48	9.3%
Missing	82	15.9%
Organization Type	Frequency	Percentage
Owner/operator	263	50.9%
EPC/general contractor	35	6.8%
Subcontractor/specialty contractor	83	16.1%
Architecture/engineering consultant	52	10.1%

Facilities management and operation	17	3.3%
Other	41	7.9%
Missing	26	5%
Organization Size by (revenue/expenditure)	Frequency	Percentage
Less than $30 million	84	16.2%
$30–$100 million	73	14.1%
$100–$500 million	85	16.4%
More than $500 million	114	22.1%
Missing	161	31.1%
Respondent Job Position	Frequency	Percentage
Senior executive/vice president	142	27.5%
Regional manager/director/local office supervisor	184	36.9%
Project members/crew members	162	31.4%
Other	10	1.9%
Missing	19	3.7%
Respondent's Years of Professional experience	Frequency	Percentage
Less than five years	14	2.7%
5–9 years	22	4.3%
10–19 years	81	15.7%
20–29 years	170	32.9%
30–39 years	153	29.6%
40 or more years	54	10.4%
Missing	23	4.4%
Respondent Generational Affiliation	Frequency	Percentage
Baby boomer (born 1946–1964)	118	22.8%
Generation X (born 1965–1978)	131	25.3%
Generation Y (born 1979–1997)	45	8.7%
Missing	223	43.1%

METHOD OF ANALYSIS

Data analysis was performed in seven steps. First, descriptive statistics of the data were performed and are shown in tables 9 and 10. Second, to obtain a single measurement for employee well-being, internal consistency of reaction responses was assessed to combine the three selected reactions by respondent into one score (using the scale shown in table 7), which indicates EWB score during changes. Third, bivariate analyses were performed between the six OCM practices and EWB. Forth, three levels of EWB (Poor, Moderate, High) were identified based on definitions of measured reactions and previous studies in the literature. Wald test for combining dependent categories was used to confirm the distinguishability of these three groups (Anderson 1984). Fifth, multinomial logistic regression (MNLR) was performed to model the relationship between OCM practices as the predictors and the three different levels of EWB. The multinomial regression model was selected over ordinal logistic regression models to avoid the potential bias of assuming parallel regression across all EWB levels (Liu et al. 2010). Finally, descriptive statistics, including frequencies and percentages, were used to identify the most used methods of communicating change-related training to employees within the AEC industry and between cases with poor, moderate, and high levels of EWB. Additionally, content analysis of respondents' feedback and comments regarding change-related training were analyzed to provide illustrative examples of the findings.

Missing data were analyzed for all study variables, based on the percentage of missing data shown in Table 9. Variables with a missing percentage of 25% and more, such as organization sector, organization size, and generational affiliation, were all excluded from the model. The remaining four controlling variables (Change Type, Organization Type, Respondent Job Position, and Years of Prof. Experience) have a missing percentage of less than 25%. Both OCM and EWB

variables have missing percentages lower than 4%. The missing data appeared to be missing at random, and the likelihood of bias arising due to missing data is low. As a result, case-wise deletion to address missing data was performed, and seven influential outliers were identified and removed at the multivariate analysis stage (Allison 2014). All resulted in a final sample size of 511 cases of organizational changes.

Bivariate relationships analysis of the controlling variables using one-way ANOVA showed statistically non-significant differences in EWB between different groups of each controlling variable. Also, when adding any of the controlling variables to the multivariate analysis, these variables did not have a significant contribution to the model. The results supported the decision to exclude these controlling variables from the multivariate model.

RESULTS

EWB Score

EWB score was obtained by averaging scores of the three most dominant employee reactions in each change case. Kuder-Richardson-KR20, as a special case of Cronbach's alpha test for dichotomous variables, was used to assess the internal consistency of reported employee reactions (Cortina 1993). The results of the KR20 test showed high internal consistency, K coefficient = 0.89. This high consistency of participants' response patterns for employee reaction questions supports averaging participants' three selected reactions in a single response (Helms et al. 2006), representing the EWB score during the change process.

Univariate Analysis

Table 4 shows the univariate results of the final research variables, independent variables (six OCM practices), and the dependent variable (EWB). Table 9 results show that the seven variables can be considered to be approximately normally distributed concerning skewness and kurtosis (George and Mallery 2010).

Table 9. Univariate statistics of the final seven research variables (N=517)

Variable Name	M (SD)	(Min, Max)	Skewness (SE)	Kurtosis (SE)
Senior-leadership commitment	5.88 (1.35)	(1, 7)	-1.57 (.11)	2.40 (.22)
Training resources	5.30 (1.47)	(1, 7)	-.98 (.11)	.42 (.21)
Communicated benefits	5.61 (1.45)	(1, 7)	-1.34 (.11)	1.52 (.22)
Realistic timeframe	5.21 (1.51)	(1, 7)	-1.08 (.11)	.59 (.22)
Measured benchmarks	4.53 (1.62)	(1, 7)	-.37 (.11)	-.76 (.22)
Change agents	5.06 (1.55)	(1, 7)	-.91 (.11)	.32 (.22)
EWB score	5.58 (1.33)	(1, 8)	-.60 (.11)	.10 (.21)

Bivariate Analysis

The bivariate results of Zero-order correlation using Pearson's correlation between OCM practices and EWB scores indicated that all OCM practices have a statistically significant positive correlation with EWB (Person correlation ranging from .28 to .40, $p < .001$). This means that all six OCM practices should be included in the multivariate models (Cohen 1988).

Multivariate Analysis

Multinomial logistics regression was conducted to assess the relationships between OCM practices and EWB, controlling for other organizational and individual variables. The results are based on the final adjusted model that has the best fit and alignment with the associated regression model assumptions. Six influential outliers were identified and removed from the final model, resulting in a final sample size of 511 cases.

Levels of EWB During Organizational Change

Three levels of EWB were identified (Poor, Moderate, and High) based on EWB scores and the spectrum of employee reactions shown in Table 7. Cases that represent actively supporting employee reactions were identified as cases of high levels of EWB during the change process. Cases that represent discouraging and unsporting reactions were identified as cases of poor EWB. While all the other remaining cases that represented passive or neutral support were identified as cases of moderate levels of EWB. Categorization of EWB levels was based on literature definitions of each observable reaction (Bovey and Hede 2001a; Bovey and Hede 2001c; Emiliani and Stec 2005; Herscovitch and Meyer 2002; Hultman 2006) and studies regarding the association of these reactions with changes in the AEC literature (Aldossari et al. 2021c; Lines et al. 2015; Lines et al. 2016)

The 511 Change cases have 250 (48.9%) Poor EWB cases, 139 (27.2%) Moderate EWB cases, and 122 (23.9%) High EWB cases. To statistically support the three groupings of EWB, the Wald test for combining dependent categories was conducted. The results were significant, meaning that the groups cannot be combined for more efficient estimation. The results show that the three groups of EWB levels are distinguishable (Anderson 1984), demonstrating unique conditions associated with each level of EWB.

Multinomial Logistic Regression

Table 10 shows the results of parameter estimates for each of the six practices of the final adjusted model, and the reference group is poor EWB. For the final multinomial regression, the first model compares both high and moderate EWB groups to the reference group. While for the second model, the reference group is set as moderate EWB, and the model compares both high and poor EWB groups to the reference group. It's worth noting that the high EWB group represents the highest reported EWB of all the collected change cases (top 20% in terms of EWB).

The final multivariate model significantly improved the prediction of EWB levels in comparison to the intercept-only model ($\chi^2(12) = 799.1$, $p < .001$). The final model also indicated a good model fit based on goodness-of-fit tests. Based on Cox and Snell, Nagelkerke, and McFadden pseudo R^2 measures, the model explained between 9.4% and 20.3% of the variance in EWB. The model correctly classified 50.9% of the cases.

When comparing groups of high EWB to poor EWB, the results indicated that when an organization increased its focus on Training resources (by one unit on a scale of 7), the odds of achieving higher EWB approximately increased by 57%, all else being equal. In comparison, the odds between the same groups increased by 50% for Realistic Timeframe, and by 49% for Senior leadership Commitment when all other variables in the model are held constant. On the other hand, Communicated Benefits, Measured Benchmarks, and Change agents were not statistically significant for this comparison.

Table 10. Parameter Estimates for Multinomial Regression Model (N = 511)

OTL practices	Moderate EWB (n = 135)			High EWB (n = 118)		
	Odds Ratio	95% CI (LL, UL)	P-Value	Odds Ratio	95% CI (LL, UL)	P-Value
Intercept			< .001			< .001
Communicated Benefits	.829	(.653, 1.05)	.122	.767	(.574, 1.02)	.072
Senior leadership Commitment	1.193	(.952, 1.50)	.125	1.499	(1.12, 2.00)	.006
Realistic Timeframe	1.005	(.809,1.25)	.966	1.502	(1.13, 2.00)	.006
Training Resources	1.268	(1.0,1.61)	.049	1.570	(1.17, 2.11)	.003
Change Agents	1.24	(.99, 1.56)	.051	1.241	(.952, 1.62)	.110
Measured Benchmarks	1.090	(.907,1.31)	.360	.983	(.802, 1.21)	.869

Note: Both EWB levels are compared to the base "reference" group of Poor EWB (n = 238).

When comparing groups of Moderate to Poor EWB, the results indicated that when an organization increased its focus on Training resources (by one unit on a scale of 7), the odds of having a moderate EWB increased by 27% (a factor of 1.27), all else being equal. In comparison, all the other remaining practices were not statistically significant for this comparison. This means that providing sufficient training resources is the key differentiable practice between achieving poor and moderate levels of EWB. In other words, organizations can avoid poor EWB levels by effectively providing change-related training to employees.

When the reference group was changed to Moderate EWB, the results comparing High EWB to Moderate EWB showed that only one practice Realistic Timeframe was statistically

significant, $p < .05$, with an odds ratio of 1.5. This means that providing a realistic timeframe for the change process is the key differentiable practice between achieving moderate and high levels of EWB. In other words, organizations can elevate their EWB levels to reach the high levels of EWB (highest 20% of the reported EWB) by excellently establishing a realistic timeframe to adopt the change, which increases the odds by 50%.

Methods of Change-Related Training

Table 11 shows descriptive statistics of training methods used during the change process. Informational presentations, memos and emails, and phone calls and meetings were the three most used methods to communicate change-related training. While instructional videos, speeches, and instructional manuals were the three least used methods in the AEC industry. When comparing used methods by organizations that achieved high, moderate, and poor levels of EWB, the results showed that informational presentations, memos and emails, and phone calls and meetings were the top three used methods in cases of moderate and poor levels of EWB. Cases with the highest levels of EWB have reported on-the-job training as the most used method (ranked 1st) in addition to informational presentation and memos and emails, while moderate and poor levels of EWB used less on-the-job training (ranked 5th and 4th respectively) as a training delivery method.

Furthermore, respondents were asked to provide comments about barriers and drivers to the change adoption case. Content analysis of respondents' comments regarding change-related training was performed to provide illustrative examples of the findings. Content analysis is an observational research method used to determine the presence of certain themes or trends by analyzing and grouping the meaning words and phrases in a qualitative data (Fellows and Liu 2021; Kolbe and Burnett 1991; Neuendorf 2002). First, responses that have addressed change-related training or used method were selected for the analysis. A total of more than 350 comments

were provided by respondents. However, a total of 36 comments were regarding change-related training. Second, respondent comments were categorized based on EWB levels; 11 for high EWB, 12 for moderate EWB, and 13 for low EWB. Third, comments were coded as either barrier or driver for the change adoption process identified by respondents. Finally, search of keyword or phrases that address the methods used in delivering change-related training.

