Action Research Approach to Implementation of APDMs within Owner Organizations

Strategic Management and Overcoming Resistance to Change in the AEC Industry

by

Brian Lines

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved July 2014 by the
Graduate Supervisory Committee:

Kenneth Sullivan, Chair
Avi Wiezel
William Badger

ARIZONA STATE UNIVERSITY

August 2014

ABSTRACT

Owner organizations in the architecture, engineering, and construction (AEC) industry are presented with a wide variety of project delivery approaches. Implementation of these approaches, while enticing due to their potential to save money, reduce schedule delays, or improve quality, is extremely difficult to accomplish and requires a concerted change management effort. Research in the field of organizational behavior cautions that perhaps more than half of all organizational change efforts fail to accomplish their intended objectives. This study utilizes an action research approach to analyze change message delivery within owner organizations, model owner project team readiness and adoption of change, and identify the most frequently encountered types of resistance from lead project members. The analysis methodology included Spearman's rank order correlation, variable selection testing via three methods of hierarchical linear regression, relative weight analysis, and one-way ANOVA. Key findings from this study include recommendations for communicating the change message within owner organizations, empirical validation of critical predictors for change readiness and change adoption among project teams, and identification of the most frequently encountered resistive behaviors within change implementation in the AEC industry. A key contribution of this research is the recommendation of change management strategies for use by change practitioners.

TABLE OF CONTENTS

ii

iii

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

CHANGE COMMUNICATION STUDY

As market conditions and competition continuously shift, owner organizations that procure services for the delivery of architecture, engineering, and construction (AEC) projects have become increasingly interested in implementing new project delivery strategies to improve procurement methods, planning and contracting approaches, and risk and performance management over the lifetime of their projects (Hallencreutz and Turner 2011). Yet successful implementation of new business processes can be difficult for organizations to accomplish, and literature sources suggest that more than half of all such efforts ultimately fail to accomplish their original intended goal (Balogun and Hope Haley 2004, Maurer 1996, Pascale *et al*. 1997). This high failure rate is a function of many complex process management challenges that face implementation (Judson 1991). For an owner organization (defined within the context of this paper as large public agencies such as local, city, state, and federal government institutions), the adoption of a new project delivery strategy requires widespread change, including substantial numerous owner responsibilities, including procurement methodologies, evaluation criteria, standard contract documentation, contract award procedures, project risk management, and project organization (Magliaccio *et al.* 2008).

One of the key challenges confronting organizations that are implementing a change initiative is the effective distribution of training content to organizational personnel (Kotter 1995). Furthermore, many aspects of AEC project delivery make change

1

implementation inherently difficult for owner organizations to provide adequate training

(Magliaccio *et al.* 2008). Among the challenging aspects of AEC project delivery is the

fact that it is an industry of high product diversity, making it particularly difficult for

owner organizations to balance the dichotomy between the company-wide

standardization and application on individual projects that each contain a unique set of

requirements and constraints (Pheng and Teo 2004). Another challenge is the need to

develop role-specific project information to explicitly define the interrelationship

between various project stakeholder roles within the new project delivery system (Froese

2010). Oftentimes senior leadership and change leaders within the organization

underestimate the time and resources that need to be devoted towards basic training for

all participants (Hendersen *et al.* 2000). Lastly, and perhaps most challenging, is the

employee resistance to change because frontline personnel on the project level have

trained for years in one method, so it is difficult to convince and train them to

successfully enact a new approach (Hoff 2006; Sullivan 2011).

All of these challenges make it extremely important for AEC owner organizations to

utilize effective training frameworks when implementing a new project delivery strategy.

In response to these challenges, this paper develops a framework for providing process-

based training to project-level personnel within AEC owner organizations. A process

training tool (PTT) was developed via a Delphi study of expert groups with experience as

trainers tasked with providing project- and organizational-level training to AEC owner

organizations as well as trainees who has received the training to implement a new

project delivery strategy on their projects. The PTT's framework made extensive use of

information and communication technology (ICT), and the specific technologies that were utilized are presented along with details of the resultant PTT (including screenshots, layouts, and menu navigation). The framework of the PTT was validated via application within multiple large public agencies, with feedback from project-level personnel confirming the tools' ability to reduce barriers to change implementation. Furthermore, the beneficial impact of the PTT framework on the allocation of in-person training requirements was also documented.

CHANGE READINESS AND CHANGE ADOPTION STUDY

Owner organizations are increasingly in the pursuit of new tactics for procuring, contracting, and managing the services needed in the delivery of architecture, engineering, and construction projects. The concept of a new "project delivery tactic" (PDT) is fundamental to this study and is defined as a set of innovative procurement and project management tools, contracting processes, and operational techniques that are new to the owner organization and used to accomplish specific objectives within any of the procurement, contract award, and project execution phases of a project. Within the context of this study, these PDTs do not include holistic systems of alternative project delivery such as design-build, construction manager at risk, integrated project delivery, or public-private partnerships; rather, the scope of PDTs in this research is centered on the implementation of a project-level tactic (or set of tactics) aimed at accomplishing a specific deliverable within a project phase at a greater level of performance. In 2000, Miller *et al.* predicted that owner organizations would continue to require such PDTs on their projects in the form of different service methods, including specific techniques of

decision analysis, proposal evaluation, application of technologies, and changes in project management functions.

True to Miller *et al.*'s prediction, much recent literature has been devoted to the application of PDTs such as pre-project scope assessment tools (Cho and Gibson 2001, Gibson *et al.* 2006, Wang and Gibson 2010), quality management programs (Sullivan 2011), project management software technologies (Wong and Zhang 2013), different evaluation and selection criteria (Xia *et al.* 2013, Gransberg and Barton 2007, Gransberg and Molenaar 2004, Pietroforte and Miller 2002), concepts of enhanced risk transfer in contract documents (Malisch 2012), multicriteria decision-making tools (Cristobal 2011), project control and performance reporting systems (Sullivan and Michael 2011), structured project management concepts (Hegazy 2006), and even conscious efforts to change the management culture within an owner organization's operations (Ankrah *et al.* 2008). The specific PDTs analyzed in the context of this study consisted of alternative procurement methods (with associated evaluation criteria that were new to the owner organization), new processes for including project operation planning deliverables for inclusion in contract award documentation, and risk tracking tools to enhance project control across the lifespan of project execution. A more detailed description is provided in the methodology section.

Researchers have predicted that sophisticated owners will consciously attempt to adapt to the pressures in the industry by shifting their procurement and management paradigms while others will struggle to keep up with the pace of change (Miller *et al.* 2000). Yet for

4

any organization, implementing tactical changes in their operations requires a significant change management effort to facilitate organizational learning (Huang and Shih 2011, USDOT 2004, FHWA 2004). Medina, Lavado and Cabrero's (2005) study of innovation across many industries noted a large number of organizational and structural variables related to an organization's capacity to absorb new practices. Similarly, much research conducted in the field of organizational behavior has affirmed the organizational change implementation to be a longitudinal, complex, and dynamic endeavor (Bandura 1986, Gray *et al.* 2012, Langley 1999). Specifically within the AEC industry, Migliaccio, Gobson, and O'Connor (2008) remarked upon how little descriptive information currently exists in the literature regarding how owner organizations implement a change in project delivery. The objective of this study is therefore to address the question: How can owner organizations in the AEC industry approach change management to ensure their organizations and project teams are both ready and able to adopt new project delivery tactics?

RESISTANCE TO CHANGE STUDY

In recent years, the architecture, engineering, and construction (AEC) industry have seen consistent growth in the implementation of advanced project delivery tactics (PDTs), whether specifically in the form of alternative procurement systems, evaluation and selection criteria, contracting methods, project management approaches, and risk management tools to assist project control (Barrett and Sexton 2006). In the context of this study, PDTs are defined as any individual (or set) of innovative approaches, tools, or processes that are intended to improve some deliverable within the AEC project delivery

5

life cycle. Thomas and Bone (2000) specifically identified supply chain management, partnering, and value and risk management as key areas for innovation in the construction literature along with technical innovation. Implementation of innovation, which may be defined as a process that is new to the organization and business unit (Barrett 2006), is presented with unique challenges in the AEC industry. This is because the AEC industry has a primarily project-based nature where individual and unique projects each consist of a temporary groupings of project stakeholders (Betts and Wood-Harper 1994, Carty 1995, Halpin and Woodhead 1998, Tatum 1986).

The project owner organization is a key stakeholder and decision maker in AEC projects (Ankrah *et al.* 2008), particularly in determining the delivery method, procurement method, contracting approach, and risk management process by which the project will operate. Yet successfully implementing planned organizational change can be extremely difficult for an owner organization due to the number and extent of modifications that are made to the organization's work processes, organizational structures, and personnel roles and responsibilities (Migliaccio, Gibson and O'Connor 2008). Owner organizations that choose to proceed with the implementation of a new PDT may be considered to be undergoing a planned organizational change effort, which requires the corresponding change management support to ensure the transition is a success (Burnes 2009).

Yet change management is a challenging, complex, and dynamic process that typically unfolds over a longitudinal time horizon (Gray, Stensaker and Jansen 2012). Numerous studies that have investigated the difficulty of organizational change have shown the

majority of organizational change efforts fail to reach their originally intended purpose (Ahn *et al.* 2004, Balogun 2005, Beer and Nohria 2000). Oftentimes the primary cause of organizational change failure is resistance against the change by organizational members (Foote 2001). Despite the seeming importance of resistance to change, studies over the past twenty years have been more divergent than convergent, such that there is no widely accepted definition of resistance to change or its relationship to critical aspects of OC implementation strategies (Erwin and Garman 2010). Dent and Powley (2001), for example, present 10 widely different definitions from past authors with definitions ranging from individual reactions to the belief that resistance is inherently embedded within every organization's structure and culture. This study will take a broad view of resistance to change, defining resistance as any form of dissent or other force that slows, opposes, or stops an organizational change movement (Giangreeco and Peccei 2005, Maurer 1996).

Due to its large impact on the success or failure of organizational change efforts, resistance to change is an important problem that must be overcome or even eliminate wherever possible (Mabin *et al.* 2001, Piderit 2000). Unfortunately, very little research exists to define the type and frequency of change resistance that is encountered within the AEC industry, let alone the corresponding strategies to overcome it. Furthermore, research studies in resistance to change have primarily been based on either theoretical methods or self-report survey questionnaires, which lead Erwin and Garman (2010) to explicitly recommend further research to follow more "practice-based methods" such as case studies and action research, to better define the dynamics of resistance within

7

practical organizational settings. Fiedler (2010) in fact further described a practice-based application of action research that was useful in collecting "actual resistive behaviors" through direct researcher collaboration with the organizational team performing the change program.

This study is presented as an initial attempt at defining the specific types and timing of resistance that AEC owner organizations can expect to encounter when implementing a planned change in their project delivery processes. An action research methodology was utilized to collect resistance to change data from 52 AEC projects across sixteen owner organizations. Analysis revealed the most commonly encountered types of resistance as well their timing across the project lifespan, and specific change management strategies to overcome the top five resistance types is provided in the discussion. This study therefore addresses a hole in the literature regarding resistance to organizational change in the AEC industry and also provides actionable recommendations that may be useful for change practitioners

CHAPTER 2

LITERATURE REVIEW

CHANGE COMMUNICATION STUDY

The literature review was divided into three sections. First, specific change implementation considerations were examined with specific emphasis on the challenges faced by owner organizations in the architecture, engineering, and construction industry. Second, commonly encountered technical barriers to project-level implementation of a new project delivery strategy are identified. Third, the opportunity presented by information and communication technologies to augment the delivery of training content to all participants in the AEC project delivery cycle was explored. Specific types of information technologies are identified in the literature as possessing the capability to simultaneously assist multiple distributed AEC project teams while fostering engaging learning platforms.

Change Implementation Considerations within AEC Owners

Implementing a new strategy by which owner organizations procure and deliver architecture, engineering, and construction services presents multiple challenges. Perhaps the most fundamental challenge is due to the project-based nature of the AEC industry: owner organizations must simultaneously balance organizational-level implementation efforts with the unique project-level needs of multiple individual AEC project teams. Migliaccio *et al.* (2008) noted that project-level components of a new project delivery strategy affect organization-wide change "because they are used repetitively on every project delivered with the new approach until the agency becomes familiar with it." For

this reason, AEC owners are recommended to develop a change implementation approach to consistently and repetitively train their employees in the processes required to implement a new project delivery strategy across multiple recurring project efforts.