Table 11. Methods of Delivering Change-Related Training

Methods	All Data (N= 1171)		High EWB (N= 332)		Moderate EWB (N= 545)		Poor EWB (N= 294)	
	%	(Rank)	%	(Rank)	%	(Rank)	%	(Rank)
Speeches	5%	(7)	2%	(8)	4%	(7)	6%	(7)
Informational Presentations	21%	(1)	19%	(2)	23%	(1)	21%	(1)
Memos & Emails	19%	(2)	18%	(3)	20%	(2)	19%	(2)
Instructional Videos	3%	(8)	2%	(7)	3%	(8)	3%	(8)
Instructional manuals	10%	(6)	10%	(6)	7%	(6)	11%	(6)
Interactive Workshops / Simulations	12%	(5)	12%	(5)	14%	(4)	11%	(5)
Phone Calls & Meetings	16%	(3)	16%	(4)	16%	(3)	16%	(3)
On-the-job Training	15%	(4)	20%	(1)	13%	(5)	14%	(4)

The content analysis results showed that high EWB cases have repeatedly commented on the importance of training as a driver for the adoption process in 10 of the comments and a barrier if it was absent. Similarly, the importance of training was highlighted by moderate EWB cases where they additionally identified the lack of time needed for training as a barrier to the adoption process and the absence of training as a significant barrier to the adoption process. On the other hand, most of the low EWB comments identified training as a barrier to the adoption process rather than being a driver.

For training methods, moderate EWB comments identified Presentations, meetings, and emails as the used training delivery method, while high EWB comments add on "on-the-job training" as an effective training delivery method. Overall, the content analysis found that when moving from low EWB to high EWB cases, training comments start to change from being addressed as a barrier to a driver for the change process. In high EWB, ten comments for training as a driver, while one as a barrier. In moderate EWB, seven were as a driver and five as a barrier. Lastly, in low EWB, six comments for training were listed as a driver, while seven as a barrier to the adoption process. This pattern aligns with the role that change-related training plays in moving the change forward and helping achieve higher EWB. Table C-1 in Appendix C lists respondents' comments regarding change-related to training.

DISCUSSION

Avoiding Poor EWB

Based on the MNLR model results, organizational changes with the lowest levels of EWB were distinguished by leadership's lack of provision of effective training resources. This finding implies that management may avoid poor EWB outcomes by successfully helping employees adapt

to the change within their job functions. The importance of change-related training was highlighted in previous studies in the AEC industry (Chang et al. 2017; Lu et al. 2015; Matthews et al. 2018). Due to the importance of providing effective training as a key management practice to achieve better EWB, the study further investigated eight methods of training delivery that are prevalent in organizational changes to identify the most effective andragogical approaches for delivering training resources. The results showed that organizational changes with the highest levels of EWB emphasized on-the-job training; conversely, changes with lower levels of EWB overly relied on other methods such as presentations, memos, and emails. Providing more on-the-job support and training for employees who undergo organizational change will improve EWB during the change process.

Achieving High Levels of EWB

Organizational changes with high levels of EWB were characterized by strong leadership in three primary areas. The single most prominent management practice linked with high levels of EWB was the establishment of a realistic timeframe for the change process. This means that organizations should be sensible about identifying the required time and speed to implement the change since employees may resist if they observe that management is expecting the change process at an inappropriate timeline (Smollan 2011). The next two most important management practices were visible senior leadership commitment and delivery of effective training resources.

It's worth noting that (measured benchmarks) was the only OCM practice that did not have any significant association with EWB in any of the models. Even though it was identified in the literature as one of the key management practices for successful changes (Kotter 1995; Magsaysay and Hechanova 2017) and the lack of it may cause employees to be more reluctant to organizational change (Liao and Teo 2018). This indicates that identifying and measuring benchmarks for the

change process benefits the overall change success, but it might not improve overall EWB during that process.

In summary, organizations in the AEC industry that seeks to achieve or maintain high EWB while going through changes should focus more on effectively applying the following OCM practices training resources (including more on-the-job training), realistic timeframe, and senior leadership commitment.

CONCLUSION AND CONTRIBUTION

The study contributes to the body of the knowledge by applying an interdisciplinary approach to study management practices and employee well-being from the field of organizational behavior within the context of organizational changes in the AEC industry. Findings from the regression model identify key practices that differentiated cases of high EWB from other change cases with moderate and poor EWB. Also, it provides practitioners with insight regarding training methods that most improve employee well-being during organizational change efforts. Finally, practitioners can use the spectrum of observable employee reactions from this study to measure EWB. The data set suggests that these findings are broadly applicable across a variety of organizational changes that are common in the AEC industry.

Study Limitations

Several study limitations were identified. First, the study is limited by the number of OCM practices since only six practices were used based on the literature. Second, the cross-sectional collected data does not provide any information about the timing and sequence of each OCM practice. Third, each change case presented a single point of view regarding the use of practices and observed employee behaviors; therefore, the data may have been influenced by

respondent bias or inaccurate recall of the change process. Finally, the demographic groups were unevenly distributed, which limited the findings of the differences between groups. Sixth, the data were collected from members of the AEC industry only in the United States and Canada.

End of Chapter 3

CHAPTER 4: MANAGING ORGANIZATIONAL CHANGE UNDER TIGHT TIME CONSTRAINTS: PRACTICES FOR ACCELERATED CHANGE ADOPTION RATES

Managing Organizational Change under Tight Time Constrains: Practices for Accelerated Adoption Rates

ABSTRACT

There is increased pressure on the AEC industry to rapidly adopt new technologies, practices, and strategic changes to improve competitiveness and cope with the current market. However, a realistic timeframe for change adoption is not always a commodity that organizations have available to them. Instead, many organizations must accelerate or fast-track the adoption of change. This can lead to increased resistance levels, the necessity for more rapid learning rates, and increased pressure on the leadership to craft the change message successfully and disseminate training effectively. The objective was to identify best practices for implementing change under an accelerated timeframe without jeopardizing the ability to successfully adopt that change. A database of 92 organization-wide cases of accelerated change adoptions were collected from AEC firms across the United States and Canada. Descriptive, inferential, and content analyses were performed to achieve study objectives. The adoption rate in the collected cases ranged from accelerated timeframe to hyper-accelerated timeframe. None of the 92 fast-tracked cases achieved a very successful change adoption; one-third were moderately successful, and the remaining were unsuccessful. Furthermore, the data showed that the faster the adoption rate was, the fewer successful adoption cases were presented. Specifically, 85% of the adopted cases were unsuccessful under a hyper-accelerated timeframe. However, successful adoption was still achievable in hyper-acceleration for cases that emphasized extensive communication of employee change benefits, provided sufficient training resources, and effectively utilized change agents. Furthermore, content analysis of participant feedback was performed to identify the greatest

barriers encountered during accelerated changes and how they were overcome. This study contributes practical tips for managing change under time constraints.

INTRODUCTION

The world is continuously changing, and it is affecting everyone. Change is inevitable in the business world, and businesses are also constantly evolving and adopting new changes. Change management is a vital skill set for businesses to survive, cope, and stay competitive in a fast-changing world (Rogers 2003). Some of the drivers for adopting new changes are enhanced business processes, developing talent and skills for the future, market pressure (pandemics, recessions), and competitive pressure. However, adopting changes is often very difficult, even when the advantages are apparent, and that is the reason for the increased interest in the management of change adoption (Rogers 2003).

The AEC industry faces numerous pressures to improve productivity, safety, and sustainability (Loosemore 2014). The industry's slow pace of adopting new changes compared to other industries (Gholizadeh et al. 2018) is one of the main reasons for the productivity decline over the past 50 years (Crew 2017). To cope with these challenges, organizations in the AEC industry are rapidly adopting changes to survive and remain competitive in the fast-changing business world (Gholizadeh et al. 2018). However, the speed at which an organization adopts the change (rate of adoption) is a critical factor that may create increased of resistance to change (Smollan 2011) and hinder the success of change adoption (Aldossari et al. 2021b; Maali et al. 2022). Researchers have found that the rate of adoption is one of the crucial aspects of managing organizational changes (Rogers 2003) and have been listed as one of the six key organizational change management practices under the name of a realistic timeframe for the adoption process

(Aldossari et al. 2021b; Lines and Smithwick 2019; Maali et al. 2020; Rogers 2003; Smollan 2011; Vardireddy 2017; Zhou et al. 2019)

Organizational change management (OCM) is defined as the management strategies used to adopt new or different processes from the organization's current process to achieve organization-wide goals (Burnes 2009; Rogers 2003; Shea et al. 2014). Adopting an organizational change is a complicated task that often ends with organizations failing to successfully adopt the change (Ahn et al. 2004).

LITERATURE REVIEW

Organizational Change Management

The literature in the areas of organizational behavior and the AEC industry has explored hindrances, barriers, drivers, practices, and recommended frameworks to implement organizational changes. Several studies from the organizational behavior literature have developed organizational change models, which highlight the importance of having a well-planned process to successfully implement organizational changes (Burnes 2009; Kotter 1995; Lewin 1947; Luecke 2003; Rosenbaum et al. 2018). Researchers have recommended several practices to overcome barriers and achieve the full benefits of change adoption, such as: the use of change agents to lead the change process (Brandi and Elkjaer 2012; Kanter 1983; Martin and Hrivnak 2009; Wolpert 2010; Wynn 2019), effective communication of the goals and vision of the change (Bourne et al. 2002; Cameron and Quinn 1999; Magsaysay and Hechanova 2017), monitoring the progress of change (Kotter 1995; Magsaysay and Hechanova 2017), involvement and commitment of the top management (Armenakis et al. 1999; Beer and Eisenstat 1996; Emiliani and Stec 2005), providing change-related training (Alvesson 2002; Galpin 1996; Schneider et al. 1994), and finally

appropriate time required for an employee to learn and implement the change (Li and Becerik-Gerber 2011; Loosemore and Cheung 2015; Peansupap and Walker 2006; Sullivan 2011; Tan et al. 2012; Zhou et al. 2019). Change management has become so crucial in the AEC industry that it was recommended to be part of the project management professional (PMP) certification by Project Management Institution (Hornstein 2015), which was added to the certificate at the beginning of the year 2021.

Organizational Change Management (OCM) Practices

The interdisciplinary literature review approach identified the following six OCM practices as commonly identified in the literature on organizational behavior and the AEC industry.

Senior-leadership commitment: Top management's early and continuous involvement in the adoption process is one of the commonly cited practices to keep the momentum of change. Senior leadership should be involved and committed during the entire change adoption process (Armenakis et al. 1999) to enforce and support the adoption adoption (Emiliani and Stec 2005). Top management support is a key factor in enhancing the performance of the change adoption process (Aranyossy et al. 2018; Eskerod et al. 2017). In the AEC industry, senior leadership commitment has crucial role support the change management process (Cheng and Teizer 2013; Lu et al. 2015; Xu et al. 2014). The early commitment of senior leadership commitment was identified as a key practice to achieving successful adoption of BIM (Liao and Teo 2018; Ozorhon and Karahan 2017) and enterprise risk management solutions (Zhao et al. 2015). For this study, senior leadership is described as; the organization’s senior leaders were committed to making the change a success (i.e., they “walked the talk”).

Training resources: The lack of change-related training and education are major barriers to the successful adoption of change (Alvesson 2002; Galpin 1996; Schneider et al. 1994). In the

AEC industry, investing in and providing change-related training was identified as one important factor to avoid adoption failure and achieve successful adoption of changes such as communication technologies (Lu et al. 2015)and BIM (Ahn et al. 2016; Chang et al. 2017; Liu et al. 2019; Matthews et al. 2018; Ozorhon and Karahan 2017). For this study, training resources is described as employees having a clear understanding of the action steps for implementing the change in their job functions.

Communicating the benefits of change: Communicating the advantages and disadvantages of the change to employees within their job functions is important to overcome change resistance (Bourne et al. 2002; Cameron and Quinn 1999). In the AEC industry, employees are more likely to resist the change due to the lack of clearly communicated benefits (Ayinla and Adamu 2018). Arayici et al. (2011) and Peansupap and Walker (2006) stressed the importance of identifying clear benefits and communicating them to employees to achieve successful change adoption. For this study, Communicating the benefits of change is described as; Employees clearly understood how the change would benefit them in their job functions.

Effective change agents to lead the change: One of the most cited OCM practices to achieve successful change adoption is the use of change agents. They are individuals who are assigned to guide and support the change adoption process; they are known as the "internal champions of change" (Hunsucker and Loos 1989; Kanter 1983). Many studies have presented the benefits of effective change agents as they increase knowledge transfer, offer personal growth opportunities, and ultimately set forth a model to support novice employees (Martin and Hrivnak 2009; Wolpert 2010). It's important to select the right individuals as change agents since their knowledge level of the change determines their intellectual capacity to support the change process (Brandi and Elkjaer 2012). Wynn (2019) has discussed the struggles organizations encounter when

change agents leave the change process, even with changes that have all they need to succeed. Similarly, in the AEC industry, identifying a team that is open to change and ready to drive and support the adoption process will enhance the acceptance and adoption of that change (Ahn et al. 2016; Lee and Yu 2016). For this study, change agents is described as; Change agents (transition team) responsible for managing the change in the organization were effective.

Establish clear and measured benchmarks of the change process: Identifying clear goals for the change and executing careful planning with measured benchmarks were of the top practices performed by well-managed change initiatives (Magsaysay and Hechanova 2017). Identifying short-term successes and celebrating them during the adoption process will reward involved employees and foster the change process (Kotter 1995). In the AEC industry, establishing clear and measured benchmarks of the change process is important to maintain the change momentum (Lines and Reddy Vardireddy 2017). The lack of clear and measured benchmarks may cause employees to be more reluctant to change and deteriorate to the old methods (Liao and Teo 2018). For this study, measured benchmarks of the change process is described as the organization established clear benchmarks to measure the success of the change adoption process.

A realistic timeframe for the change adoption process (Adoption Rate)

Previous research regarding the relationship and association between OCM practices and the successful adoption of change has identified the adoption rate (adopting timeframe and speed) as one of the most significant OCM practices that affect change implementation outcomes (Aldossari et al. 2021b; Lines and Smithwick 2019; Maali et al. 2020; Rogers 2003; Smollan 2011; Vardireddy 2017; Zhou et al. 2019).

The rate of adoption is one of the important aspects of managing organizational changes. It is defined as the relative speed with which change is adopted by members of an organization

(Rogers 2003). An organization may encounter resistance to change from employees if they feel the timeframe and rate of adoption required to adopt the change is unrealistic (Smollan 2011). In the AEC industry, long term implementation plans based on understanding the necessary rate and time of implementation to successfully adopt the change is one of the key factors to overcoming barriers to successfully implementing organizational changes (Li and Becerik-Gerber 2011; Loosemore and Cheung 2015; Peansupap and Walker 2006; Sullivan 2011; Tan et al. 2012; Zhou et al. 2019). For example, (Hong et al. 2019) identified the absence of long-term BIM implementation plans as an organizational barrier to implementing BIM. Other researchers have reported that an obstacle to implementing change involves underestimating the resources and time required for an employee to learn and accomplish the change (Loosemore and Cheung 2015; Li and Becerik-Gerber 2011; Peansupap and Walker 2006; Sullivan 2011; Tan et al. 2012).

Similarly, in the two previous papers listed in Chapters 2 and 3. Establishing a Realistic timeframe was one of the most important OCM practices. Specifically, in Chapter 2, realistic timeframe was one of the only two key differentiable OCM practices between successful and very successful change adoption cases, meaning that adopting organizations can move from successful change adoption outcomes to eat very successful change adoption outcomes (reach the top 10% off successful cases) by effectively focusing on establishing a more realistic timeframe for the adoption process (Maali et al. 2022). Likewise, in Chapter 3, realistic timeframe was the only key differentiable OCM practice between moderate and high EWB, meaning that organizations can increase EWB and achieve the highest levels by effectively focusing on establishing a more realistic timeframe for the adoption process. For this study, a realistic timeframe is described as; The speed at which the organization implemented the change was appropriate.

Based on the interdisciplinary literature review, several gaps in the AEC literature were identified. First, no studies analyzed the association of OCM practices under a tight or accelerated rate of adoption. Second, no current research has measured and identified different levels of adoption rate and compared them together regarding OCM practices. Third, the existing literature on OCM is limited by study parameters. For example, focusing on a specific type of change, a specific type of organization, using only case studies, or limited data samples. All limited the ability to represent or generalize the results for the AEC industry.

RESEARCH OBJECTIVES

Much research has been conducted on establishing OCM practices that have led to successful change adoption during projects. Six OCM practices have been found to significantly drive successful change adoption; however, little research has been conducted to determine OCM practices that can lead to successful change adoption for projects that have been on an accelerated schedule. In addition, the previous analysis in Chapters 2 and 3 have identified a realistic and appropriate timeframe for adopting change initiatives as one of the most significant OCM practices that differentiated very successful cases from successful and unsuccessful cases (Chapter1), and also differentiated high employee will being from neutral and low employee well-being (Chapter 2). However, a realistic timeframe is not always a commodity that organizations have. Hence, the objective of this study was to identify best OCM practices for implementing change under an accelerated (fast-tracked) timeframe without jeopardizing the ability to achieve successful adoption of that change.

To achieve this objective, the study identified two levels of accelerated adoption rates: accelerated and hyper-accelerated. This led to the development of two research questions targeted for this research paper:

Research Question 1: When on an accelerated schedule, which of the five organization change practices (OCM) can drive successful change adoption across an organization? The following hypothesis statements were developed to answer the research question, **Hypothesis Statement 1:** Accelerated cases with successful change adoption have different OCM practices than unsuccessful cases.

Research Question 2: What are the key differences in OCM practices for hyper-accelerated and accelerated cases when they are successful and unsuccessful. The following hypothesis statements were developed to answer the research question, **Hypothesis Statement 2**: accelerated cases with successful change adoption have different OCM practices than unsuccessful change adoption cases. **Hypothesis Statement 3:** Hyper accelerated cases with successful change adoption have different OCM practices than unsuccessful cases (44 projects).

RESEARCH METHODOLOGY

Survey Design, Distribution, and Collection

The survey was designed to gather responses where each response represented an organizational change initiative implemented by an organization in the AEC industry. Participants were asked to identify successful or unsuccessful cases of change adoption that their firms had experienced. The survey was designed using an online tool that helped reach participants via email distribution. Then the survey was tested by distributing it to 25 participants via email. The pilot

survey participants recommended making minor changes, which were incorporated into the final version of the survey.

The survey had three sections. In the first section, participants were asked to identify and describe one organizational change their firms had experienced and were involved in. In the second section, participants were asked to rate their agreement or disagreement with six statements regarding the effective use of OCM practices (independent variable) and three statements regarding the successful adoption of that change (dependent variables), all using a 7-point Likert-type ordinal scale (7 = strongly agree to 1 = strongly disagree). Such ordinal scales use fixed responses to measure the opinions and attitudes of respondents (Bowling 1997; Burns and Groves 1997). The third and final section of the survey was designed to collect information about the participants and their organization's demographics, including organization sector, organization type, respondent's job position, respondent years of professional experience, and respondent's generational affiliation.

A purposive sample with a subsequent snowball technique was used to gather a wide range of architecture, engineering, construction, and owner representatives. Members from more than 20 professional groups such as Associated Builders and Contractors (ABC), American Council of Engineering Companies (ACEC), Associated General Contractor (AGC), American Institute of Architects (AIA), Construction Owners Association of America (COAA), International Facility Management Association (IFMA), National League of Cities (NLC), National Society of Professional Engineers (NSPE), and Engineering News-Record (ENR) to name a few.

A total of 633 responses were received. However, based on respondent responses regarding the rate of adoption (realistic timeframe) question, 92 change cases were selected and analyzed for this study. These cases represent accelerated change adoptions as identified by respondents'

disagreement with the availability of a realistic timeframe of the adoption process. Table 12 shows a summary of the collected data. Regarding organization type, there are 34% owners, 36% general and sub-contractors, 8% architecture and engineering firms, 12% other types of firms, and only 6% did not choose to respond. In terms of change experienced, 34% experienced a technological change (software and hardware), 27% experienced a change in management process (project management and delivery), 15% experienced a change in the business process (business improvement methods and structures), while the rest did not choose to answer. In terms of hierarchal position in the company, 56% were part of upper management, 23% from middle management, and the rest chose not to identify themselves. Lastly, 35% of respondents had more than 30 years of experience, whereas people with 10 to 30 years of experience constituted 46% of the responses, 4% had less than ten years, and the rest did not choose to answer.

Research Variables

Organizational Change Management (OCM) practices

The implementation levels of OCM practices were measured for each of the six practices using a 7- point Likert-type ordinal scale (7 = strongly agree, 6 = agree, 5 = somewhat agree, 4 = neutral, 3 = somewhat disagree, 2 = disagree, and 1 = strongly disagree). The definitions of these practices are presented in the following paragraph.

Table 12. Data Sample of Fast-Tracked Adoption Cases

Change Type	**Frequency**	**Percentage**
Technology	32	34.4%
Management Process	25	26.9%
Business	14	15.1%
Missing	22	23.7%

Organization Type	**Frequency**	**Percentage**
Owner / Operator	32	34.4%
EPC / General Contractor	13	14.0%
Subcontractor / Specialty Contractor	20	21.5%
Architecture/engineering consultant	7	7.5%
Other	11	11.8%
Missing	10	10.8%
Years of Prof. Experience	**Frequency**	**Percentage**
Less than 5 yrs.	1	1.1%
5-9 yrs.	3	3.2%
10-19 yrs.	15	16.1%
20-29 yrs.	28	30.1%
30-39 yrs.	26	28.0%
more than 40 yrs.	6	6.5%
Missing	14	15.1%
Current Position	**Frequency**	**Percentage**
Senior Executive or equivalent	14	15.1%
Vice President or Assistant Vice President	4	4.3%
Regional Manager / Director	34	36.6%
Team Lead / Crew Lead	12	12.9%
Team Member / Crew Member	9	9.7%
Other	1	1.1%
Missing	19	20.4%
Generational Affiliation	**Frequency**	**Percentage**
Traditionalists (born prior to 1946)	1	1.1%
Baby Boomer (born 1946 to1964)	11	11.8%
Generation X (born 1965 to 1978)	20	21.5%
Generation Y (born 1979 to 1997)	2	2.2%
Missing	59	63.4%

Senior-leadership commitment: The organization's senior leadership was committed to the organizational change initiative ("walked the talk"). Communicated benefits: Employees clearly understood how organizational change would benefit them personally within their specific job functions. Change-agent effectiveness: change agents responsible for leading and managing the change initiative were effective. Measured benchmarks: The organization established clear benchmarks for evaluating the success of the change adoption process. Training resources: Employees clearly understood the action steps necessary to implement the change within their specific job function.