According to Migliaccio *et al.*, the change implementation approach adopted by owner organizations must address three critical areas within AEC project delivery: first, organizational-level components govern the long-term strategic aspects of sustaining a new project delivery strategy, and should include an organization-wide implementation plan, consideration of the agency's staff availability for implementing the change, and consistent training content across the organization. Strategic objectives of organizational-level components are centered on long-term institutionalization of the new process as a permanent tool within the organization's skill set (Kanter *et al*. 1992). Second, project-level components focus on the technical aspects of implementing the new project delivery strategy on the individual work tasks completed by frontline personnel. Project-level components include project contractual documentation that is suitable for the new approach, details of an efficient procurement process, specific approaches to managing project risks, and well-defined contract administration procedures for facilitating the new approach. Whelan-Berry and Somerville (2010) further noted that role-specific training is a key driver of successful implementation of the new approach and suggested that individual employees should be provided with an understanding of explicit skills needed to accomplish critical tasks. Finally, the third critical area was consideration of external interface components, which incorporate communication and training avenues to inform

AEC industry providers of the change in project delivery strategy at the owner organization with the purpose of securing industry support.

Technical Barriers to Project-Level Implementation

AEC owner organizations must consider that the introduction of new business processes often leads to employee feelings of stress and insecurity (Denhardt *et al.* 2009). Luecke (2003) stated that employees' first reactions to new business processes typically consist of shock and insecurity, and Jick (1996) stated that employee shock stems from natural feelings of uncertainty with completing new technical tasks which can hinder implementation efforts. Tichy and Ulrich (1984) referred to task-related barriers as "technical resistance," which they believed were caused by employee fear of the unknown aspects of the new process. In the AEC industry, project-level technical barriers do not necessarily originate from open resistance to the new approach; rather, employees may simply have trouble changing their day-to-day work practices for technical reasons (Ott *et al.* 2008).

The extent to which training resources provide employees with an understanding of the knowledge, skills, and behaviors to overcome technical barriers has a direct impact on how well the organization achieves its intended outcome (Schneider *et al.* 1994, Alvesson 2002, Holt *et al.* 2003). Armenakis *et al.* (1999) identified two components of the training message, appropriateness and efficacy, as being essential to overcoming technical resistance. Appropriateness revolves around the question of "why are we implementing this particular process?" and drives the need for the organization to describe how

11

individual technical tasks contribute to the overall strategic sequence and purpose of the process (Walker *et al.* 2007). Allen-Meyer (2001) explained that training can address concerns over appropriateness by describing the purpose and intended impact of each technical step within the new process, thereby providing clear expectations of how overall strategic objectives will be achieved. The second training component, efficacy, deals with employee uncertainty and feelings that they do not possess the capability to successfully implement the new process (Armenakis *et al.* 2007). Efficacy barriers stem from the tendency of individuals to avoid activities they are unsure of or perceive to be above their capabilities and to instead more readily undertake tasks they deem themselves able to perform (Bandura and Locke 2003). A summary of the literature around commonly encountered technical barriers to new process implementation in AEC projects is provided in Table 1.

Table 1

Technical Barriers to Change Implementation

Barrier	Description
B1	Limited time and resources to provide training about how to accomplish day-to-day tasks.
B2	Uncertainty and confusion about how to complete day-to-day technical tasks within the new process ("How do I do this?")
B3	Efficacy considerations regarding discomfort and fear of the unknown ("Can I be successful in this unfamiliar process?")
B4	Lack of clarity with how individual tasks or steps are sequenced within the new process ("What do I do next?")
B5	Lack of clarity with how individual technical tasks appropriately align with the overall strategic goal ("What does this individual task accomplish?")
B6	Discomfort among trainees that a large amount of time is required for education and training ("Training takes too much time")

Distributed Interactive Multimedia Technology

In order to overcome technical barriers to project-level implementation, owner organizations must provide personnel with the training needed to successfully enact the new approach; however, the amount of time and resources available to provide organization-wide training to each individual AEC project group is often limited (Self and Schraeder 2009). Reports by the U.S. Department of Transportation (2004) have shown that large public agencies that implement new project delivery strategies frequently encounter time excesses spent on developing and distributing the training content necessary to foster new organizational routines in support of the project delivery change. Traditional training models are typically predicated upon in-person interactions between trainers and employee trainees, yet this approach is limited by the need to match the schedule availability of trainers and trainee in order to deliver training sessions (Baloian, Pino, and Hoppe 2000).

In response to this limitation, advancements in information and communication technology provide unique opportunities to augment traditional training practices by supporting distance learning via trainee access to a single repository of educational resources (Lee 2005). Online modes of distance learning provide time and location flexibility by offering on-demand delivery of training materials, which has the resultant impact of reducing the time required for in-person training (Hiltz and Wellman 1997). In order to be effective, training content must be organized in a framework that addresses the role-specific needs of the various AEC project stakeholders that are impacted by a change in project delivery strategy (Whelan-Berry and Somerville 2010). Training

13

information must also be consistent across the organization to reduce variability in application over multiple individual project efforts, while also orienting each project team with how specific project tasks fit within the overall sequence of the project delivery strategy.

Multimedia technology (MMT) has the unique potential to meet these needs due to its ability to facilitate many different learning module configurations (Bradley 2011; Shen, Li and Deng 2001), where MMT is defined as the delivery of information in a computer-based presentation that integrates two or more forms of media, which may include text, illustrations, photos, graphics, narrations, sounds, animations, and video (Beckman 1996). In fact, AEC industry-connected research has previously shown that distributed interactive MMT can augment project management training (Hashmi and Guvenli 2001, Ellis, Wood and Thorpe 2004), which lead the authors to consider developing the framework for an ICT-based training tool that utilizes MMT to deliver role-specific process training for a project delivery strategy.

Perhaps the main reason that MMT has the potential to augment project delivery training is its ability to be utilized in an interactive manner such that trainees can "adjust the instruction to conform to their needs and capabilities" (Haseman, Nuipolatglu and Ramamurthy 2002). Hofstetter (1995) equated interactivity to trainees' ability to directly adjust the nature of verbal, visual, numerical, and audibly display systems, which enables trainees to control the instructional pace and the sequencing or branching of the information being received. Research has shown that MMT can stimulate employee

curiosity and interest due to the "vividness" of presentation (Holmes and Wenrich 1997; Agius and Angelides 1999, Crowley 1999). Additional studies have reported improved learning performance when instructional videos with integrated multimedia formats were employed (Kelsey 2000, Wetzel, Radtke and Stern 1994).

Another key benefit of ICT is that streaming video playback and multicast capabilities enable the transmission of a single digital video file to multiple users, thereby fostering a collaborative learning environment that is able to link physically dispersed trainees (McCloskey, Antonuccia and Schug 1998, Alavi and Leidner 2001). In this manner, delivery of the training content becomes asynchronous, where trainees do not have to be present at the same time as the trainers and instead are free to learn in a maximally flexible environment (Barnes and Blackwell 2004).

Based on the characteristics of MMT to support distributed and interactive training, the development of a framework for an ICT-based process training tool to assist owner organizations implement new project delivery strategy is an important contribution to the AEC industry literature.

CHANGE READINESS AND CHANGE ADOPTION STUDY

The project-based nature of the AEC industry presents owner organizations with significant and unique challenges from a change management perspective. First, the fact that the industry is driven by single and unique projects means that each project contains different configurations in relation to size, location, participants involved, complexity,

and project type, all of which may influence project delivery (Ankrah *et al.* 2008, Betts and Wood-Harper 1994, Carty 1995, Halpin and Woodhead 1998, Tatum 1986). Adding to the complexity, each owner typically has their own unique blend of traditional project approaches, which may even vary depending on specific AEC project types (Bouchlaghem *et al.* 2004, Levy 2000, Tzortzopoulus *et al.* 2005).

The unique and temporary nature of each project is identified as a significant barrier to the spread of innovation from an organizational learning perspective (Day 1994, Dodgson and Bessant 1996). This is because new PDTs must be learned, codified, and implemented on the project-level (Winch 1999), yet the temporary nature of AEC project teams makes it challenging for organizations to repeat the transfer of innovation from project-to-project over time (Construction Productivity Network 1997). Multiple studies have examined this challenge by describing change implementation within two dimensions –organization- and project-level change – that must occur simultaneously within owner organizations (Migliccio, Gibson, and O'Connor 2008, Walewski, Gibson and Jasper 2001). Organization-level change consists of long-term decisions, opportunities, and attempts to maintain performance and process consistency over a longitudinal time horizon. Project-level change is defined as the testing ground to apply the new processes within the specific context of individual AEC projects and project sub-phases. The difficulty in maintaining an effective change management focus between these two levels was investigated by Lines, Sullivan, and Smithwick (2014), who proposed methods of communication to enhance owner organizations' ability to

consistently and effectively deliver the training content for new PDTs across multiple disparate project teams over time.

Another challenge is that the implementation of new PDTs is coupled with the deinstitutionalization of the organization's previously used practices (Migliaccia *et al.* 2006, O'Connor *et al.* 2004 a,b, O'Connor *et al.* 2006). This is extremely difficult in the AEC industry, where an organization's existing project delivery tactics may have been built up over years or even decades of previous application and experience. In a project-based industry, management systems are necessary to provide project-level personnel with a sense of project direction (Walker 2002) and oftentimes owners have developed specific sub-processes to manage project cost, time, risk, value, and quality (Fisk 2003, Griffith and Watson 2004).

Measuring the Success of Organizational Change

In order to analyze the implementation of new PDTs within AEC owner organizations, it is first important to understand how success is defined from an organizational change perspective. The existing literature, unfortunately, lacks consensus on how measure successful change implementation (Hughes 2011, Zammuto 2001). One form of measurement is process-oriented and focuses on tangible results regarding the extent to which the objectives of the change are adopted and benefits achieved (Holt *et al.* 2003). Yet others argue that attention to "bottom-line" criteria to measure project performance is insufficient because it does not measure whether the people themselves have adopted the change, nor does it account for specific employee responses to the actions undertaken

during change implementation that more personnel-oriented measures are able to capture (Armenakis and Bedeian 1999). Perhaps an apt analogy for the difficulty in measuring organizational change success may be made in a comparison to how project success is defined in the AEC industry. For example, many researchers operationalize project success in terms of quantifiable measures of budget, schedule, and quality (Belassi and Tukel 1996, Chua *et al.* 1997, De Wit 1988, Eriksson and Westerberg 2010, Phua and Rowlinson 2004, Swan and Khalfan 2007). Other researchers, however, acknowledge that these traditional performance measurements do not fully capture the project performance environment to the extent of certain qualitative measures, such as client expectations, client satisfaction, or other overall project objectives (Cooke-Davies 2002, Dainty *et al.* 2003, El-Sheikh and Pryke 2010, Lehtiranta 2012). In order to capture both process- and personnel-oriented measures of organizational change, this study utilized two outcome measures to empirically capture organizational change success within owner organizations: change adoption and change readiness.

Change Adoption

Change adoption is a process-oriented measure of organizational change success. As an outcome variable, change adoption specifically gauges the extent to which the aggregated process steps of the intended change are actually executed by organization members (Hendry *et al.* 1996). The rationale for utilizing process-oriented measures for owner organizations was aptly described in a study of design-build project delivery implementation, where Jergeas (2006) found that a top "success tip" was that the process itself must be understood and enacted by stakeholders lest a gap in expected outcomes

18

occur. Other studies have described the performance of a process, such as a PDT, in terms employee completion of defined process tasks according to the appropriate sequence, level of detail, and organization of the tasks (Gareis 2010, Gareis and Stummer 2008). Coulson-Thomas (2013) specifically stated that performance can be measured based upon "particular tasks" and urged companies to focus on the actual "deeds" performed by personnel. Based on these literature recommendations, this study measured change adoption on a five-point Likert-like scale defined as follows:

1) No Adoption: the new processes were not implemented

2) Low Adoption: the new processes were implemented with major deviations

3) Medium Adoption: the new processes were implemented with some deviations

4) High Adoption: the new processes were implemented with minor and/or correctable deviations

5) Extreme Adoption: the new processes were implemented with no deviations

Change Readiness

Behavior that is supportive of change, whether in the form of cooperation, enthusiasm, and championing action, is oftentimes used a personnel-oriented measure that indicates an employee's readiness for change. Change readiness is defined as the extent to which employees hold positive views about the need for organizational change and their beliefs that the change will have positive impacts on the organization as well as their individual work roles (Eby *et al.* 2000, Jones *et al.* 2005, Rafferty *et al.* 2013). Other researchers have linked readiness for change to organizational members' "change commitment and self-efficacy to commit the change" (Holt *et al.* 2007, Weiner 2009) along with their

willingness to participate in the change process (Cunningham *et al.* 2002). Change readiness is an important personnel-oriented measure of employee acceptance of change that is widely used in organizational behavior literature. Its origins can be traced back to the foundational research of Kurt Lewin (1947), who believed that people need to be psychologically prepared to accept the change before they will be able to let go of traditional practices. Along those lines, change readiness represents a certain measure of the change management effort that must be expended to implement a change, where high change readiness corresponds to employee commitment and willingness to exert considerable effort on behalf of the organization as well as high employee morale during the change (Gilmore, Shead and Unseem 1997, Lines 2004).