Levels of Change Adoption Rate (Accelerated and Hyper Accelerated)

Participants were asked to provide their agreement or disagreement regarding a statement related to the used time frame (rate of adoption) for the implementation process of that change adoption case; "The speed at which the organization implemented the change was realistic and appropriate." Respondents used a 7- point Likert-type ordinal scale (7 = strongly agree, 6 = agree, 5 = somewhat agree, 4 = neutral, 3 = somewhat disagree, 2 = disagree, and 1 = strongly disagree) to identify the adoption rate.

Responses that disagreed with the implementation timeframe and the adoption rate as being realistic or appropriate were identified as change adoption cases implemented under an accelerated time frame. Specifically, responses that somewhat disagreed, disagreed, or strongly disagreed with the time frame being appropriate and realistic were considered as cases with a fast-track adoption rate (n=92). Of those 92 cases, 18 selected strongly disagree, 26 selected disagree, and 48 selected somewhat disagree. Based on definitions and the absence of any statistical differences between "disagree" and "strongly disagree" cases, the author combined them into one group, resulting in two groups representing the speed of the fast-tracked adoption rate. The two groups are "Hyper

accelerated" with 44 cases and "Accelerated" with 48 cases. Table 13 shows the frequencies of the collected cases based on the speed of adoption rate and change adoption outcome.

Measuring Change Adoption Outcomes (CAC)

Successful adoption of change is the goal of any change initiative. This goal has been measured in different ways throughout the literature. For this study, three variables (*Implemented into Operations, Benefits Achieved, and Long-Term Sustainability*) - measured using the previously identified 7- point Likert scale - were used to measure the success of change adoption and were based on previous AEC literature (Aldossari et al. 2021b; Lines and Smithwick 2019). These three variables (defined in Table 1) were used to construct one single variable representing the overall success of change adoption (*Change Adoption Construct*, CAC). CAC is a reliable indicator of successful change adoption in the AEC industry (Aldossari et al. 2021b). Due to the significant difference in the levels of change adoption between organizations in the AEC industry (Chong et al. 2016; Lee and Yu 2016; Liu et al. 2017), the CAC was categorized into three distinguished levels of successful change adoption as listed in Table 1.

METHOD OF ANALYSIS

Data analysis was performed in seven steps. First, to obtain a single measurement for change adoption outcome (CAC), the internal reliability of the three change adoption outcome variables listed in Table 1, Chapter 2 was assessed via Cronbach's alpha. Second, a principal component analysis (PCA) with a varimax rotation was performed to create the Change Adoption Construct as the linear composite of the optimally weighted original variables (Thurstone, 1947). A single factor was extracted based on a visual inspection of the scree plot, which revealed only a single point above the inflection point. The resulting Change Adoption Construction (CAC) was then used in all future analyses. Third, descriptive analysis was used to determine the measure of

central tendency and spread measure, including mean, median, standard deviation, minimum, and maximum values of the five OCM practices for the different types of accelerated adoptions. Fourth, the results from the descriptive analysis were used to conduct an inferential analysis. The dataset was analyzed to determine how different OCM practices can lead to a successful adoption that has been on an accelerated timeline. Fifth, differences between successful and unsuccessful cases for all the 92 accelerated cases were determined using Mann–Whitney U test. Sixth, differences between successful and unsuccessful cases within each adoption rate level (accelerated and hyper-accelerated) were determined using Mann–Whitney U test. Seventh and finally, content analysis of respondent comments within the fast-tracked change adoption cases was performed to provide illustrative examples of what happened during the implementation process.

RESULTS

Internal Reliability of Change Adoption Outcome Measurement (CAC) and PCA

To produce a single reliable measurement of successful change adoption, three variables were used (*Implemented into Operations, Benefits Achieved, and Long-Term Sustainability*). These three variables were shown to have high internal consistency based on a Cronbach's alpha value of 0.853, which is above the acceptable threshold of 0.7 (DeVellis 2003).

To produce one dependent variable, Principal Component Analysis (PCA) was performed. The suitability of PCA was assessed before the analysis. Inspection of the correlation matrix showed that all variables had a correlation coefficient greater than 0.3. The overall Kaiser-Meyer-Olkin (KMO) measure was 0.704, with all individual KMO measures greater than 0.6. A KMO value of 0.704 is classified as good, according to Kaiser (1974) classification. Bartlett's test of sphericity was statistically significant ($p < .0005$), indicating that the data was likely factorizable.

Visual inspection of the scree plot indicated that one component should be retained (Cattell 1966). Also, the one-component solution met the interpretability criterion. PCA revealed one component with an eigenvalue greater than 1, explaining 77.4% of the total variance. The extracted component was named the Change Adoption Construct (CAC).

Descriptive Analysis

Analysis of Successful and Unsuccessful Change Adoption for Accelerated Adoption

Descriptive analysis was conducted to determine how adoption cases behaved when put on an accelerated timeline. Table 13 below shows the frequency of successful and unsuccessful adoption for cases completed on an accelerated timeline to those that had a hyper-accelerated timeline.

Table 13. Frequencies of Fast-Tracked Changes with Change Adoption Outcomes

Adoption Rate	**Change Adoption Outcome**			Total N (%)
	Unsuccessful N (%)	**Successful N (%)**	**Very successful N (%)**	
Hyper Accelerated	37 (84%)	7 (16%)	0 (0%)	44 (48%)
Accelerated	24 (50%)	24 (50%)	0 (0%)	48 (52%)
Total N (%)	61 (66%)	31 (34%)	0 (0%)	92 (100%)

Interestingly, across all the 92 cases of fast-tracked adoption rates, none of the cases were considered a very successful change adoption (top 10% of the 633 cases identified in Pape1 – Chapter 2). This means that the 66 very successful change adoption cases identified in Paper1 Chapter 2 were not on a fast-tracked timeframe. Moreover, the percentages of successful change adoption cases decrease moving form accelerated to hyper-accelerated adoption rates, from 50%

to 16% respectively. Overall, the data shows a swing in cases from successful to unsuccessful when increasing the adoption rate.

Further analysis was conducted between successful and unsuccessful cases to determine OCM practices used to drive the change adoption process. Table 14 below shows descriptive results of the five OCM practices being used in these adoption cases. The table shows that median scores of OCM practices for successful adoption cases were all greater than unsuccessful adoption cases.

Descriptive analysis was conducted to analyze the differences in OCM practices for accelerated cases. Table 15 shows the descriptive analysis of different OCM practice scores for successful and unsuccessful adoption cases that went through an accelerated adoption rate.

Table 14. Descriptive Statistics of Fast-Tracked Changes with Change Adoption Outcomes

Change Adoption Outcome	OCM Practices	N	Mean	Median	Std. Dev.
Unsuccessful	Communicated Benefits	61	3.48	3.00	1.75
	Senior Leadership Commitment	61	4.49	5.00	1.86
	Training Resources	61	3.18	3.00	1.56
	Change Agents	59	3.02	3.00	1.53
	Measured Benchmarks	61	2.82	2.00	1.56
Successful	Communicated Benefits	31	5.32	5.00	1.35
	Senior Leadership Commitment	31	5.48	6.00	1.18
	Training Resources	31	4.42	5.00	1.52
	Change Agents	31	4.17	4.00	1.42
	Measured Benchmarks	31	3.90	4.00	1.58

Table 15. Descriptive Statistics of Accelerated Adoption Cases by Adoption Outcomes

Adoption Rate	Change Adoption Outcome	OCM Practices	N	Mean	Median	Std. Dev.
Accelerated Cases	Unsuccessful Change	Communicated Benefits	24	3.96	4.00	1.71
		Senior Leadership Commitment	24	5.33	5.00	1.17
		Training Resources	24	3.67	3.00	1.40
		Change Agents	24	3.46	3.00	1.25
		Measured Benchmarks	24	3.04	3.00	1.40
	Successful Change	Communicated Benefits	24	5.29	5.50	1.30
		Senior Leadership Commitment	24	5.50	6.00	1.06
		Training Resources	24	4.42	5.00	1.32
		Change Agents	23	3.87	4.00	1.42
		Measured Benchmarks	23	3.57	3.00	1.44

Table 16 shows the descriptive analysis of different OCM practice scores for successful and unsuccessful adoption cases through hyper-accelerated adoption rate.

Table 16. Descriptive of Hyper Accelerated Adoption Cases by Adoption Outcomes

Adoption Rate	Change Adoption Outcome	OCM Practices	N	Mean	Median	Std. Dev.
Hyper Accelerated Cases	Unsuccessful Change	Communicated Benefits	37	3.16	3.00	1.72
		Senior Leadership Commitment	37	3.95	4.00	2.03
		Training Resources	37	2.86	3.00	1.58
		Change Agents	35	2.71	2.00	1.64
		Measured Benchmarks	37	2.68	2.00	1.65
	Successful Change	Communicated Benefits	7	5.43	5.00	1.62
		Senior Leadership Commitment	7	5.43	5.00	1.62
		Training Resources	7	4.43	5.00	2.23
		Change Agents	7	5.14	5.00	0.90
		Measured Benchmarks	7	5.00	5.00	1.63

The results show that irrespective of the extent of acceleration, those who had successful adoption had higher median OCM practice scores than those who were unsuccessful.

Group Differences

The Mann–Whitney U test was employed instead of one-way ANOVA because of the limited data sample and unevenly distributed groups (the Kolmogorov–Smirnov test resulted in $p < 0.05$ for all tests conducted, thereby failing the test for normality), Thereby violating the two primary assumptions of one-way ANOVA. By contrast, all the Mann–Whitney U test assumptions were satisfied and are not affected by the sample size or statistical power. In addition, the data had independence of observation, meaning there was no relationship between the observations in each independent variable group or between the groups. Further, a box plot visual inspection indicated that all categorical variables were similar in shape.

Group Differences between All 92 Fast-Tracked Successful and Unsuccessful Cases

Inferential analysis between successful and unsuccessful change adoption cases for all 92 fast-tracked cases was conducted to determine the differences in the used OCM practices. Table 17 shows the results Mann-Whitney U test.

Table 17. Mann-Whitney U Test for OCM and Change Adoption Outcomes

OCM Practices	Successful		Unsuccessful		z-score	p-value
	N	Median	N	Median		
Communicated Benefits	31	5.00	61	3.00	-4.57	< 0.001*
Senior Leadership Commitment	31	6.00	61	5.00	-2.33	0.019*
Training Resources	31	5.00	61	3.00	-3.38	< 0.001*
Change Agents	30	4.00	59	3.00	-3.22	0.001*
Measured Benchmarks	30	4.00	61	2.00	-3.00	0.002*

*Significant at $p < 0.05$

The result showed that all OCM practices for successful adoption cases had significantly higher median scores than unsuccessful projects at a p-value of 0.05.