Change readiness is typically understood as a continuum measured by employee willingness to actively participate in, facilitate, and contribute to change supportive behaviors on one end of the spectrum and resistive behaviors on the other (Kim *et al.* 2011). Lines (2005) described change readiness as a range of "strong or weak behaviors" that could be positive or negative toward the change, while Giangreeco and Peccei (2005) found that readiness could be found in "pro- and anti-change behaviors." Herscovitch and Meyers (2002) proposed a continuum of behaviors ranging through active resistance, passive resistance, compliance, cooperation, and championing. Another continuum of resistance was defined by Coetsee (1999) as ranging from aggressive resistance, active resistance, passive resistance, apathy/indifference, and enthusiastic support. Within this study, a five-point Likert-like scale was used to measure the output variable of change readiness:

1) Extremely Low: active subversion and resistance to the change effort

2) Low: passive resistance and begrudging cooperation with the change effort

3) Neutral: indifferent to the change effort, carried out job function within the new constructs of the change but was neither resistive or supportive

4) High: passively favoring and supporting the change effort

5) Extremely High: actively supporting and championing the change effort

RESISTANCE TO CHANGE STUDY

Before delving fully into the past literature, it is important to define the lens through which resistance to change is viewed in this study. Much past research by organizational scholars has concentrated on a leader-centric focus of change management that takes the perspective of transformational leaders who are trying to bring about the change and create inspiring visions to overcome organizational resistance (Ford *et al.* 2008, Kanter 1983, Kotter 1995, Mumby 2005, Schein 1987). Other researchers, conversely, have adopted a more employee-focused viewpoint to understand the individual responses, motivations, and actions of change recipients (Armenakis and Harris 2009). Change recipients are commonly defined as the employees or personnel who are strongly affected by the change and implementation yet typically do not have much influence over the strategic, organization-level planning of the change effects (Walker *et al.* 2007). This study follows the employee-focused approach, viewing resistance to change though the actions and responses from change recipients within AEC owner organizations (specifically, project-level level personnel) to answer the questions: How do change recipients respond to AEC change? What are the most common resistive behaviors

experienced within change implementation? And where do these behaviors occur throughout the AEC owner organization's project timeline (from scope development through project closeout)?

Historical Viewpoints on Resistance to Change

The origins of organizational change research are rooted in Lewin's (1947) three stage model of change (unfreezing, moving, and refreezing) and Coch and French's (1948) early works that referred to employee negative reactions to change in terms of resistance. Lewin espoused the idea that organizational members need to disregard old behaviors, structures, and processes in an "unfreezing" phase before new behaviors can be successfully adopted. Only then could employees begin to learn new behaviors in Lewin's "moving" stage. Once this learning is complete, change must be stabilized during "refreezing" via positive reinforcement. Lewin (1951) defined resistance as any restraining forces that seek to restrict the change. Ensuing research saw the introduction of many motivation and expectancy theories, yet O'Toole's (1986) comprehensive review of change implementations studies found that there was no theory of implementation or resistance that maintained widespread agreement.

The 1990's subsequently gave witness to the rise of a multitude of process models for change agents to follow with the objective of minimizing resistance and maximizing implementation success rates (Galpin 1996, Judson 1991, Kanter *et al.* 1992, Kotter 1995). These models typically consisted of multiple phases of change management strategies during implementation; for example, Judson's (1991) five-phase change

process consisted of 1) Analyzing and planning for the change; 2) Communicating the change; 3) Gaining acceptance of new behaviors; 4) Changing from status quo to a desired state; and 5) Consolidating and institutionalizing the new state. Kotter's (1995) eight-step process built upon this by adding three phases: 1) Establish a sense of urgency; 2) Create and communicate a vision of the desired end-result; and 3) Plan for and publicize short-term "wins" or successes to building momentum for continued change. In a review of these models, along with other studies, Armenakis and Bedeian (1999) identified three themes related to individual reactions to organizational change that emerged in the 1990's research: resistance due to issues with change content (what the change was), context (environmental considerations), and process (how the change was executed). Yet despite this progress, Leonard *et al*. (1999) noted that traditional models did not adequately explain the sheet diversity of resistive behaviors found in organizational settings. Trader-Leigh (2001) summed up this type of dilemma in her statement that up to that point, "much of the implementation planning typically focuses on technical, procedural, and operational aspects" of organizational change, yet the "social, cultural, and political systems" where resistance to change mainly occurs "is largely an unmanaged process."

More recent research in the 2000's has divided individual resistance to change into three specific dimensions: cognitive, affective, and behavioral (Erwin & Garman 2010). The cognitive dimension refers to how employees think about the change, including their perceived capability to be effective in new work roles (Chreim 2006, Giangreeco and Peccei 2005), their opinions of how individual self-interest is being threatened (Clarke *et*

23

al. 1996), and generally whether certain individuals may simply possess a "low tolerance" for change (Kotter and Schlesinger 1979). The affective dimension is defined as the emotional and psychological reactions employees experience in how they feel about the change (Denhardt and Denhardt 2009), where positive and negative personal feelings may be simultaneously invoked (Tichy and Ulrich 1984). These two dimensions are often accepted as the sources or reasons behind resistance, whereas the behavioral dimension separately examines the forms of resistance exhibited by employees as an outcome of the cognitive and affective processes (Bovey and Hede 2001a,b, Fiedler 2010).

This study focuses on the behavioral dimension of resistance to change rather than the cognitive or affective dimensions. The reason is that behavioral phenomena are often observable in a practice-based research setting whereas the thoughts and emotions behind resistive behaviors are not easily detected (Mumby 2005). Behavioral resistance, it must be noted, provides significant insight into individual reactions to change, which in turn has been shown to be positively correlated with organizational-level change (Kinicki and Kreitner 2006). In this manner, this study aims to better define individual-level change as an indicator of organization-level implementation success and also provide further understanding of the project-level manifestations of change resistance.

The Behavioral Dimension of Resistance

Behavioral resistance is frequently viewed as manifestations of employee opposition to change efforts (Smollan 2011), and many researchers divide behavioral resistance into

categories based upon the form of behavior displayed by employees. One of the major dives in resistive behavior categories is active and passive resistance. Active resistance is generally defined by behaviors that are open, overt, and directly challenging to the change effort (Bolognese 2002, Bovey and Hede 2001a,b). Many examples of active resistance are put forth in the literature. Fiedler (2010) included the behaviors of finding fault, ridiculing, appealing to fear, resigning and leaving the company, and manipulating to be active forms of resistance. Other active resistive behaviors such as bad-mouthing and retaliating against the change were described by Mishra and Spreitzer (1998). Hultman (2006) divided passive and active resistance into 20 forms of "displayed behaviors." Among the active forms were the displayed behaviors of being critical, undermining, starting rumors, and arguing.

Passive resistance, on the other hand, may still be overt (openly expressive) but in more submissive, docile, and tractable forms of dissent that hinder the change effort (Bolognese 2002, Bovey and Hede 2001a,b). Fiedler included employee behaviors of agreeing verbally but not following through, feigning ignorance, and withholding information to be passive forms of resistance. Resultant compliance and submissive collaboration were noted as passive dissent (Bacharach *et al.* 1996) along with employee withdrawal and procrastination (Misha and Spreitzer 1998). As previously noted, Hultman (2006) defined multiple forms of displayed behaviors of the passive form, including conscious actions of standing by and doing nothing, feigning ignorance, procrastinating, withholding information, and agreeing verbally but not following through.

When comparing active and passive resistive behaviors, no studies provided practice- nor theory-based analysis of the individual forms of resistance. Giangreeco and Peccei (2005) did, however, find in a study of 359 mid-level managers that anti-change behaviors were mostly passive rather than active. An objective of this study is to not only provide practice-based results that describe the difference between active and passive resistance, but also to capture data on specific individual forms or types of resistance within these categories.

Other studies have noted more ambiguous or involuntary behaviors that may negatively impact change efforts despite not being clear whether dissent was the employee's intent. For example, Prasad and Prasad (2000) described ambiguous accommodations to authority as sometimes having a trickle-down effect to hinder change. Emiliani and Stec (2004) described instances of employees reverting away from the change back towards traditional organizational practices, but noted that these behaviors may be blamed on a lack of employee understanding of the change process. Other studies have found this to be a particularly vexing challenge in the AEC industry; for example, Molenaar and Gransberg (2001) found that as owner organizations attempted the design-build approach to alternative project delivery, their project-level employees were "constrained" by the traditional low-bid approach of their organizations. Finally, Van de Ven and Poole (1995) describe organizational change implementation often leading to unintended outcomes, which can be interpreted to be an unexpected outcome of the original change effort or an

eventual misguided application that departs from the intent of the original change process.

CHAPTER 3

METHODOLOGY

CHANGE COMMUNICATION STUDY

Research Objectives

The objectives of this research were threefold: first, to develop the framework for a

process training tool utilizing information and communication technologies to improve

the training resources available for AEC owner organizations that implement a new

project delivery strategy. The second objective was to craft the framework of the process

training tool in such a way as to reduce technical barriers to project-level change

implementation that confront frontline personnel within the AEC owner organization.

Finally, the third objective was to utilize the PTT to demonstrate a shift in the allocation

of in-person training resources from technical project-level tasks towards strategic

organizational-level aspects of implementation.

Research Context

This section provides a detailed description of the specific participant roles that must be

considered when a new project delivery strategy for AEC services is implemented within

an owner organization. The organizational structure and key participants are illustrated in

Figure 1, where the solid arrows represent the AEC owner organization's managerial

hierarchy and the dashed lines represent collaborative relationships between various

participants (both within and external to the AEC owner organization) during the

implementation effort. The specific roles, responsibilities, and involvement of each

stakeholder group are described in the following sections.

28

Within the context of this study, the new project delivery strategy in question consisted of value-based project delivery methods. These methods included a best value approach to procurement of AEC firms (incorporating new contract document templates and proposal evaluation criteria), a unique pre-contract planning process between the project teams from each the owner organization and selected AEC firm, and a new risk management system for the duration of project execution (involving methods of contract administration and change management documentation).

AEC Owner Organization

AEC owner organizations in this study are considered to be large public agencies, such as state and city governments, federal governments, and federally-funded institutions of higher education. The AEC owner organizations considered within this study all made the decision to adopt a new project delivery strategy to procure services for delivery of architectural, construction, and engineering projects. As shown in Figure 1, two separate organizational silos are typically involved in the implementation of a new project delivery strategy: facilities and operations (responsible for the management and delivery of AEC projects for the owner) and finance and administration (responsible for procurement, contract documentation, and contract administration). Both silos are critical in the implementation of new project delivery strategy and associated training content must be crafted to address their separate project roles.
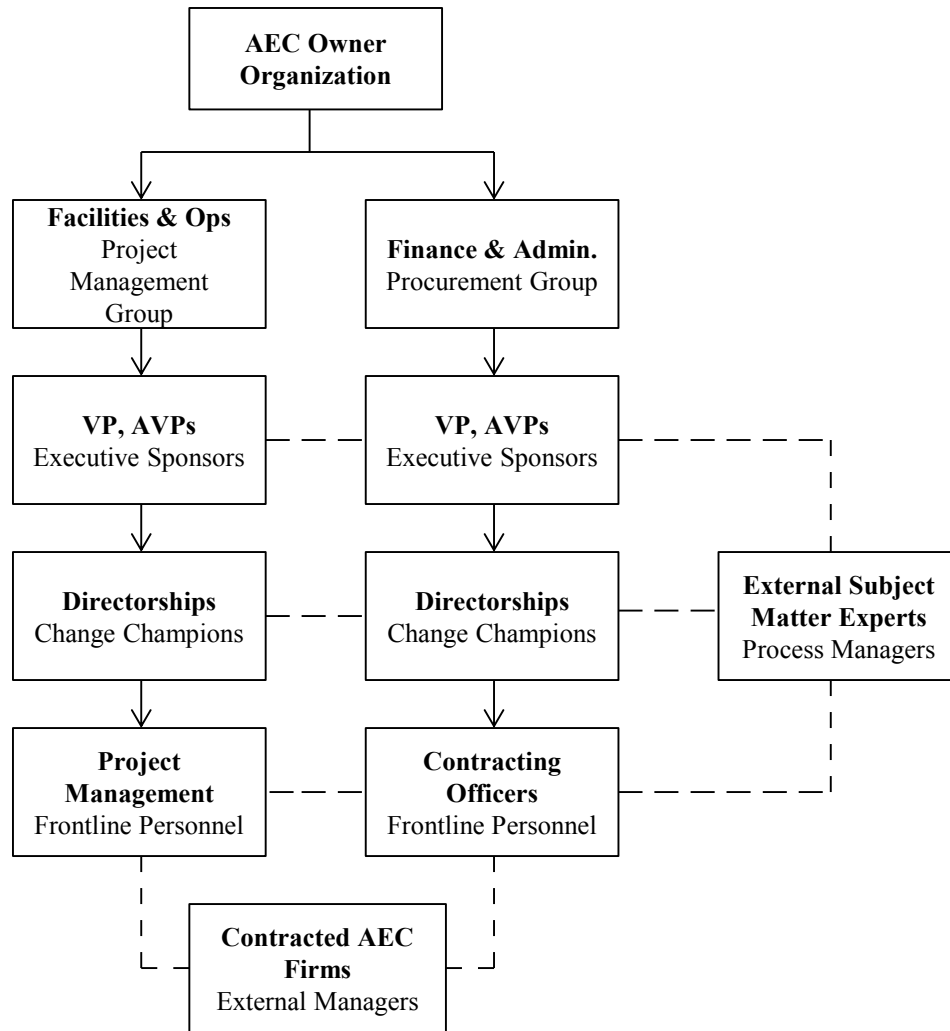
Figure 1. Stakeholders within a Project Delivery Strategy Change Effort

Executive Sponsors

From an organizational change perspective, it is critical to secure senior management

support for the adoption of a new project delivery strategy (Holt *et al.* 2003). Within the

AEC owner organization, the senior management within both organizational silos

function as executive sponsors, commonly occupying the organizational positions of vice

president or assistant vice president. Although these individuals are not often involved

with the day-to-day or project-level implementation of a new project delivery strategy,

their high level support it nonetheless critical to sustainability of the change within the

AEC owner organization. Contained within the executive sponsors' role is the removal of

strategic-level organizational barriers to the change as well as being a signal to frontline

personnel of the organization's long-term commitment to the new project delivery

strategy (Armenakis *et al.*, 2007).

Change Champions

Supervisory personnel function as leaders of the implementation effort for a new project

delivery strategy on both the organizational- and project-level. Within an AEC owner

organization, the directorship positions within the departments of facilities and operations

and finance and administration serve as internal change champions to lead and organize

the implementation of a new project delivery strategy. The change champions also fulfill

the strategic role of planning for upcoming project opportunities that may utilize a new

project delivery strategy. They also provide important project-level support to the

frontline personnel under their supervision on individual AEC projects and ensure these

projects contribute to organizational strategic goals.

Frontline Personnel

Frontline personnel within the AEC owner organization consist of project-level

employees. These employees typically occupy the position of project managers and

procurement or contracting officers. Within the project delivery cycle, procurement

officers are responsible for developing request for proposal documentation, setting

selection criteria, compiling contract documents, and conducting contract administration.

Project managers are responsible for scope development, carrying out evaluation

procedures, conducting risk management, and serving as the lead point of contact for the

procured AEC firm.

<p style="text-align:center">External Process Managers</p>

AEC owner organizations often form a partnership with a separate firm of subject matter

experts in a new project delivery strategy. The subject matter experts provide in-person

training to the owner organization. In this study, the subject matter expert group was an

external research group that specializes in value-based project delivery methods, which

include best value procurement approaches, a unique contract planning and negotiating

process, and risk management systems for the duration of project execution. Individual

members of the subject matter expert group functioned as "process managers" to assist

the AEC owner organization implement the new project delivery strategy. The role of

process managers is to provide in-person training regarding organization- and project-

level components, including extensive step-by-step training for frontline personnel on

each individual AEC project that utilizes the new project delivery strategy.

<p style="text-align:center">External AEC Firm Managers</p>

Representatives from the procured AEC firms function as external managers on each

individual project implemented within the AEC owner organization. External AEC firm

managers are the lead point of contact representing the procured AEC firm. This role

varies based upon the specific project type and scope, but is typically filled by a

construction project manager, head design architect, or lead engineer. These individuals

must be trained how to interact with the owner organization within the new project

delivery strategy throughout the procurement process, contract negotiations, and duration of project delivery.

Delphi Approach for Process Training Tool Development

A Delphi study was used to develop the content, layout, and delivery platform for a process training tool to address project-level components required to assist frontline personnel implement a new project delivery strategy within an AEC owner organization. The Delphi method is a structured problem solving process that iteratively collects, reviews, and analyzes feedback from expert groups (Linstone & Turloff, 1995; Skulmoski & Hartman, 2002). Two expert groups were selected to participate in the Delphi process. The first group of experts consisted of ten Process Managers who had experience delivering process training to more than fifty AEC owner organizations. The second expert group consisted of a panel of nine change champions and frontline employees from seven large public sector AEC owner organizations who had between one and six years of direct experience implementing the new project delivery strategy within their respective organizations. The Delphi method consists of multiple iterative rounds wherein feedback may be solicited via questionnaires, surveys, and phone or in-person interviews. A four round Delphi was employed in this research to develop the optimal training content, structure, format, and layout of the PTT, shown in Figure 2. This was in line with the research of Delbecq, Van de Ven, and Gustafson (1975), who suggested that a minimum of two to three rounds was sufficient for most Delphi research.

Delphi Round One

The first round began with the initial observation that technical barriers appear to hinder project-level adoption of new project delivery processes. Members of the two expert groups individually participated in open-ended phone interviews to obtain their feedback regarding the challenges they experienced in process implementation. Both groups confirmed the research objective to create an ICT-based process training tool to overcome technical barriers to implementation.

Delphi Round Two

Open-ended interviews were conducted with both expert groups regarding the specific content and delivery platform of the PTT. Emergent categories of key training content were identified. Consensus feedback suggested the content would most effectively be hosted on an ICT platform that provided a chronological, step-by-step walkthrough of how to implement the project delivery processes over the lifetime of an individual AEC contract. The authors functioned as the facilitators of the Delphi study to analyze and combine the resultant feedback and begin organizing the content to be contained within the process training tool. Based on this analysis, Draft 1 of the PTT was generated in the form of visual mockups that depicted how the training content would be integrated into a web-based ICT platform.

Delphi Round Three

The online delivery platform was selected and developed during round three. The selected platform was a website to support navigation through interactive multimedia

training content. Additional feedback regarding training content and layout was collected, reviewed, and incorporated into a second draft of the process training tool. The drafted training content was assimilated into the PTT website platform for the first time for further review and refinement.

Delphi Round Four

Another review was conducted by expert groups to provide feedback regarding PTT Draft 2. The collected feedback was reviewed to further refine the training content and delivery platform, resulting in a final version of the process training tool that was ready for testing application.

Post-Delphi Test Application of the PTT

After the final process training tool was developed, three forms of data were collected to triangulate the tool's impact on the implementation of new project delivery processes. Data collection consisted of phone-interview, in-person interviews, and test application of the PTT in order to triangulate the data and enable multiple levels of analysis.
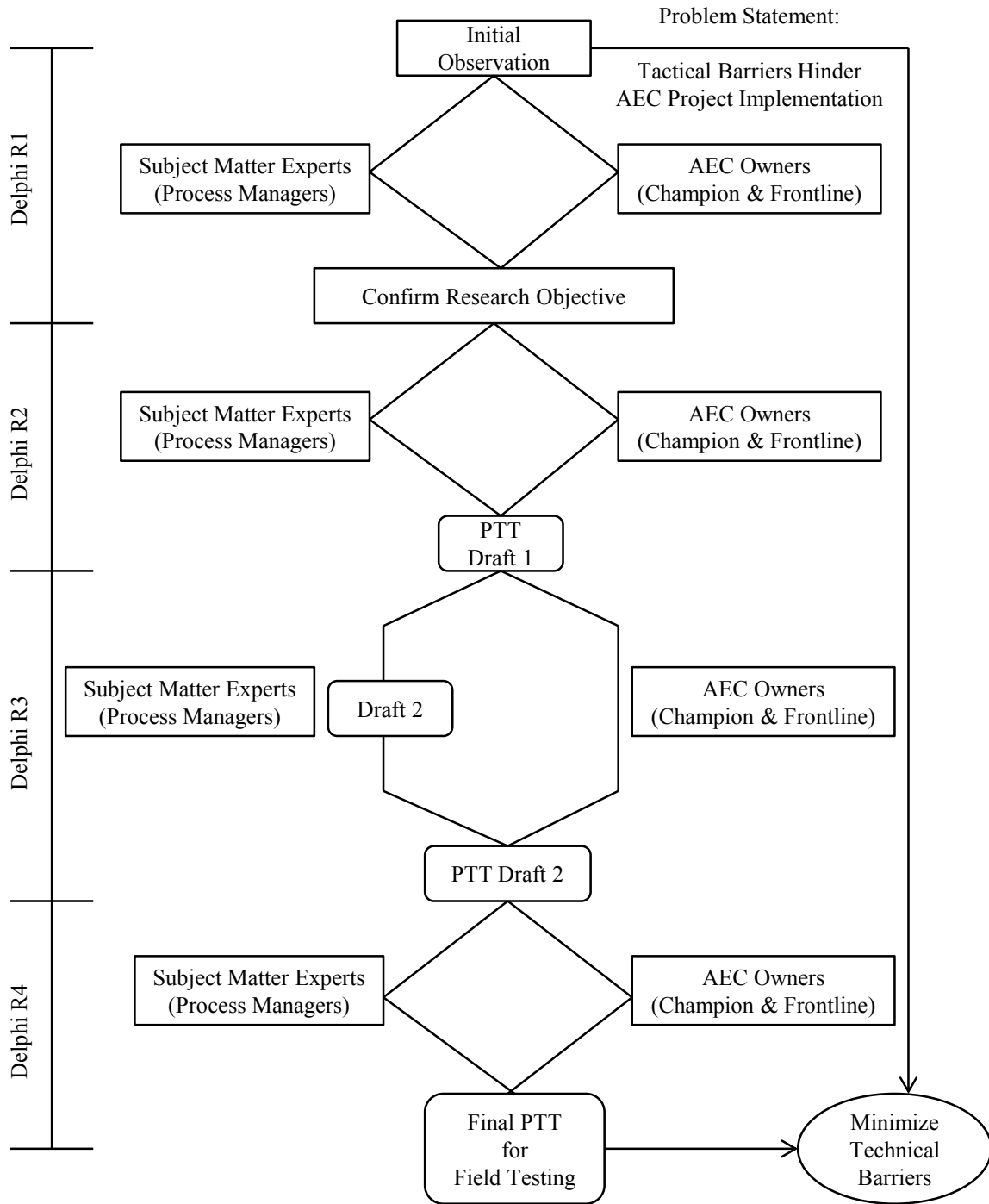
Figure 2. Four Round Delphi Method

CHANGE READINESS AND CHANGE ADOPTION STUDY

Change Management Factors and Hypothesis Testing

Successful implementation of new PDTs is affected by many change management factors. This study tracked individual change management factors during the implementation of PDTs within owner organizations in order to support hypothesis testing. The authors propose that there is a statistically significant bi-variate relationship between individual change management factors and the organization's observed (a) change readiness level, and (b) change adoption level.

Project Characteristics

One important change management factor is the specific context of the change, and in the project-based AEC industry it is important to consider a project (and its sub-phases) as an individual unit for organizational change (Gareis 2010). This then begs the question of whether the variety in project type, size and value, and duration encountered in the AEC industry impact change adoption and readiness levels (Barrett and Sexton 2006, Yun *et al.* 2011). Three hypotheses were proposed in order to test individual factors of project characteristics.

Hypothesis 1 **(**H1a,b**)**

There is a statistically significant relationship between Project Type and (a) Change Readiness Level, (b) Change Adoption Level.

Where Project Type was categorized as follows:

   1) Construction

2) Design & Engineering

3) Facility Management / Facility Services

Hypothesis 2 (H2a,b)

There is a statistically significant negative relationship between Project Value and (a) Change Readiness Level, (b) Change Adoption Level.

Where Project Value was defined in three categories:

1) Less than $1M

2) Between $1M and $25M

3) Larger than $25M

Hypothesis 3 (H3a,b)

There is a statistically significant negative relationship between Project Duration and (a) Change Readiness Level, (b) Change Adoption Level.

Where Project Duration was defined as follows:

1) Shorter than one year

2) Between one and three years

3) Three years or longer

Personnel Characteristics

The literature has also noted that the individual personnel involved on each project may impact change implementation, particularly when considering the range of abilities, knowledge, experience, know-how, skills, and qualifications possessed by individual

project participants (Hore *et al.* 1997, Loosemore *et al.* 2006, Yun *et al.* 2011). Smollan (2011) also demonstrated the importance of organizational members at different hierarchical levels within the change effort and their reactions to support or resist the change (a readiness measure). Based on the literature, two change management factors were measured for hypothesis testing of personnel characteristics: Position Level and Career Stage.

Hypothesis 4 (H4a,b)

There is a statistically significant positive relationship between an employee's Position Level within the organization and (a) Change Readiness Level, (b) Change Adoption Level.