Group Differences between Accelerated and Hyper Accelerated Cases

Further analysis was conducted to determine OCM practices that resulted in successful adoption cases for different levels of adoption rate. Table 18 shows Mann-Whitney U test result for hyper-accelerated cases.

Table 18. Mann-Whitney U Test for OCM and Adoption Outcomes of Different Adoption Rates

Adoption Rate	OCM Practices	Successful		Unsuccessful		z - score	p-value
		N	Median	N	Median		
Accelerated	Communicated Benefits	24	5.29	24	3.96	-2.70	0.007*
	Senior Leadership Commitment	24	5.50	24	5.33	-0.43	0.665
	Training Resources	24	4.42	24	3.67	-1.74	0.082
	Change Agents	23	3.87	24	3.46	-1.06	0.290
	Measured Benchmarks	23	3.57	24	3.04	-1.22	0.223
Hyper Accelerated	Communicated Benefits	7	5.43	37	3.16	-2.72	0.006*
	Senior Leadership Commitment	7	5.43	37	3.95	-1.77	0.083
	Training Resources	7	4.43	37	2.86	-1.79	0.083
	Change Agents	7	5.14	35	2.71	-3.22	0.001*
	Measured Benchmarks	7	5.00	37	2.68	-2.85	0.003*

*Significant at $p < 0.05$

The results show that three OCM practices were significant; communicated benefits, change agents, and measured benchmarks, where cases with successful adoption had higher scores

than unsuccessful cases. Furthermore, for accelerated cases, the results show that only one OCM practice, communicated benefits, was significant, in which successful cases had higher median scores.

Content Analysis of Respondent's Comments

Respondents were asked to provide comments about barriers and drivers to the change adoption case in addition to any other related feedback. Content analysis is research methodology used to identify patterns or certain themes in a qualitative data by systematically codeing and analyzing key words and phrases (Fellows and Liu 2021; Kolbe and Burnett 1991; Neuendorf 2002). First, the 92 cases had 70 cases with respondent comments. Second, respondent comments were categorized based on CAC levels; unsuccessful, successful, very successful. Third, comments were coded based as either accelerated or hyper-accelerated cases. Finally, identifying patterns or themes within the data was done by searching for keywords or phrases that might address drivers or barriers of the change adoption process.

The content analysis found common themes and patterns that represent the overall scene of the implementation process. For example, the common patterns within the successful adoption cases were active management support and involvement, sufficient training resources, communication throughout the process, and leadership buy-in. On the other hand, comments from unsuccessful adoption cases presented a chaotic and hostile environment. Common themes within those cases were entitled by the fear of losing jobs, the fear of speaking out, forcing the adoption, poor definition and plan, and high resistance to change. These observations align with study findings, where accelerating the change adoption process increases the chances of achieving unsuccessful outcomes. These findings shed additional light on reasons why fast-tracking the

adoption process could fail. Table C-2 in Appendix C lists respondents' a sample of comments from successful and unsuccessful adoption cases.

DISCUSSION

Successful and Unsuccessful Change Adoption of Accelerated Projects

Change adoption cases tend to become unsuccessful with shorter, fast-tracked, or unrealistic timeframes. It was found that the faster the change implementation process was, the smaller number of successful change adoption cases were found. For example, 50% of the accelerated adoption cases were unsuccessful, while 84% of the hyper-accelerated adoption cases were unsuccessful. Previous studies have also shown underestimating the time required to implement the change is one of the key obstacles to successfully adopting changes (Li and Becerik-Gerber 2011; Loosemore and Cheung 2015; Peansupap and Walker 2006; Sullivan 2011; Tan et al. 2012; Zhou et al. 2019). Moreover, the absence of a long-term implementation plan was identified as a key barrier to implementing BIM in the AEC industry (Hong et al. 2019).

Within all fast-tracked cases (n=92), it was found that all five OCM practices are important to drive successful change adoption, where these practices were utilized to a larger extent. As shown from previous results, with the increase in the acceleration of the project, the number of successful change adoption cases has decreased. However, sometimes change adoption in the AEC industry must be completed in a shorter time. When this happens, it becomes imperative for the leadership to understand the higher risk of failing the adoption due to this acceleration and navigate through management practices to encounter that risk. In general, leadership should effectively utilize and implement all five OCM practices that can drive the success of change adoption. Therefore, based on the results of this study, leadership should ensure the following when adopting

any change under a tight (fast-tracked) timeframe; the benefits of the change are to be communicated extensively and thoroughly to the end-user; senior leadership should be fully committed to implementing and supporting the change; users should be provided with extensive and tailored training resources; benchmarks for adoption success should be established and tracked throughout the implementation process; finally, committed and effective change agents should be assigned to champion and drive the change being implemented.

Successful Change Adoption under Hyper Accelerated and Accelerated Timeframes

When change adoption cases were grouped based on the speed of adoption rate into two levels (accelerated and hyper-accelerated), it was found that specific OCM practices drive the adoption success within each level. In adoption cases, where change adoption must occur under a tight timeframe that is considered to be accelerated to an extent (but not hyper-accelerated), leadership should focus on all five OCM practices but should do an outstanding job in effectively implementing one specific OCM which is communicating the benefits of the change. However, when change adoption must occur under a faster timeframe -where it would be much faster than the previous level (hyper-accelerated adoption rate)- leadership should also focus on all five OCM practices but should do an outstanding job in two more practices: change agents and measured benchmarks for adoption success.

In other words, organizations adopting changes under an accelerated adoption rate should prepare to do an excellent job in applying the OCM practice of communicating the benefits of the change. For organizations adopting changes under a hyper-accelerated adoption rate, they must prepare to do an excellent job of applying all three OCM practices of communicating the benefits of the change, effective change agents, and measured benchmarks for adoption success. All are

necessary to minimize the high potential of change adoption failure that comes with fast-tracking and increasing adoption rate.

Those results bolsters the finding from the previous section, where the faster the rate of adoption is, the greater the risk of failing the adoption process; the absence of very successful change adoption cases when fast-tracking the adoption process. In addition, they are aligned with study findings of Paper 1, Chapter 2; the significance of all OCM practices in avoiding unsuccessful adoption and the importance of establishing a realistic timeframe and adoption rate -if applicable- while adopting changes.

CONCLUSION

A realistic and appropriate timeline for change adoption is not always a commodity that organizations have, and many organizations accelerate or fast track the adoption of change. This can lead to increased resistance levels, the necessity for more rapid learning rates, and increased pressure on the leadership to craft the change message successfully and disseminate training effectively. The objective of this study was to identify best OCM practices for implementing change under an accelerated (fast-tracked) timeframe without jeopardizing the ability to achieve successful adoption of that change. An industry-wide approach was taken to collect 92 fast-tracked organizational change adoption cases from AEC firms across North America. Almost two-thirds of the collected cases represented unsuccessful cases of change adoptions, without any single case categorized as a very successful adoption, based on previously identified three levels of successful change adoption (*Unsuccessful, Moderately Successful, Very Successful*). Descriptive, inferential, and content analyses were performed to study OCM practices for change adoption cases under fast-tracked adoption rates. The study shows that the effective use of five OCM strategies was

crucial to avoiding *Unsuccessful* change adoption in all fast-tracked changes. In addition, the study shows that achieving a very successful level of adoption is not likely when accelerating the adoption with an unrealistic timeframe. However, the study shows that avoiding unsuccessful change adoption is still possible when leadership focuses on effective use of specific OCM strategies; communicating the benefits of the change for accelerated cases, and communicating the benefits of the change, change agents, and measured benchmarks for adoption success for Hyper accelerated cases.

Claimed Contribution

This study contributes to the body of knowledge by providing a more specific understanding of the importance of each OCM practice to avoid and successful change adoption and achieve successful outcomes when change adoption must go through an accelerated adoption rate. The results showed that fast-tracking and accelerating the change adoption process could hinder organizations from achieving all desired outcomes and benefits of the change. There are multiple aspects of this contribution that are worth highlighting. First, the study analyzed the possibility of an organization not being able to utilize one of the key OCM practices that has a significant association with successful change adoption, establishing a realistic timeframe. Second, the results showed that all five OCM practices must be implemented to avoid unsuccessful adoption outcomes while going through fast-tracked adoption rates. Third, the study identifies OCM practices for each accelerated level to help leadership avoid unsuccessful outcomes of fast-tracked change adoption processes. Finally, the study results will assist practitioners in better strategizing the implementation of each OCM practice when adopting organizational change initiatives under accelerated (fast-tracked) adoption rates and timelines.

Limitations and Recommendations for Future Research

Several study limitations were identified. First, the limited number of data samples forced the author to pursue an exploratory type of analysis, including non-parametric analysis. Second, the cross-sectional data does not provide any information about the actual timing or durations of the change adoption process; a longitudinal collection of data will help explain the insignificant results and avoid any distilled factors that can be mediated. Third, each change adoption case presents a single point of view regarding OCM strategies and observed outcomes; therefore, the data may have been influenced by respondent bias or inaccurate recall of the change process. Fourth, the data were collected from members of the AEC industry only in the United States and Canada. Finally, the study is limited regarding factors that may correlate with successful change adoption; for example, industry trends, underlying motivations, the organization's level of initial investment, and employees' reaction to change were not considered in this study. Besides covering the limitations mentioned earlier, future researchers are recommended to collect more data and information for change adoption cases under an accelerated timeframe.

End of Chapter 4

CHAPTER 5: CONCLUSION

SUMMARY

The objective of the dissertation was to identify and analyze a set of OCM practices that can be learned, used, and developed to overcome adoption barriers, avoid adoption failure, and more consistently achieve the desired goals and outcomes of change initiatives in the AEC industry. To achieve this objective, the dissertation identified a set of common OCM practices using an interdisciplinary literature review and pursued three research objectives to analyze the set of OCM practices as follows:

- Research Objective #1: to model the relationship between OCM practices and the different achieved levels of successful change adoption. The intent is to understand (a) how organizations can avoid unsuccessful adoption outcomes and (b) the distinctive OCM practices that achieve the highest levels of successful change adoptions.
- Research Objective #2: to model the relationship between OCM practices and the levels of employee resistance (in the context of EWB). The intent is to understand (a) employee resistance as one of the key barriers to change implementation and (b) foster a better work environment that will positively impact the change adoption.
- Research Objective #3: to study the relationship of OCM practices under fast-tracked or "accelerated" change implementation timelines. This will help practitioners emphasize specific practices that will support the fast adoption rate of change and avoid adoption failure.

Data was collected using a purposive sample of members from more than 20 professional groups in the AEC industry. Three selection criteria were used. First, the study sought well-

recognized groups representing all different types of firms in the industry. Second, these groups were selected with the intent that they would include firms of all different sizes. Third, national and international groups were included to ensure broad geographical coverage of the responses. In total, 633 cases of organizational change adoption were collected. Each case represented a single organizational change initiative that an AEC organization had experienced. The collected cases consisted of 43% owners and 42% professional organizations across the United States and Canada. These organizations have an estimated annual revenue or expenditure ranging from less than $30 million to more than $500 million. Within these organizations, 36% have adopted technological changes, 34% adopted changes in the management process, and 17% adopted changes in their business structure and approach.