Where employee Position Level was defined as:

1) Front Line: project-level personnel such as a Contracting Officer or Project Manager

2) Supervisor: direct-line supervisor of front line staff, typical position titles include Director or Associate Director of Capital Projects / Facilities & Operations / Procurement and Sourcing

3) Executive: supervisor level reports to executive level, typical position titles are Vice President or Associate Vice President of Capital Projects, Facilities & Operations, or Procurement and Sourcing

Hypothesis 5 (H5a,b)

There is a statistically significant negative relationship between and employee's Career Stage and (a) Change Readiness Level, (b) Change Adoption Level.

Where employee Career Stage was defined as:

1) Early Career: first 10 years of career

2) Mid-Career: greater than 10 years' experience and more than 10 years from retirement.

3) Late Career: within 10 years of retirement

Organizational Expectations

The expectations that an organization possesses when initiating a change effort can also impact reactions towards change implementation and associated outcomes. One aspect of an organization's expectations is concerned with the expected timeline and pacing of the change to achieve the anticipated results (Bluedorn and Denhardt 1988, McGrath and Rothford 1983, Todnem 2005). Other researchers have noted the importance of properly diagnosing the magnitude of the change; in other words, how much of a shift do the new PDTs represent from the organization's traditional practices? Sullivan (2011) specifically noted "unrealistic expectations" for the amount of time, effort, training, and time period required to apply the change and demonstrate results. Two change management factors were measured for hypothesis testing regarding the impact of organizational expectations.

Hypothesis 6 (H6a,b)

There is a statistically significant positive relationship between Implementation Duration Expectation and (a) Change Readiness Level, (b) Change Adoption Level.

Where organizational Implementation Duration Expectation was measured as:

1) No Institutionalization: singular implementation on an individual project, no intent to adopt the change within long-term organizational processes

2) Accelerated Institutionalization: expected institutionalization approximately within 1 year of implementation on 1-5 projects

3) Longitudinal Institutionalization: expected institutionalization within 3 or more years with continuing education needs and 5+ projects

Hypothesis 7 (H7a,b)

There is a statistically significant positive relationship between Organizational Shift Expectation and (a) Change Readiness Level, (b) Change Adoption Level.

Where organizational Shift Expectation was measured as:

1) Low: minimal shift in organizational operation, only implementing minor tools and adjusting existing processes

2) Medium: non-trivial shift in operation, adding entire new tools and processes within context of traditional project delivery processes

3) High: substantial to revolutionary shift in the fundamental methods and processes of delivering projects

Implementation Approach

Another critical change management factor is the actual implementation approach taken by the organization, which is often described in terms of specific change management activities that are performed (Batillana *et al.* 2010, Hendry *et al.* 1996). Research in the

41

field of organizational behavior specifically highlights the importance of delivering the change message to organizational members. Whelan-Berry and Alexander (2007) argued that defining how the change initiative will work within the group level is of key importance, while Cummings and Worley (2004) noted that when the change message is communicated on the group and individual levels of the organization it becomes more specifically understood, which may in turn enhance change adoption and change readiness. Another critical factor of the change implementation approach often described in the literature is the essential importance of change agent support (Luecke 2003). Change agents are commonly defined as internal leaders tasked with leading the change and supporting other organization members who are tasked with carrying out the change implementation actions (Armenakis, Harris, and Field 1999, Kinicki and Kreitner 2006). The factors of change message delivery and change agent support are directly applicable to the AEC industry. In a study of four transportation projects in the United States where the owner was first adopting the design-build alternative delivery approach, Migliaccio, Gibson, and O'Connor (2008) prioritized the top two success factors for change implementation to be the organization's comprehensive implementation plan and management support. This study performed hypothesis testing on these two factors in order to empirically validate their impact on change adoption and readiness levels.

Hypothesis 8 (H8a,b)

There is a statistically significant positive relationship between Change Message Delivery and (a) Change Readiness Level, (b) Change Adoption Level.

Where Change Message Delivery was measured on a four-point Likert-like scale:

42

1) None: project personnel received no formal change-related training prior to beginning work on project deliverables

2) Limited: project personnel received a minimum of two-hour lecture-based training about change activities and how they were to be implemented within project-specific constraints

3) Immersive: project personnel received a minimum one full day of lecture-based training about change activities and training content including hands-on workshops and organizational-level change management information

4) Previous Experience: project personnel previously participated on at least one project that implemented the new processes

Hypothesis 9 (H9a,b)

There is a statistically significant positive relationship between Change Agent Involvement and (a) Change Readiness Level, (b) Change Adoption Level.

Where Change Agent Involvement was defined on a four-point Likert-like scale:

1) None: no change agent involvement on the project or no formal change agent group identified within the organization

2) Irregular: disparate and irregular monitoring of project progress and change implementation aspects – minimum monitoring of approximately less than once-per-month

3) Regular: repeated, frequent monitoring of project progress and change implementation aspects – minimum monitoring of approximately once-per-month

4) Extreme: one or more change agents direct participated on the project level as a lead individual (i.e. contracting officer, project manager) and directly prepared and contributed to project deliverables

Research Objectives

The objective of this study was to empirically analyze project-level implementation of new project delivery tactics from an organization change perspective. Change management success was measured via two outcome variables: change adoption, which gauged the extent to which the PDTs were actually executed, and change readiness, which was a measure of personnel acceptance of the new PDTs. Nine independent variables were tracked to define the change management factors of each project and better understand their impact on successful change implementation. These nine change management factors were identified and defined based upon a review of the literature and were organized into four categories: project characteristics (type, value, duration), personnel characteristics (career stage, position level), organizational expectations (implementation duration, change magnitude), and implementation approach (change message delivery, change agent involvement. A conceptual diagram of the research methodology is given in Figure 3 and a detailed description of each process step is provided in the following sections.

Research Context

The organizational change analyzed in this study was the implementation of new PDTs consisting of alternative procurement, contracting, and project management processes

within AEC owner organizations ("the change"). Although each AEC owner organization held different traditional methods for their procurement, contracting, and project management processes, all organizations that participated in this study were implementing new PDTs that had identical forms, processes, and objectives. This presented the authors with a unique opportunity to study a variety of organizations and personnel implementing organizational change with matching objectives.

```
┌─────────────────────────────────────────────────────────────────┐
│                        1. Data Sample                            │
│  -  14 Public AEC Owner Organizations                            │
│  -  46 AEC Project Implementations                               │
│  -  2 Personnel per Project Implementation (PM and CO, N = 92)   │
└─────────────────────────────────────────────────────────────────┘
                                 │
                                 ▼
┌─────────────────────────────────────────────────────────────────┐
│                      2. Data Collection                          │
│  -  5 researchers with direct participation on all 46 projects   │
│     (Action Research)                                            │
│  -  Data Sources: project meetings, documents, surveys,          │
│     open-ended interviews                                        │
└─────────────────────────────────────────────────────────────────┘
                                 │
                                 ▼
┌─────────────────────────────────────────────────────────────────┐
│                3. Bi-variate Correlation Analysis                │
│  -  Spearman's rho – Rank Order Correlation                      │
│  -  Objective: identify statistically significant associations,  │
│     remove insig. variables                                      │
└─────────────────────────────────────────────────────────────────┘
                                 │
                                 ▼
┌─────────────────────────────────────────────────────────────────┐
│  4. Variable Selection Testing: Hierarchical Multiple Regression │
│  -  Stepwise, Forward, and Backward methods of Hierarchical      │
│     Mult. Regression                                            │
│  -  Objective: identify best fit models for predicting each      │
│     outcome variable                                            │
└─────────────────────────────────────────────────────────────────┘
                                 │
                                 ▼
┌─────────────────────────────────────────────────────────────────┐
│                   5. Relative Weight Analysis                    │
│  -  Objective: understand the relative importance of how each    │
│     predictor variable contributes towards the variance          │
│     explained in the dependent variables                         │
└─────────────────────────────────────────────────────────────────┘
```

Figure 3. Conceptual Diagram of Research Methodology

The change being implemented in each organization consisted of three main PDT processes. First, an alternative value-based procurement process was implemented on the

project-level within each of the AEC owner organizations. The new procurement process was used to select contractors, design and engineering firms, and vendors based upon both price and specifically defined performance criteria. In many cases this new procurement process was replacing the AEC owner organization's traditional procurement practices based upon low-bid or other, more general and wide-ranging proposal criteria. The second new process being implemented was a unique pre-contract planning period between the project teams from the owner organization and selected AEC firm, which occurred in parallel to traditional contract finalization steps. This planning period was completed *prior to* contract award and contained written deliverables centered on potential risks to project execution and coordinated the resources and interactions between the owner and selected AEC firm's project teams. The third new process being implemented was a systematic project management approach for tracking risk and performance for the entire lifetime of the contract agreement. This project management process occurred weekly for the project's duration to track all impacts to project cost, schedule, quality, and owner satisfaction. In this manner, the three new processes being implemented in sequence were considered to be a set of project delivery tactics when compared to each AEC owner organization's traditional processes of project delivery.

Data Sample

The data sample consisted of fourteen AEC owner organizations with specific participation from each organization's capital projects and facility operations department as well as their contracting and procurement group. A total of 46 project-level

46

implementations of the new PDTs were observed. Two lead owner organization personnel were specifically measured for each project (therefore, N=92): the owner's contracting officer (responsible for all procurement and contract management aspects of the project) and the owner's project manager (responsible to oversee the operation and delivery of the project).

Data Collection

Data collection followed an action research methodology, where the researcher participated directly within each of the 46 projects that were observed in a collaborative role with the AEC owner organization's contracting officer and project manager. This methodology was consistent with action research approaches supported by other organizational change researchers (Armenakis and Harris 2009, Cowan-Sahadath 2010, Powell Jr. 2002). Benefits of action research to the researcher include the opportunity to observe changes as they occur in "real time," allows "knowledge building in action," and facilitates a high degree of involvement which provides a more holistic perspective of the organizational change dynamics within a specific organizational context (Coughlan and Coughlan 2002, Gummesson 2000, Jorgensen *et al.* 2003). Data collection specifically occurred at four key milestones along the project delivery life-cycle for each of the projects observed: RFP Development, Evaluation and Selection, Contract Negotiation and Planning, and Project Management. Several different research tools were used for data collection, including the researcher keeping a journal, regularly participating in project meetings, conducing participant observation, and collecting project documentation and performing content analysis (i.e. Requests for Proposal (RFP),

47

proposal evaluation score sheets, pre-contract planning documents, risk management plans, project schedules, action item lists, change orders, and client satisfaction surveys).

Bi-variate Correlation Analysis: Spearman's rho Correlation

The relationships between the independent and dependent variables were investigated using bi-variate correlation analysis. Spearman's rho was chosen for the study due to the fact that the independent variables were ordinal data measures measured by ordered ranks (McClure 2005). The Spearman's correlation coefficient test results showed that certain individual change management factors were significantly correlated with Change Readiness and/or Change Adoption Levels. Spearman's rho was used to test Hypothesis 1a,b, through Hypothesis 9a,b based upon the authors' proposal that a statistically significant relationship exists between individual change management factors and the organization's observed (a) change readiness level, and (b) change adoption level.

Variable Selection Tests (Hierarchical Multiple Regression)

Variable selection tests were performed to generate a best fit model for each dependent variable, Change Readiness Level and Change Adoption Level. Variable selection was identified by performing hierarchical multiple regression (sometimes referred to as sequential multiple regression) with all independent variables that were found to have statistically significant associations with the dependent variables based on the bivariate correlation analysis (Spearman's rho correlation).

Three hierarchical regressions were performed for each dependent variable: stepwise, forward, and backward. The stepwise and forward methods start with an empty model and add predictors one at a time until no more variables meet the criteria for entry. The main difference between the stepwise and forward methods is that stepwise re-evaluates the significant of all predictors when a new predictor is added; in this manner, stepwise considers variables for entry based upon model significance ($p < .05$) whereas the forward method adds variables based upon their partial correlations. The third variable selection method, backward, starts with a full model and considers the variable with the smallest partial correlation for removal ($p < .05$) until no more variables meet the criteria to be removed. Each of these three variable selection tests ultimately identify a best fit model that explains the most variance in the dependent variables from all independent variables included for consideration.

Relative Weight Analysis

For theory building purposes, relative weight analysis (RWA, Johnson 2000) was utilized to understand how each variable contributes to the variance explained in the outcome variables. RWA is a methodology to measure the relative importance of each predictor (or independent variable) in terms of their proportionate contribution towards the total predicted variance of a regression model, accounting for both a variable's individual contribution and in combination with other predictor variables (Johnson and LeBreton 2004). RWA is a supplement to regression analysis and has been used across a variety of domains in the organizational sciences literature (Tonidandel and LeBreton 2014), including studies around the impacts of leader behaviors (Braddy *et al.* 2013), predicting

managerial effectiveness (Snell *et al.* 2013), and relative importance of employee attributes as predictors of performance (Dalal *et al.* 2012).

The difference between RWA and more traditional methods used by researchers to compare the variance among correlated predictors is important to note. Researchers often report standardized regression coefficients (β values) to analyze the importance between a predictor and the outcome variable. However, standardized regression coefficients produce known flaws around variable importance, particularly when predictors are correlated with one another (Johnson and LeBreton 2004, Tonidandel and LeBreton 2014). RWA permits more "accurate partitioning of variance among correlated predictors" through the use of an orthogonal variable transformation approach and eliminates problems associated with collinearity (Tonidandel and LeBreton 2014). This makes RWA an effective tool in understanding how each variable contributes towards the variance explained in the dependent variables.

RESISTANCE TO CHANGE STUDY

The methodology is divided into multiple sections. First, the research context is provide to specifically describe the type of change being implemented within each owner organization's projects. Second, details of the data sample are provided. Third, the data collection methodology and sources are described. Next, the specific definitions of the observed resistive behavior categories and types are defined along with specific project phases during which the observations were recorded. Hypotheses for resistance categories, types, and project phases are provided.

Research Context

The organizational change studied in this paper was the implementation of a set of advanced project delivery tactics (PDT) within AEC owner organizations. The PDTs impacted the entire project delivery timespan of each project in the sample due to its including of new procurement, contracting, and project management processes. More specifically, the new procurement process was a value-based procurement method that consisted of the implementation of new request for proposal (RFP) documentation, proposal forms and templates to be used by AEC respondents, evaluation procedures, and selection criteria. The new contracting process was a pre-contract planning process that occurred between the owner's project team and the selected AEC firm from the procurement process. This brief yet rigorous pre-contract planning process took place in parallel with traditional contracting negotiation and legal award activities, yet marked a change in process for all AEC owner organizations due to the personnel timing of involvement along with the planning deliverables prior to contract award, such as a risk management, owner-AEC firm interaction schedule, and an agreed-to owner action item list for the duration of the project. Last but not least, the new project management process included the implementation of a risk management tool that restructured the project team's communication around risk identification, response, and impact assessment. A unique aspect of this study was that all AEC owner organizations in the data were undergoing the same change, since each organization was implementing the PDT on their projects. This opened a rare opportunity for the research team: the ability to analyze multiple different organizations and project teams that were all attempting to accomplish the same exact organizational change processes and objectives.

Data Sample

The data sample consisted of sixteen AEC owner organizations, fourteen from the public sector (state agencies, counties, cities, universities, school districts) and two from the private sector (defense, private education). The identities of these organizations will remain anonymous. A total of 52 project-level change implementations were observed across the sixteen owners. Within each organization, direct research participation on the contract administration portion of change implementation was achieved from their department of procurement, purchasing, or contract management. On the operations and project management side of change implementation, direct participation from each owner's department of capital projects or facilities management was engaged. In each of the 52 project-level applications of the change, the change-related actions of two lead project personnel were measured (therefore, N=104): the owner's contracting officer (who was responsible for all procurement and contract management aspects of the change), and the owner's project manager (responsible to oversee the management, delivery, and closeout of the change from an operations standpoint).

Data Collection

Data collection followed the action research methodology. Action research is defined as a method of systematically collecting research data about an ongoing organizational process relative to some goal, objective, or need of the organization (French and Bell 1990). The action research method is often characterized as a cyclical approach of planning, acting, observing, and reflecting upon the results before again planning to enhance the next implementation aspects (Altrichter *et al*. 2002). Powell Jr. (2006) was a

52

strong supporter of action research based its foundation in three main concepts: first, the research is based on actual conditions rather than being limited to theoretical models; second, the research is based upon collaboration between the researchers and the affected members of the group of organization; and third, the cyclical approach enables the flexibility in reevaluation that necessary to adequately analyze organizational challenges, which often act as moving targets. Contemporary work in organizational change is recommended to consider the action research approach by many researchers (Bommer, Rich and Rubin 2005, Coghlan and Brannick 2002, Denhardt *et al*. 2009) and was strongly advocated by Armenakis and Harris (2009) in their reflection of the previous 30 year in organizational change research and practice.

The decision to apply the action research methodology in this study was based on three factors: first, a high degree of researcher participation was deemed necessary to fulfil the research objective of implementing change on the project-level within AEC owner organizations (Jorgensen *et al.* 2003); second, the open collaboration between researchers and practitioners opened a rich source of data collection (Cowan-Sahadeth 2010); and third, the direct researcher participation enabled the research team to observe and document change implementation as it occurred in real time (Coughlan and Coghlan 2002). Based upon this approach, the research team participated directly within each of the 52 project-level change implementations in collaboration with the owner's project personnel to provide change-related support to the project teams, including provision of project documentation templates, process training (alongside internal change agents within the owner organizations), visibility to answer change-related questions, and

feedback within the analysis and documentation of change outcomes. This high degree of collaboration gave the research team access to direct lines of observation that provided a more holistic perspective of how the change occurred within the specific organizational- and project-level context of application (Gummesson 2000).

Multiple data collection sources were used. Direct meetings, discussions, and evaluations of the 104 lead personnel from the owner organizations were conducted. As a standard part of the action research process, each member of the research team kept a research journal of observations, thoughts, and impressions of their direct participation in project meetings (Cowan-Sahadeth 2010). Content analysis of project documentation was also conducted, specifically focused on RFP documentation, evaluation score sheets, contract documentation, risk management plans, project schedules, action item lists, change orders, and owner satisfaction surveys.

Resistive Behavior Categories

Individual instances of resistive behavior were documented for each of the 52 projects and coded into three over-arching categories: passive, active, and inadvertent. Passive resistance was defined as conscious behaviors that were openly observable yet the responsible individual did not directly confront or challenge the change; rather, the behaviors were more submissive and compliant. Passive resistance behaviors included reluctant compliance, delaying or avoidant behavior, hiding information, and restricting education. Active resistance, conversely, consisted of open and directly challenging behaviors that were more expressive and exposed, such as argument, obstruction and

subversion, and spreading negative rumors, and the individual's termination from the project or organizational role. The third category, inadvertent forms of resistance, consisted of behaviors that adversely impacted the change yet were ambiguous regarding the perpetrator's intent. In other words, inadvertent behaviors may be intentionally (with resistive intent) or unintentionally (innocent of resistive intent) hindering the change effort. Inadvertent behaviors included reversion to previous organizational practices, misguided application of the change, individuals that overly forced the change implementation upon other organizational members, and negative personnel reactions due to input from external sources. Hypothesis 1, detailed below, is centered on the expectation that the frequency with which change initiatives encounter resistive behaviors will be different for the three categories, passive, active, and inadvertent.

Hypothesis 1 (H1)

Resistive behavior categories (passive, active, inadvertent) do not all have the same statistical mean frequency, such that the mean frequency of at least one resistive behavior category statistically different from the others.

Resistive Behavior Types

Each individual display of resistive behavior encountered from lead project personnel was coded as a specific type of resistive behavior. Each instance of resistive behavior encountered was coded as one of a possible twelve individual types of resistive behavior, summarized in Table 2. An alphabetical coding system from A to L was utilized to associate each behavior type with its associated label. The definition of each resistive

behavior type was based on readily observable and categorical behaviors that were supported by previous literature research. Hypothesis 2 tests the question of whether different resistive behavior types are encountered more frequently than others during change implementation.

Hypothesis 2 (H2)

The twelve defined individual resistive behavior types do not all have the same statistical mean frequency.

Table 2

Summary of Resistive Behavior Types

Type Code	Label for the Resistive Behavior	Definition of the Resistive Behavior
A	Reluctant Compliance	Doing the minimum required, lack of enthusiasm, guarded and doubtful
B	Delaying	Agreeing verbally but not following through, stalling, procrastinating
C	Lack of Transparency	Hiding or withholding useful information during implementation
D	Restricting Education	Avoiding or restricting the spread of the change message
E	Arguing & Open Criticism	Verbally opposing and/or finding fault with the change implementation
F	Obstructing & Subverting	Openly sabotaging, blocking, undermining the change implementation
G	Spreading the Negative Word	Spreading negative opinions and rumors, appealing to fear in resistance
H	Termination	Voluntary or involuntary removal from the project or organization
I	Reversion	Changing back to traditional practices during the implementation
J	Misguided Application	Changing the implementation beyond the stated process, goals, methods
K	Forcing the Change	Striving for perfection at expense of implementation effort
L	External Influence	Behavior in response to negative feedback from external sources

The first four resistive behavior types (A, B, C, D) were of the passive category. Reluctant Compliance was encountered when the owner's project personnel (either the lead contracting officer or lead project manager) was observed to be doing only the

minimum required to follow through with the change. In these instances, the employee was making it clear that they lacked enthusiasm and were not supportive of the change but rather were guarded and doubtful in their compliance with the tasks they were required to perform (Bacharach, Bamberger, and Sonnenstuhl 1996, Giangreco and Peccei 2005). The second resistive behavior type, Delaying, was observed when employees agreed verbally with a change-related task but then did not follow through and stalled, procrastinated, avoided, or dragged their feet when it came to action (Bovey and Hede 2001a,b, Hultman 2006, Mishra and Spreitzer 1998). Lack of Transparency referred to instances where employees hid or withheld information that was valuable to the project-level change effort (Hultman 2006). The fourth and final type of passive resistance was Restricting Education, where employees avoided change-related training or did not make an effort to ensure other project stakeholders had access to training resources (Giangreco and Peccei 2005).

The next four resistive behavior types (E, F, G, H) were included within the active category. Type E, Arguing and Open Criticism, included instances where employees voiced verbal opposition to the change effort, which typically included disagreement with either the content of the change or the approach with which the implementation process unfolded (Bovey and Hede 2001a,b, Fielder 2010, Hultman 2006). The Obstructing and Subverting behavior type contained instanced wherein an employee took actions to sabotage, block, or undermine the change initiative (Bovey and Hede 2001a,b, Hultman 2006). Spreading the Negative word consisted of employees that actively started rumors that spread negative opinions about the change or used change-related facts selectively

with the effect of intimidating others about the change (Fiedler 2010, Hultman 2006). Termination was the fourth and final active behavior type and involved both voluntary (resignation) and involuntary (removal) departure from either the project-level change or the owner organization as a whole (Fielder 2010).

The final four resistive behavior types (I J, K, L) fell under the inadvertent resistance category due to the ambiguous nature in relation to conscious resistance. The first type, Reversion, referred to instances where an employee deviated from the intended change during implementation by returning back to the organizations traditional practices (Emiliani and Stec 2004). Type J, Misguided Application, involved employee deviation from the change during implementation, but rather than reverting back to traditional processes, the employee inappropriately altered the change in a new and unintended manner, often leading to unexpected consequences (Van de Ven and Poole 1995). Employees that were observed to be Forcing the Change were those who had taken actions to drive the change implementation onward despite strong and open protests of other project-level stakeholders. Finally, External Resistance contained instances where the lead project personnel's actions were impacted in a resistive manner towards the change based primarily upon negative feedback from sources outside the owner's project team. These outside sources were commonly identified as the AEC industry firms that proposed on the owners' projects, the single AEC firm that was contracted to the owner, or other internal user groups and managers within the owner organization.

Resistive Behaviors across AEC Project Delivery Phases

Data collection specifically occurred at four key milestones along the project delivery lifespan for each of the 52 projects observed: Request for Proposal (RFP) Development, Evaluation and Selection, Contract Negotiation, and Project Execution. These four phases were defined based upon the varying focus, personnel involvement, and deliverable sets that are contained within each. More specifically, the RFP Development phase encapsulated all owner-side project functions starting with project scope development, RFP documentation, selection of evaluation criteria, determination of a target procurement schedule, and all other associated activities up until the release of the final RFP document to the AEC industry. The Evaluation and Selection phase consisted of the time from when the RFP was release up until a single AEC firm was selected, including all requests for information (RFIs), addenda, proposal evaluations, and interviews. Contract Negotiation then began with the selection of a single AEC firm out of the pool of proposers on any given project and ended with a contract award from the owner to that firm, including all discussions and planning deliverables produced therein. Finally, the Project Execution phase consisted of all activities following contract award through project closeout.

Hypothesis 3 (H3)

Different phases of the AEC project delivery lifecycle (RFP Development, Evaluations and Selection, Contract Negotiation, and Project Execution) do not all have the same statistical mean frequency of resistive behaviors.

The reason H3 was included was included was based on the recommendation of Beer and Eisenstadt (1996) , who noted that many research design were limited to the analysis of "snapshot data" that was only collected at one point in time during the change initiative. This type of data, they argued, is "unable to offer a true picture of the intricacies inherent in the dynamic analysis of change." For this reason, the authors saw tremendous value to track the timing with which resistive behaviors were encountered across the AEC project delivery timespan in an effort to better arm change practitioners with the knowledge of which project phases may face greater challenges in implementation.