DISCUSSION OF DISSERTATION-WIDE FINDINGS

The AEC industry is experiencing numerous changes and organizations are rapidly adopting those changes to maintain their competitiveness and cope with market pressure. High failure rates of change adoption cases result in organizations failing to achieve their desired outcomes and benefits of the change or failing to sustain and maintain the change for the long term. However, this study provides empirical evidence that change adoption barriers and high failure rates can be reduced by using a set of six management practices.

The study found the importance of the six OCM practices identified in the literature via consistent findings throughout the three study objectives. All six OCM practices were found to be significant in avoiding change adoption failure, reducing employee resistance to change, increasing employee well-being, and making it possible to implement changes under tight timelines successfully. The first research objective found all OCM practices to be important in

avoiding unsuccessful change adoption. The second research objective found all OCM practices to be important in avoiding low employee well-being during the change adoption process. Similarly, the third research objective found all OCM practices to be important in successfully implementing changes under a fast-tracked adoption pace.

While avoiding change adoption barriers and failures is crucial for organizations, the study also investigated ways to achieve the highest levels of change adoption and employee well-being. In the first research objective, the study identified three levels of change adoption success; unsuccessful, successful, and very successful, in which the study analyzed the association of each OCM practice with each of the adoption levels. The study found two practices (change agents and realistic timeframe) to stand out in achieving a very successful change adoption; achieving all desired benefits outcomes and sustaining the change for the long term. Similarly, in the second research objective, the study identified three levels of employee well-being; low, moderate, and high, in which the study analyzed the association of each OCM practice within each level. The study found one practice (realistic time frame) to stand out in achieving high employee well-being. The results of the two objectives had one common OCM practice that helped achieve the highest levels of successful change adoption and employee well-being: establishing the proper and realistic time frame required for the adoption process. However, this OCM practice is the only one among the six that cannot always be directly controlled by the organization; rather, sometimes a change adoption timeline is dictated by external which may force organizations to adopt changes under a limited time frame. This led to the third research objective, which analyzed change adoption cases that were implemented under a tight timeframe. The study found that the number of successful change adoption cases dramatically decreased while increasing the speed (e.g. shortening the timeline) of the change adoption process. Within those change adoption cases, the study identified

OCM practices that stood out in successful adoption cases compared to unsuccessful cases, which were found to be communicated benefits, measured benchmarks, and change agents.

RESEARCH CONTRIBUTION

The study contributes to the body of knowledge by using an interdisciplinary approach to analyze and study practices, barriers, and the drivers of organizational change adoption in the AEC industry. There are multiple aspects of this contribution that are worth highlighting. First, based on the author's knowledge, the study currently has the largest data sample collected to-date of change adoption cases in the AEC industry. Second, the study contributes by providing a methodology and framework to be used by future researchers to measure different levels of change adoption success and employee well-being. Third, it enables the results to be broadly generalized for all change types through the AEC industry due to the industry-wide and purposive collected data sample of 633 change adoption cases rather than being limited to a specific type of change or individual sub-sector of the AEC industry. Finally, the study contributes to the body of knowledge by providing a more specific understanding of the unique association of using each OCM practice to achieve greater change adoption success, higher employee well-being, and a faster implementation timeline; whereas previous studies have been limited to associations between these variables without accounting for the nuances that are present among the different levels of change adoption and employee well-being.

LIMITATIONS

Several study limitations were identified. First, the study is limited to the six predominant OCM strategies identified in the literature and does not account for additional factors that may

contribute to a successful change initiative. Second, the data does not provide information about the specific timing and sequence of each OCM practice or employee reactions; a longitudinal collection of data across individual cases is recommended in future studies. Third, each change adoption case presents a single point of view regarding OCM strategies and observed outcomes; therefore, the data may have been influenced by respondent bias or inaccurate memory recall of the change process. Fourth, the limited number of data samples in Chapter 4 has forced the author to pursue non-parametric analysis. Fifth, the demographic groups were unevenly distributed, which limited the findings of the differences between groups. Finally, the data were collected from members of the AEC industry only in the United States and Canada.

FUTURE RESEARCH

Future research is recommended to address the limitations mentioned above and build upon current research. Several recommendations for future research are listed below:

- Investigate the effective use of change agents in greater detail by identifying the characteristics and responsibilities of change agents to better support the selection process of change agents. Such research is recommended to develop a framework to measure the effectiveness of change agents throughout the change adoption process.
- Evaluate specific techniques used by organizations to communicate the benefits of the change to their employees.
- Develop a framework that organizations can use to identify the most appropriate timeline for the adoption process and measure progress toward change-related milestones.

End of Chapter 5

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APPENDICES

APPENDIX A – DEFINITION OF MAIN RESEARCH VARIABLES

List of Tables

Table A - 1. Organizational Change Management Practices

OCM Variables	Definition
Senior-leadership commitment	The organization's senior leaders were committed to making the change a success (i.e., they "walked the talk").
Training resources	Employees had a clear understanding of the action steps for implementing the change in their job functions.
Communicated benefits	Employees clearly understood how the change would benefit them in their job functions.
Realistic timeframe	The speed at which the organization implemented the change was appropriate.
Change-agent effectiveness	The change agents (transition team) responsible for managing the change in the organization were effective.
Measured benchmarks	The organization established clear benchmarks to measure the success of the change.
Adjusted workload	The organization's leaders appropriately adjusted staff members' workloads so they could focus on implementing the change.

Table A - 2. Measurement of Successful Change Adoption

Change Adoption Variables	Definition
Implemented into Operations	The organizational change was successfully adopted in the organization's operations as intended.
Benefits Achieved	The organization achieved benefits through implementing the change.
Long-Term Sustainability	The organization has sustained the change in its long-term operations (or is on track to sustain the change).
Change Adoption Construct (CAC)	The overall organizational change adoption is measured as the linear composite of the optimally weighted change adoption variables. (The obtained variable encompasses the above three measures of successful change adoption)
Success Levels of Change Adoption	Three adoption levels were identified based on the three change adoption measurements reported by respondents. The three levels are unsuccessful, moderately successful, and very successful change adoption.

Table A - 3. Employee Reactions during Change Adoption

Employee Reaction	Definition of Observable Employee Reaction
Championing	Initiating and embracing the change in the organization
Actively Supporting	Supporting the change within the organization
Passively Supporting	Accepting the change
Reluctantly Complying	Just going with the change
Passively Avoiding	Ignoring, withdrawing, avoiding the change
Openly Not Participating	Refraining, waiting, observing the change
Covertly Opposing	Stalling, dismantling, undermining the change
Overtly Opposing	Obstructing, opposing, arguing the change
EWB Score	An average score of the reported reactions

Table A - 4. Types of Organizational Changes

Change Type	Definition and Examples
Technology	Digital or software technologies (examples include estimating, project management, data management, document management, data analysis, payroll automation, time management, operating platforms, communication, and BIM) and hardware technological changes (examples include drones, smartphones, tablets, tracking sensors, movements sensors, GPS sensors, and scanning tools for virtual reality, and internet of things)
Management Processes	Quality management, alternative procurement, and alternative project delivery methods (examples include design-build, construction manager at risk, public-private-partnership, and integrated project delivery)
Business	Changes in organizational structure and business approach (examples include mergers, acquisitions, hierarchical reorganizations, and entering new markets)

Table A - 5. Respondents' Demographics

Variables	**Definitions**
Sector type	The organization's sector is either public or private.
Organization type	The organization performs as an owner; engineering, procurement, and construction (EPC); subcontractor; architect/engineering consultant; or other types.
Respondent's job position	The respondent's job position in the organization is senior executive, vice president, regional manager, project lead, team member, or another position.
Respondent's years of professional experience	The respondent has been in the industry for less than five years, 5–9 years, 10–19 years, 20-29 years, 30-39 years, or 40 or more years.
Generational affiliation	The respondent is a baby boomer (1946–1964), a member of generation X (1965–1978), or a member of generation Y (1979–1997).

End of Appendix A

APPENDIX B – FACTOR ANALYSIS

Principal Component Analysis (PCA) is a variable-reduction technique (similar to factor analysis) that was performed to produce one dependent variable that represents the three change adoption variables, where the obtained variable was named Change Adoption Construct (CAC).

IBM® SPSS® Statistics software version 27 was used to perform this analysis.

The two following sections will present the process and test performed to implement PCA and the results of it:

Section 1) lists the code (syntax) used in SPSS to perform PCA.

Section 2) lists exported SPSS output in response to the code.

Section 1 – SPSS Syntax

```
**Step 1. Internal Reliability.

SPSS Syntax

RELIABILITY
  /VARIABLES=GoalsAchieved BeneficialImpacts SustainedLongterm
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /STATISTICS=CORR.


**Step 2. Factor Analysis – PCA

FACTOR
```

```
  /VARIABLES GoalsAchieved BeneficialImpacts SustainedLongterm
  /MISSING LISTWISE
  /ANALYSIS GoalsAchieved BeneficialImpacts SustainedLongterm
  /PRINT INITIAL CORRELATION KMO REPR AIC EXTRACTION ROTATION
  /FORMAT SORT BLANK(.3)
  /PLOT EIGEN ROTATION
  /CRITERIA MINEIGEN(1) ITERATE(25)
  /EXTRACTION PC
  /CRITERIA ITERATE(25)
  /ROTATION VARIMAX
  /SAVE REG(ALL)
  /METHOD=CORRELATION.
```

End of SPSS Syntax

Section 2 – SPSS Output

Reliability

Case Processing Summary

		N	%
Cases	Valid	621	98.1
	Excluded[a]	12	1.9
	Total	633	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.853	.853	3

Inter-Item Correlation Matrix

	Goals Achieved	Beneficial Impacts	Sustained Long-term
Goals Achieved	1.000	.763	.627
Beneficial Impacts	.763	1.000	.589
Sustained Long-term	.627	.589	1.000

- - - - - - - - - - - - - - F A C T O R A N A L Y S I S - - - - - - - - - - - - - using PCA.

Factor Analysis

Warnings

Only one component was extracted. Component plots cannot be produced.

Correlation Matrix

		Goals Achieved	Beneficial Impacts	Sustained Long-term
Correlation	Goals Achieved	1.000	.763	.627
	Beneficial Impacts	.763	1.000	.589
	Sustained Long-term	.627	.589	1.000

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.704
Bartlett's Test of Sphericity	Approx. Chi-Square	877.626
	df	3
	Sig.	.000

Anti-image Matrices

		Goals Achieved	Beneficial Impacts	Sustained Long-term
Anti-image Covariance	Goals Achieved	.370	-.240	-.157
	Beneficial Impacts	-.240	.398	-.106
	Sustained Long-term	-.157	-.106	.578
Anti-image Correlation	Goals Achieved	.658[a]	-.625	-.340
	Beneficial Impacts	-.625	.679[a]	-.220
	Sustained Long-term	-.340	-.220	.819[a]

a. Measures of Sampling Adequacy (MSA)

Communalities

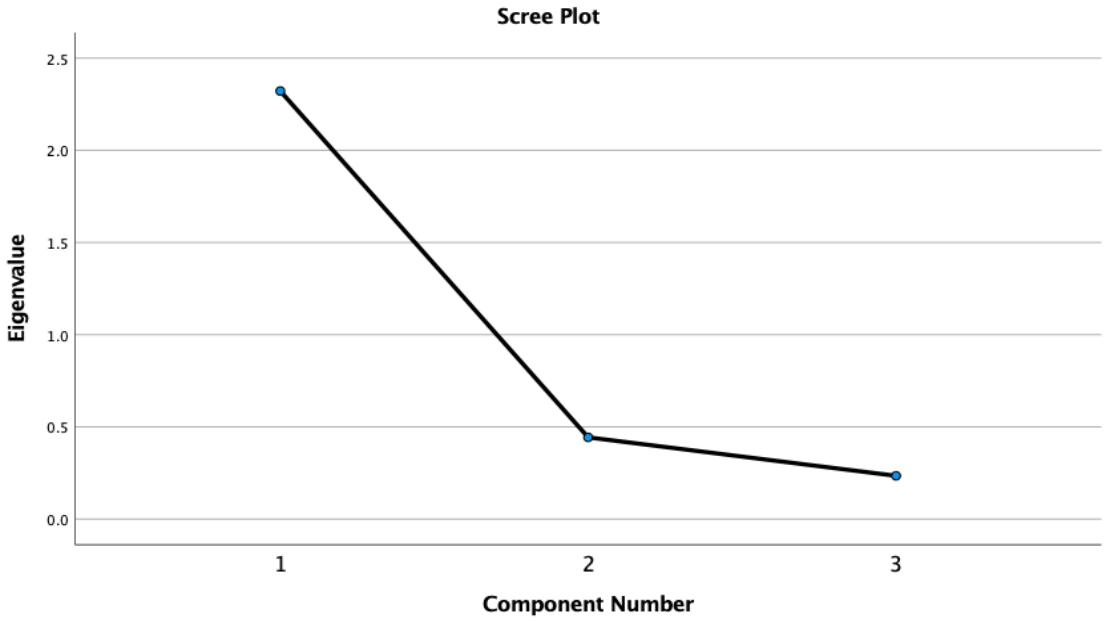
	Initial	Extraction
Goals Achieved	1.000	.829
Beneficial Impacts	1.000	.802
Sustained Long-term	1.000	.690

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.322	77.392	77.392	2.322	77.392	77.392
2	.443	14.778	92.170			
3	.235	7.830	100.000			

Extraction Method: Principal Component Analysis.



Component Matrix[a]

	Component 1
Goals Achieved	.911
Beneficial Impacts	.896
Sustained Long-term	.831

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Reproduced Correlations

		Goals Achieved	Beneficial Impacts	Sustained Long-term
Reproduced Correlation	Goals Achieved	.829[a]	.816	.757
	Beneficial Impacts	.816	.802[a]	.744
	Sustained Long-term	.757	.744	.690[a]
Residual[b]	Goals Achieved		-.053	-.130
	Beneficial Impacts	-.053		-.155
	Sustained Long-term	-.130	-.155	

Extraction Method: Principal Component Analysis.
a. Reproduced communalities
b. Residuals are computed between observed and reproduced correlations. There are 3 (100.0%) nonredundant residuals with absolute values greater than 0.05.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

End of SPSS Output

End of Appendix B

APPENDIX C – SAMPLE OF RESPONDENT COMMENTS

Table C - 1. Respondents' comments regarding change-related training

Barriers: "What were the biggest barriers to the change implementation?"
• Restricted investment funds, access/time available of project staff to participate in training & workshops. • Lack of training in using the new product. • Not enough time was allotted for training. • Many users did not have strong computer skills. • Training and lack of resources to support change • Training to maximize user adoption • People who had only done things the old way for their entire career were not interested in change. Also, contract language had to be changed, and staff needed training.
Drivers: "What were the greatest drivers of success to the change implementation?"
• Traveling to each of the mills and presenting the process and showing them how it functions as well as showing the value of it and the system that supports it. • Strong functional VP engagement & guidance through weekly meetings within functions and cross-functional VP meetings. • Training and more formal and informal presentations on changes and meetings with individual groups. • Workgroup training sessions on the new software and discussion of the new workflow. • Regular meetings; proactive participants; a set outcome; realistic time horizons; easily recognizable and measurable results. • Lots of training on how to use the system and having people to contact that can answer questions.

Table C - 2. Respondents' comments from fast-tracked adoption cases

Successful change adoption cases
• Management who actively supported the project • Owner commitment to change • Training was provided to maximize user adoption. • Senior Management support and demonstrated buy-in. • Communications once the project was begun. • Champions and forcing the spending of resources. • Spending more money on training and hiring more staff to cover for extra time spent on training
Unsuccessful change adoption cases
• People who didn't want to change and an unrealistic timeline to implement. • Timeline. No trial or testing prior to implementation. • You lose your job and will be replaced if you don't do this. • Scopes were left undefined, and there was no direction as to how to execute the work based on details, so assumptions had to be made. • Not well understood. Not well aligned with the current state of the business. • Lack of a clear plan to implement the change. Lack of communication about the change. The lack of prior research indicates that the change would be successful. • Poor preparation for implementation. Lack of understanding of the capabilities of the new system. • Top-down bullying approach. Fear that individual jobs would change or be eliminated. • Outsiders trying to force change without understanding the system. • Removal of employees which hindered the process and replacement of leadership who didn't agree with it. • People who didn't want to change and an unrealistic timeline to implement. • The program being shoved at us and saying you WILL use this. • Poorly organized implementation. Poor description of benefits.

End of Appendix C

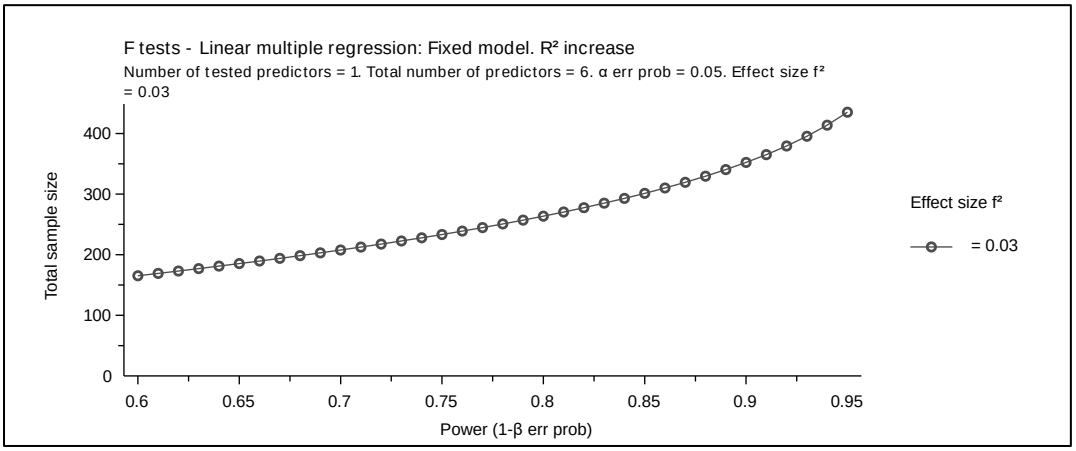
APPENDIX D – POWER ANALYSIS

Power analysis for regression models was performed to understand the limitation of the sample size. Power analysis was performed using G*Power app, version 3.1.9.6, by Ute Clames.

G*Power is a tool to compute statistical power analyses for many different t tests, F tests, $\chi 2$ tests, z tests and some exact tests. G*Power can also be used to compute effect sizes and to display graphically the results of power analyses. Definitions and interpretation of results were based on publications by the G*Power team (Faul et al. 2009).

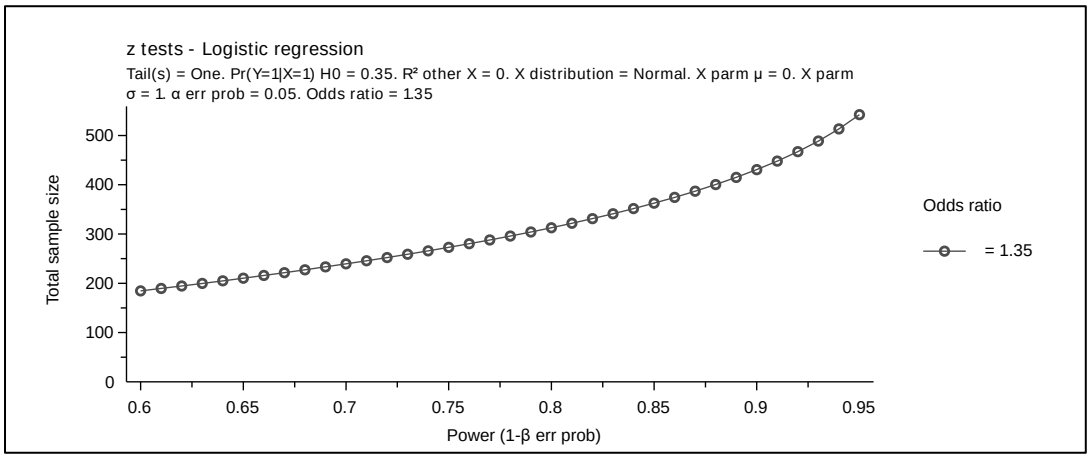
Linear Multiple Regression

Below is the X-Y plot exported from the G*power app. The plot shows how large the sample size must be to achieve a power of 0.95. based on study variables it was found that the required sample size is N = 429. This provide that the study sample size for the multiple regression analysis (N=517) is above the required threshold for high statistical power. The total sample size is 429 for a relatively small effect size of 0.03 based on Cohen (1969, p.76) identification.



Logistic Regression

Below is the X-Y plot exported from the G*power app for logistic regression. The result shows that with a data sample of N=543, nonsignificant variables with odds ratio below 1.35 might be significant in a bigger data set. This means that the data sample of this study (N=595) were large enough to avoid Type 2 errors for variable with odds ratio above 1.35.



End of Appendix D

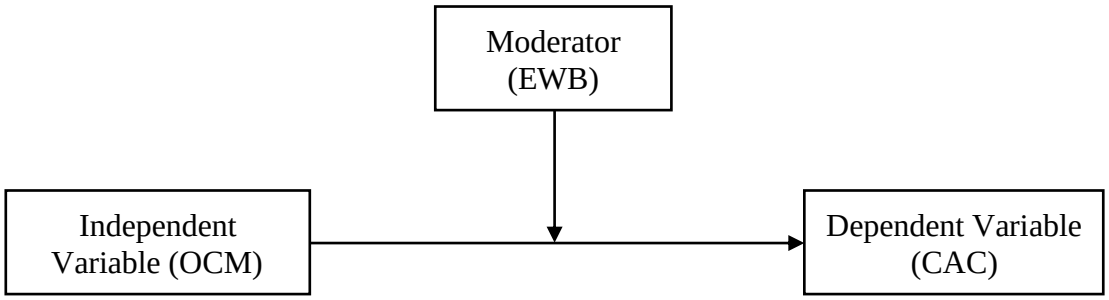
APPENDIX E – MODERATION AND MEDIATION EFFECT

Moderation and mediation analysis were performed to analyse if EWB as variable is moderating or mediating the relationship between OCM practice and CAC. Moderation and Mediation analysis were performed on the data using Hayes's (2018) process tool version 3.5 in SPSS.

Reference: *Hayes, A. F. (2018). Partial, conditional, and moderated mediation: Quantification, inference, and interpretation. Communication monographs, 85(1), 4-40.*

Moderation Effect

Moderation is a way to check whether that third variable (Moderator) influences the strength or direction of the relationship between an independent and dependent variable. The figure below shows the moderator relationship diagram that was tested for this research.