Resistive Behavior Frequency by Personnel Type

Each resistive behavior encountered was codified according to which owner department was the source of the resistance, either the procurement group's lead contracting officer or the operations department's project manager. The reason for this was to better understand which internal departments within an owner organization displayed the greatest frequency of resistive behaviors. This information may assist change practitioners in prioritizing their change management training and support between the key personnel types that are involved on the owner's project team. Since there were only two populations for this hypothesis test, a t-test rather than one-way ANOVA was performed to statistically compare the mean frequency resistive behaviors measured for each personnel type.

Hypothesis 4 (H4)

The mean frequencies of contracting officers and procurement officers are statistically different.

CHAPTER 4

RESULTS

CHANGE COMMUNICATION STUDY

Framework of an ICT-Based Process Training Tool

Multiple information and communication technologies were incorporated within the process training tool. The key ICT characteristics of the PTT are discussed below to highlight benefits of the online delivery platform and multimedia technology integration to a change in project delivery strategy.

Online Delivery Platform

The online delivery platform provided an easily navigable layout of training content as well as the ability to include of interactive training formats. Navigation within the PTT was designed to mirror the individual project steps within the project delivery cycle for AEC projects. The left hand screenshot in Figure 4 shows the navigation menu included on the left side of the webpage, providing a chronological road map of the entire AEC contract lifecycle including procurement and proposal evaluation techniques, contract clarification and negotiation processes, project management tools for risk minimization and project closeout. This sidebar menu provides a simple layout to depict how singular steps fit within the holistic project delivery process, which enables trainees to quickly jump to detailed training content for any project-level component.

Figure 4. Sample Web Pages from the Process Training Tool

Another key ICT aspect of the online training platform is the ability to integrate numerous multimedia technologies into a single web page. The screenshots in Figure 4, for example, incorporate visual graphics, explanatory text, links to downloadable template documents, and multimedia videos, all on a single webpage. Combining MMT formats in this manner enhances the effectiveness of training content delivery by providing multiple learning avenues. For example, explanatory text offers a written description of process tasks, downloadable documents can provide even more detailed process guidance as well as templates that can be directly utilized by trainees, graphics depict visual representations of how individual tasks fit together to contribute towards the strategic objectives of the holistic project delivery process, and videos provide engaging step-by-step training instructions.

Video Multimedia Technology Formats

The wide range of video configurations was perhaps the most important of the MMT training formats included within the process training tool. Video files were directly embedded within training web pages such that trainees can access video content with a

single click of their mouse. The video player configuration used within the PTT (shown in Figure 5) granted trainees full control of video playback, including buttons to stop, start, and pause the video as well as controls to adjust volume, expand the video to a full screen view, and replay portions of the video. These video player controls supported self-paced learning such that trainees were able to directly interact with the video content.

Multiple screenshots showing the four major video formats utilized in the PTT are provided in Figure 5. These four video formats were recorded online-choreographed presentations (upper left), animations (upper right), lecture-based videos (lower left), and computer screen-sharing recordings (lower right). Each video format was used to present training content in a unique manner. For example, recorded online-choreographed presentations accommodated the balance between providing detailed information on individual process steps while also presenting appropriate visual representation of how each step was sequenced in the holistic project delivery process. Animated videos, on the other hand, were utilized to deliver training content in a less formal yet still visual manner to display relationships between AEC project participants in the new project delivery strategy. Lecture-based video formats provided a traditional educational setting where a process manager presents training information in a whiteboard setup. Another lecture-based format included standard PPT presentations where MMT displayed Power Point slides digitally such that each slide would move forward automatically to the next corresponding slide. The fourth video format consisted of direct screen-sharing recordings which enabled process managers to present detailed training guides on how to properly use certain downloadable template documents that were hosted on the PTT

website. For example, the lower right hand screenshot in Figure 5 shows a Microsoft Excel spreadsheet where process managers provided an accompanying narration to walkthrough how each tab within the spreadsheet can be utilized by frontline personnel.
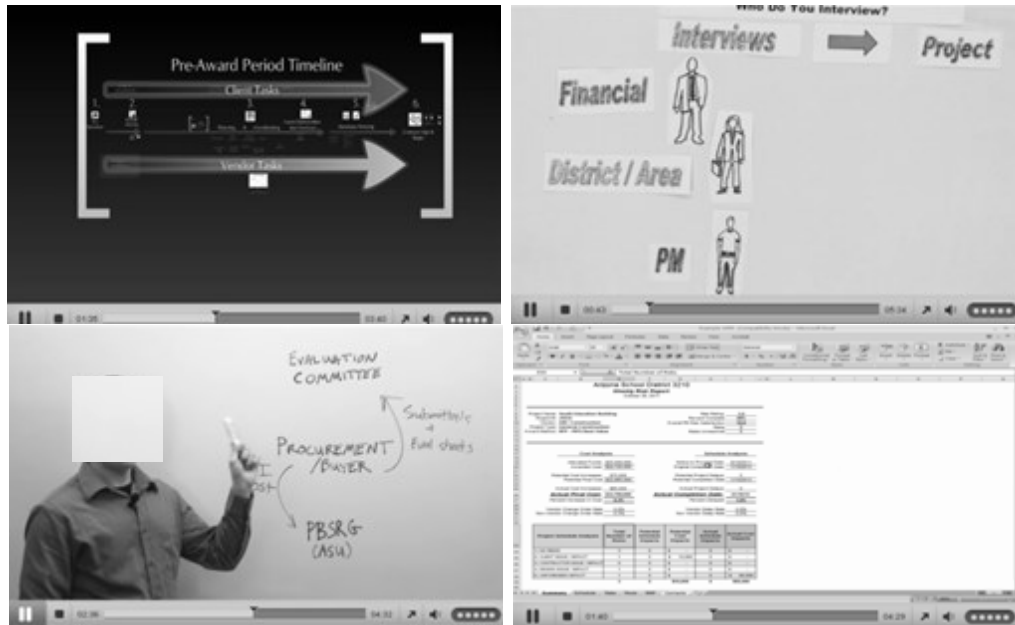
Figure 5. Video Technology Formats

Validation of the Process Training Tool

The impact of the ICT-based process training tool was tested via the three data collection methods: phone interviews, in-person surveys, and test application of the process training tool. Results of these three methods were triangulated to permit multiple levels of analysis, including the PTT's ability to minimize technical barriers to implementation of project-level components, favorably impact training resource allocation, and reduce repetitive in-person training interactions for technical aspects.

The ability of the process training tool to minimize the types of technical barriers commonly encountered during implementation of project-level components was investigated. Two expert groups participated in interviews in order to obtain feedback from the two critical perspectives that would directly utilize the PTT: process managers and frontline employees to represent the perspectives of trainers and trainees, respectively. Both groups conducted an extensive review of the tool's online delivery platform, navigation tools, content layout, and use of multimedia technology. The participants were then interviewed via teleconference to assess the impact they perceived the ICT-based process training tool addressed the technical barriers to project-level components based upon their extensive personal experiences with implementing new project delivery processes. A ten-point Likert scale was used where 1 = a strongly negative impact and 10 = a strongly positive impact on process implementation. The impact of the PTT was compared against the reference point of the participants' experience with traditional methods of process implementation that lacked the benefit of ICT-based training tools and instead relied almost entirely on in-person training.

The results shown in Table 3 indicated strong consensus among the two expert groups. Their perception was that the PTT has a highly positive impact in reducing the technical barriers that hinder process implementation on the project-level. The participants rated the impact of PTT utilization on reducing technical aspects of project delivery process implementation as an average 8.1 out of 10. The results clearly demonstrate expressed their belief that the PTT would improve the ability of PIOs to deliver internal training and

ultimately improve project-level personnel's comfort level with enacting new project delivery processes.

Table 3

Impact of PTT on Technical Barriers

Key Factors of Process Implementation	Process Manager Feedback	Frontline Personnel Feedback
Ease of initially implementing the technical aspects of the project delivery process within a project setting.	8.0	8.3
Comfort level and ability to become self-sufficient with implementation of technical aspects of the process.	8.5	8.6
Ability to support internal training of project-level personnel who have not yet been exposed to the technical changes.	8.8	9.1
Ability to address the process implementing organization's specific needs, constraints, and requirements in implementation.	7.3	7.5
Overall value of utilizing a process training tool to support organizational implementation of new project delivery processes.	10.0	9.1

Impact on Training Resource Allocation

Project-level technical training resources traditionally consist of in-person support by process managers to frontline personnel on each AEC owner project team. The traditional training methods included in-person interactions between process managers and frontline personnel via meetings or teleconferences. After applying the PTT within multiple AEC owner organizations, process managers were asked measure the shift in their work time spent providing technical training on project-level components, strategic training on organizational-level components, and other administrative functions. Technical work time was defined as implementation support delivered directly to frontline employees on singular project efforts. Strategic work time was characterized as support provided towards planning and coordinating organizational objectives across multiple AEC

projects. Lastly, administrative work time was labeled as any remaining support not included in the first two categories, such as updating and maintaining the contractual partnership between the process managers (as the subject matter experts) with the owner organization.

A baseline measurement was established by recording process managers' work time distribution while applying traditional training methods without assistance of the ICT-based process training tool. The results, shown in Table 4, revealed that process managers spent the vast majority of their time (71 percent) addressing technical issues on the level of individual AEC contracts. Once this baseline was established, the process managers were surveyed to assess the work role shift they expected to result from deploying the process training tool to increase the availability and distribution of technical training content. Feedback indicated an expected shift in training resources from technical to strategic components by nearly 40 percent. These results demonstrated that incorporation of a technically-focused PTT would likely have a significant impact in supporting the technical training process for individual AEC project teams.

Table 4

Impact of the PTT on Training Resource Allocation

Process Manager Work Time	Traditional Baseline	Utilizing PTT	Shift in Work Time
Technical (Project-Level Components)	71%	32%	-39%
Strategic (Organization-Level Components)	8%	47%	39%
Administrative	21%	21%	0%

Reduction in Repetitive Technical Training Interactions

Further evidence of the process training tool's effectiveness in delivering training content was documented via direct test application on AEC projects at a large public owner organization. The PTT was directly applied on seven separate AEC contracts as a supplement to in-person training interactions between process managers and the owner's frontline personnel. These test applications were compared against traditional training procedures that utilized fully in-person training for project-level implementation. Two role-specific tasks were specifically observed to document the number of in-person interactions required for task completion: the establishment of a project-specific procurement schedule for the new project delivery process and the development of the Request for Proposal (RFP). These two tasks were selected for observation due to fact that they occur on every type of AEC contract and are among the first technical tasks that project-level personnel are exposed to within a new project delivery process, which means that high levels of confusion and uncertainty are typically related with task accomplishment.

Each in-person interaction was defined as a distinct communication event between a process manager and project-level employee, where the primary purpose was to make progress towards completing one of the two tasks selected for observation. In-person training interactions were considered to be real-time, person-to-person communications conducted via any median, whether face-to-face or over a teleconference. A baseline comparison was selected via random sampling of thirteen AEC contracts that implemented the new project delivery via traditional training methods without utilizing

the PTT. The results, shown in Table 5, demonstrate that application of the PTT to distribute technical training information corresponded with a 70 percent reduction in the number of in-person training interactions required to create a procurement schedule and a 61 percent reduction for RFP development. Thus test application of the PTT appears to indicate the potential for ICT-based training content to drastically reduce the amount of management effort required to accomplish certain technical tasks during the implementation of new project delivery processes.

Table 5

Test Application – Minimization of Repetitive Technical Training Interactions

Technical Task	Traditional Training Interactions	PTT Training Interactions	Reduction of In-Person Training Effort
Create a Full Project Delivery Schedule of Activities	3.9	1.2	70%
Develop and Release a Complete RFP Document	7.3	2.8	61%

CHANGE READINESS AND CHANGE ADOPTION STUDY

Spearman's rho Correlation

Reviewing the Spearman's correlation matrix in Table 6, it was observed that not all the hypotheses were supported, with the null hypothesis being accepted for the following hypotheses: H3a, H4b, H5a, H5b, and H7a. The final two rows of Table 6 show the corresponding values for Spearman's rho. All other hypotheses were supported. Another observation was for Change Readiness Level, the strongest correlation was for Change Agent Involvement (0.604). Following Field's (2009, pg. 73) rule of thumb for

interpreting coefficients (where values above 0.5 indicate a large effect, above 0.3 a medium effect, and above 0.1 a small effect), the only other large correlation was for Change Message Delivery (0.561). One variable, Position Level, had a medium association (0.310). The remaining variables had either a small effect or no statistically significant correlation. For Change Adoption Level, the strongest correlation was for Change Agent Involvement (0.663). There were no other strongly associated coefficients and four medium associations: Change Message Delivery (0.446), Project Value (-0.337), Project Duration (-0.318), and Implementation Duration Expectation (0.301). Position Level had a small effect and Career Stage did not have a statistically significant correlation. Correlation analysis revealed three main points of difference in the bi-variate relationships between each the dependent variable and individual independent variables. First, Project Duration was did not have a significant correlation for Change Readiness Level (H3a, -0.177) but had a medium effect for Change Adoption Level (H3A, -0.337). Second, Position Level had a medium effect for Readiness (H4a, 0.310) but did not have a statistically significant relationship with Adoption (H4b, 0.149). Third, Organizational Shift Expectation did not have a significant relationship with Readiness (H7a, 0.192) but had a medium effect for Adoption (H7b, 0.301).