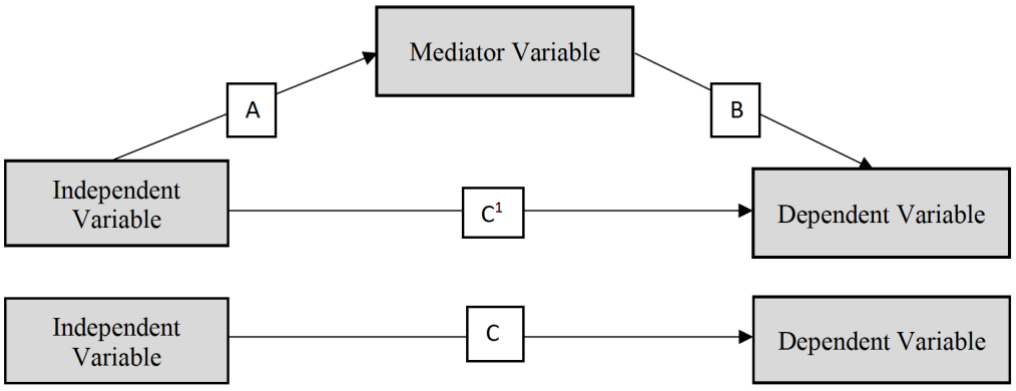


A moderator analysis is used to determine whether the relationship between two variables (OCM & CAC) depends on (is moderated by) the value of a third variable (EWB). In other words, the effect of OCM on CAC is influenced or dependent on EWB. The analysis results and variables plot using Hayes's process are shown at the end of this section. The interaction term between OCM and EWB is not significant p = 0.1661. The results show no statistically significant moderator effect of EWB on the relationship between OCM and CAC. Meaning that CAC is not dependent on EWB. The insignificant effect of EWB on CAC is also visible in in the plot.

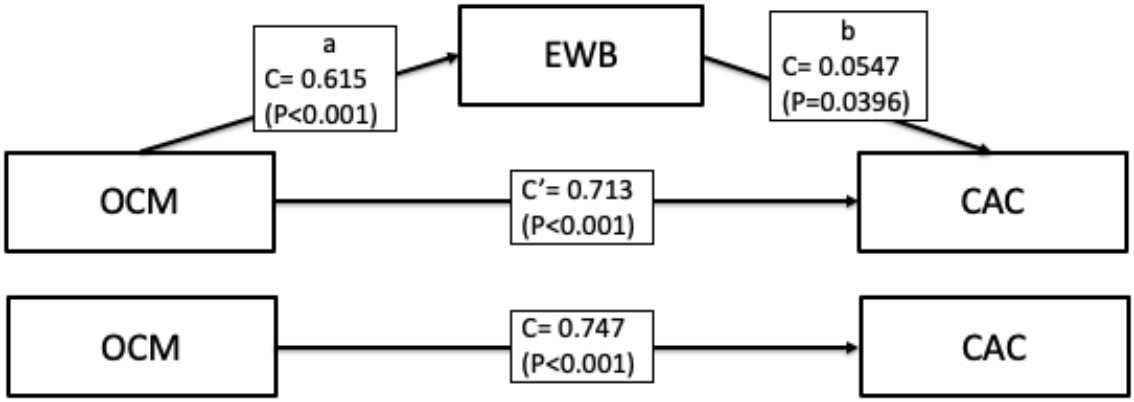
Mediation Effect

Mediation effect happens when a mediator mediates the relationship between the independent and dependent variables, which would explain the reason for such a relationship between the independent and dependent variables to exist. The figure below shows the mediation model that was tested in for this research.

Total Effect (C) = Direct effect (C^1) + Indirect Effect (A*B)



The purpose of mediation analysis is to see if the influence of the mediator (EWB) is stronger than the direct influence of the independent variable (OCM) on the dependent variable (CAC). The analysis results and variables plot using Hayes's process are shown at the end of this section. As presented in the below figure, the mediation results showed that there no significant indirect effect of OCM on CAC through EWB; mediation has not occurred, ab=0.034, CI [-0.004, 0.074]. The mediator could account for 4.5% of the total effect of OCM on CAC.



The results overall shows that there is a small effect found of EWB on CAC while OCM are in consideration. In other words, EWB during change adoption slightly affected the successful change adoption. Moreover, the results shows that it is possible to achieve successful change adoption without focusing on increasing EWB. However, even with these results the author failed to reject the null hypothesis that there is no mediation effect of EWB on CAC. Further, analysis is needed to explore this phenomenon that connect EWB with CAC.

SPSS Output of Hayes's (2018) Process Tool Version 3.5

```
/* PROCESS version 3.5 */.
/* Written by Andrew F. Hayes */.
/* www.afhayes.com */.
/* www.processmacro.org */.
/* Copyright 2017-2020 by Andrew F. Hayes */.
/* Documented in http://www.guilford.com/p/hayes3 */.
/* PROCESS workshop schedule at http://www.processmacro.org/workshops.html */.

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/* OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE */.
/* SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE */.
/* USE OF THIS SOFTWARE IMPLIES AGREEMENT WITH THESE TERMS */.

set printback=off.
```

Matrix

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 3.5 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : CAC NEW
    X  :  OCM
    M  :  EWB avg

Sample
Size:  428

**************************************************************************
OUTCOME VARIABLE:
 Ravg

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .4704      .2213     1.4291   121.0740     1.0000   426.0000      .0000
```

```
Model
              coeff         se          t          p       LLCI       ULCI
constant     5.6639       .0579    97.8734       .0000     5.5502     5.7777
   OCM        .6152       .0559    11.0034       .0000      .5053      .7251

**************************************************************************
OUTCOME VARIABLE:
 CAC_NEW

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .7652       .5856       .4280   300.2650     2.0000   425.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -.2843       .1535    -1.8526       .0646     -.5860      .0173
   OCM        .7134       .0347    20.5769       .0000      .6453      .7816
EWB avg       .0547       .0265     2.0639       .0396      .0026      .1068

************************** TOTAL EFFECT MODEL ****************************
OUTCOME VARIABLE:
 CAC_NEW

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .7625       .5814       .4312   591.7420     1.0000   426.0000       .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      .0256       .0318       .8058       .4208     -.0369      .0881
   OCM        .7471       .0307    24.3257       .0000      .6867      .8075

************** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **************

Total effect of X on Y
     Effect         se          t          p       LLCI       ULCI       c_ps       c_cs
      .7471       .0307    24.3257       .0000      .6867      .8075      .7369      .7625

Direct effect of X on Y
     Effect         se          t          p       LLCI       ULCI      c'_ps      c'_cs
      .7134       .0347    20.5769       .0000      .6453      .7816      .7037      .7282

Indirect effect(s) of X on Y:
        Effect     BootSE   BootLLCI   BootULCI
```

```
EWB avg      .0337      .0193     -.0038      .0735

 Partially standardized indirect effect(s) of X on Y:
          Effect     BootSE   BootLLCI   BootULCI
EWB avg      .0332      .0192     -.0038      .0731

 Completely standardized indirect effect(s) of X on Y:
          Effect     BootSE   BootLLCI   BootULCI
EWB avg      .0344      .0198     -.0039      .0751

 ************************ ANALYSIS NOTES AND ERRORS *************************

 Level of confidence for all confidence intervals in output:
   95.0000

 Number of bootstrap samples for percentile bootstrap confidence intervals:
   5000

 ------ END MATRIX -----

 * Encoding: UTF-8.

 /* PROCESS version 3.5 */.
 /* Written by Andrew F. Hayes */.
 /* www.afhayes.com */.
 /* www.processmacro.org */.
 /* Copyright 2017-2020 by Andrew F. Hayes */.
 /* Documented in http://www.guilford.com/p/hayes3 */.
 /* PROCESS workshop schedule at http://www.processmacro.org/workshops.html */.

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 set printback=off.
```
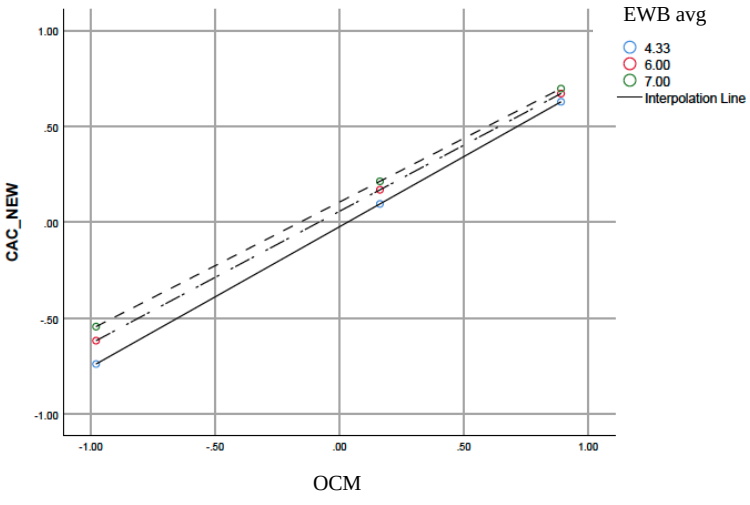

Matrix

```
 Run MATRIX procedure:
```

```
***************** PROCESS Procedure for SPSS Version 3.5 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
Model  : 1
    Y  : CAC_NEW
    X  :    OCM
    W  :    EWB avg

Sample
Size:  428

**************************************************************************
OUTCOME VARIABLE:
 CAC_NEW

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      .7665      .5875      .4270   201.2533     3.0000   424.0000      .0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     -.2327      .1578    -1.4749      .1410     -.5428      .0774
OCM           .8409      .0982     8.5632      .0000      .6479     1.0339
EWB avg       .0484      .0269     1.7988      .0728     -.0045      .1012
Int_1        -.0253      .0182    -1.3871      .1661     -.0611      .0106

Product terms key:
 Int_1    :         OCM      x        EWB avg

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0019     1.9241     1.0000   424.0000      .1661
----------
    Focal predict:    OCM    (X)
          Mod var:   EWB avg  (W)

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
     OCM       EWB avg       CAC_NEW    .
```

```
BEGIN DATA.
     -.9795     4.3333     -.7394
      .1624     4.3333      .0956
      .8908     4.3333      .6283
     -.9795     6.0000     -.6175
      .1624     6.0000      .1693
      .8908     6.0000      .6713
     -.9795     7.0000     -.5444
      .1624     7.0000      .2136
      .8908     7.0000      .6971
END DATA.
GRAPH/SCATTERPLOT=
 OCM      WITH      CAC_NEW  BY       Ravg      .

********************** ANALYSIS NC  EWB avg  ORS ************************

Level of confidence for all confidence intervals in output:
  95.0000

------ END MATRIX -----

DATA LIST FREE/
    OCM         EWB avg        CAC_NEW     .
BEGIN DATA.
     -.9795     4.3333     -.7394
      .1624     4.3333      .0956
      .8908     4.3333      .6283
     -.9795     6.0000     -.6175
      .1624     6.0000      .1693
      .8908     6.0000      .6713
     -.9795     7.0000     -.5444
      .1624     7.0000      .2136
      .8908     7.0000      .6971
END DATA.
GRAPH/SCATTERPLOT=
  OCM      WITH      CAC_NEW  BY       EWB avg      .
```

Graph



End of Appendix E