Table 6

Spearman's Correlation of Independent and Dependent Variables

	Project Characteristics			Personnel Characteristics		Organizational Expectations		Implementation Approach		Dependent Variables	
	Project Type	Project Value	Project Duration	Posit. Level	Career Stage	Implem. Duration	Change Magnitude	Change Message Delivery	Change Agent Involve.	Change Readiness Level	Change Adopt. Level
Proj. Type	1.000										
Proj. Value	.131	1.000									
Proj. Duration	.392**	.597**	1.000								
Position Lvl.	-.150	.023	.107	1.000							
Career Stage	-.113	.111	-.002	.511**	1.000						
Impl. Speed	.015	-.138	-.009	-.142	-.215*	1.000					
Change Magn.	.126	.159	.207*	.122	-.145	.460**	1.000				
Message Deliv.	-.070	-.038	.049	.041	-.024	.369**	.262**	1.000			
Change Agent	-.284**	-.250*	-.111	.146	-.058	.339**	.247*	.558**	1.000		
Readiness	-.297^{**a}	-.227^{*b}	-.177^{c}	.310^{**d}	.167^{e}	.250^{*f}	.192^{g}	.561^{**h}	.604^{**i}	1.000	
Adoption	-.253^{*A}	-.337^{**B}	-.318^{**C}	.149^{D}	.034^{E}	.301^{**F}	.206^{*G}	.446^{**H}	.663^{**I}	.838**	1.000

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

* Correlation is significant at the 0.05 level (2-tailed).

Bi-variate association specific to study hypothesis:

[a] H1a., [b] H2a., [c] H3a., [d] H4a., [e] H5a., [f] H6a, [g] H7a., [h] H8a., [i] H9a.

[A] H1b., [B] H2b., [C] H3b., [D] H4b., [E] H5b., [F] H6b., [G] H7b., [H] H8b., [I] H9b.

Variable Selection Tests (Hierarchical Multiple Regression)

The results of the three variable selection tests conducted for each dependent variable are summarized in Tables 7 and 8. The bolded rows indicate the best fit model selected for each dependent variable. Collinearity statistics were analyzed for each best fit model. For Change Readiness Level, the highest variable inflation factor (VIF) value was reported at 1.655 and the lowest 1.023. For Change Adoption Level, the highest and lowest VIF values were reported at 1.967 and 1.083, respectively. Among both best fit models, the highest VIF values were for Project Duration and Project Value, indicating that these variables displayed the highest collinearity. Since all VIFs were reported below a value of 2, the results indicated that no serious or excessive multi-collinearity was present (Menard 1995, O'Brien 2007). Table 7 indicates that Model 4 (stepwise & forward methods) was the best fit for predicting Change Readiness Level, which was identical to Model 3 selected by the backward method. The linear regression equation for the best fit model is as follows:

$$y = 2.150 + 0.316x_1 + 0.260x_2 - 0.226x_3 + 0.325x_4 \tag{1}$$

Where:

y = Change Readiness Level

x_1 = Change Message Delivery

x_2 = Change Agent Involvement

x_3 = Project Type

x_4 = Position Level

The best fit model was found to define 50.1% of the variance in Change Readiness Level by including four predictors: Change Agent Involvement, Change Message Delivery, Personnel Position, and Project Type. It is important to note that although the backwards method indicated that adding predictors (specifically, Project Value and Implementation Duration Expectation) does slightly increase the coefficient of determination beyond the selected model of best fit (from .501 to .514), the change statistics indicated the difference was not statistically significantly difference at the .05 alpha level ($p = .121$). Therefore, it was concluded that adding or removing any further independent variables from the selected best fit model did not statistically improve model fit, and the fact that all three variable selection tests identified the same best fit model suggests that the statistical "best" model was indeed selected.

Examining Table 8 for the dependent variable Change Adoption Level revealed a selected best fit model that included the variables Change Agent Involvement and Project Duration with a coefficient of determination of .439 (selected by both the stepwise and forward methods). The backward method test selected a different best fit model, including three predictors: Change Agent Involvement, Project Type, and Project Value. It is important to note that there is no right or wrong choice of variable selection method and, in general, the three methods can be expected to identify different best fit models. Upon examining the results of all three variable selection tests, the authors selected Model 2 via the stepwise and forward methods as the best fit due its simplicity in including only two predictors (as opposed to three in the backwards method best fit

model) with a nearly negligible difference in coefficient of determination (.439 and .450, respectively, which represented only a 1.2 percent difference). The linear regression equation for Model 2 is shown below:

$$y = 2.499 + 0.525x_1 - 0.381x_2 \qquad (2)$$

Where:

y = Change Adoption Level

x_1 = Change Agent Involvement

x_2 = Project Duration

Relative Weight Analysis

RWA was conducted using RWAWeb (Tonidandel and LeBreton 2014) for the selected multiple regression model for each outcome variable, Change Readiness and Change Adoption Levels. Confidence intervals and significance tests for each relative weight were based upon bootstrapping with 10,000 replications and 95% confidence intervals as recommended by Tonidandel et al. (2009). Results of the analysis are summarized in Tables 9 and 10 for the outcome variables change readiness and change adoption, respectively.

Results of RWA for the dependent variable Change Readiness Level indicate that that all four variables in Equation 1 explained a statistically significant ($p < .05$) amount of variance in change readiness as none of the 95% CIs for the tests of significance contained the value zero. The most important variables were shown to be Change

Message Delivery (RW = 0.194) and Change Agent Involvement (RW = 0.185). The variables of Project Type (RW = 0.066) and Position Level (RW = 0.056), although statistically significant, explained a relatively lower amount of variance in change readiness. The relative weight results differ slightly from what was obtained from the traditional multiple regression analysis, particularly when examining the relative magnitude of the variable effects. RWA revealed Change Message Delivery and Change Agent Involvement to have a much greater proportional contribution than Position Level and Project type than would be revealed in a simple analysis of the unstandardized or standardized regression coefficients.

Examining the RWA results for Change Adoption Level revealed that both variables in Equation 2 were statistically significant ($p < .05$). Change Agent Involvement was found to be the most important variable by a significant amount, explaining 38.5% of the variance in change adoption (82% of the total predicted variance in the criterion variable). Project Duration, conversely, had a much lower relative weight (RW = 0.08). Once again, RWA revealed that the most important variable explained a much higher portion of the variance in adoption than would have been concluded from a cursory examination of regression coefficients.

Table 7

Summary of Variable Selection Tests for Change Readiness Level

Model Description			*Model Results*					*Change Statistics*		
Variable Selection Test	Model	Dependent Variable	R	R Square	Adjusted R Square	F	Sig.	R Square Change	F Change	Sig. F Change
Stepwise & Forward	1	Readiness	.582[a]	.339	.332	48.170	.000[a]	.339	48.170	.000
Stepwise & Forward	2	Readiness	.648[b]	.420	.407	33.606	.000[b]	.081	12.929	.001
Stepwise & Forward	3	Readiness	.683[c]	.467	.449	26.606	.000[c]	.047	8.113	.005
Stepwise & Forward	**4**	**Readiness**	**.708[d]**	**.501**	**.479**	**22.834**	**.000[d]**	**.034**	**6.265**	**.014**
Backward	1	Readiness	.718[e]	.515	.482	15.752	.000[e]	.515	15.752	.000
Backward	2	Readiness	.717[f]	.514	.487	19.049	.000[f]	-.001	0.159	.691
Backward	**3**	**Readiness**	**.708[d]**	**.501**	**.479**	**22.834**	**.000[d]**	**-.013**	**2.452**	**.121**

a. Predictors: (Constant), Change Agent Involvement

b. Predictors: (Constant), Change Agent Involvement, Change Message Delivery

c. Predictors: (Constant), Change Agent Involvement, Change Message Delivery, Personnel Position

d. Predictors: (Constant), Change Agent Involvement, Change Message Delivery, Personnel Position, Project Type [selected model]

e. Predictors: (Constant), Change Agent Involvement, Change Message Delivery, Personnel Position, Proj. Type, Proj. Value, Implement. Duration Expect.

f. Predictors: (Constant), Change Agent Involvement, Change Message Delivery, Personnel Position, Proj. Type, Proj. Value

Table 8

Summary of Variable Selection Tests for Change Adoption Level

Model Description			*Model Results*					*Change Statistics*		
Variable Selection Test	Model	Dependent Variable	R	R Square	Adjusted R Square	F	Sig.	R Square Change	F Change	Sig. F Change
Stepwise & Forward	1	Adoption	.613[A]	.376	.369	54.242	.000[A]	.376	54.242	.000
Stepwise & Forward	**2**	**Adoption**	**.663[B]**	**.439**	**.426**	**34.823**	**.000[B]**	**.063**	**9.988**	**.002**
Backward	1	Adoption	.690[C]	.476	.432	10.900	.000[C]	.476	10.900	.000
Backward	2	Adoption	.689[D]	.475	.438	12.801	.000[D]	-.001	0.208	.649
Backward	3	Adoption	.684[E]	.468	.437	15.138	.000[E]	-.007	1.061	.306
Backward	4	Adoption	.678[F]	.459	.434	18.476	.000[F]	-.009	1.426	.236
Backward	5	Adoption	.671[G]	.450	.431	24.009	.000[G]	-.009	1.483	.227

A. Predictors: (Constant), Change Agent Involvement

B. Predictors: (Constant), Change Agent Involvement, Project Duration [selected model]

C. Predictors: (Constant), Change Agent Involve., Proj. Type, Proj. Value, Change Msg. Deliv., Proj. Dur., Change Magnitude Expect., Impl. Duration Expect.

D. Predictors: (Constant), Change Agent Involvement, Proj. Type, Proj. Value, Change Message Deliv., Proj. Duration, Change Magnitude Expect.

E. Predictors: (Constant), Change Agent Involvement, Proj. Type, Proj. Value, Change Message Deliv., Proj. Duration

F. Predictors: (Constant), Change Agent Involvement, Proj. Type, Proj. Value, Change Message Deliv.

G. Predictors: (Constant), Change Agent Involvement, Proj. Type, Proj. Value

Table 9

Summary of Relative Weight Analysis for Change Readiness Level

Dependent Variable = Change Readiness Level (R^2 = .501; F[22.834], p < .001)

Predictor	b	β	RW	CI-L	CI-U	RS-RW
Intercept	2.150					
Change Message Deliv.	0.316*	0.360	0.1942*	0.0972	0.3069	38.77%
Change Agent Involve.	0.260*	0.310	0.1854*	0.0923	0.2970	37.00%
Project Type	-0.226*	-0.193	0.0658*	0.0047	0.1602	13.14%
Position Level	0.325*	0.202	0.0555*	0.0023	0.1262	11.08%

*Significant at the 0.05 level

Note:

b = unstandardized regression coefficient

β = standardized regression coefficient

RW = raw relative weight (within rounding error raw weights will sum to R^2)

CI-L = lower bound of confidence interval used to test the statistical significance of raw relative weight, RW

CI-U = upper bound of confidence interval used to test the statistical significance of raw relative weight, RW

RS-RW = relative weight rescaled as a percentage of predicted variance in the criterion variable attributed to each predictor (within rounding error rescaled weights sum to 100%)

Table 10

Summary of Relative Weight Analysis for Change Adoption Level

Dependent Variable = Change Adoption Level (R^2 = .439; F[34.823], $p < .001$)

Predictor	b	β	RW	CI-L	CI-U	RS-RW
Intercept	2.499					
Change Agent Involve.	0.525*	0.588	0.3858*	0.2367	0.5262	82.92%
Project Duration	-0.381*	-0.252	0.0795*	0.0216	0.1664	17.08%

*Significant at the 0.05 level

Note:

b = unstandardized regression coefficient

β = standardized regression coefficient

RW = raw relative weight (within rounding error raw weights will sum to R^2)

CI-L = lower bound of confidence interval used to test the statistical significance of raw relative weight, RW

CI-U = upper bound of confidence interval used to test the statistical significance of raw relative weight, RW

RS-RW = relative weight rescaled as a percentage of predicted variance in the criterion variable attributed to each predictor (within rounding error rescaled weights sum to 100%)

RESISTANCE TO CHANGE STUDY

Frequency of Resistive Behavior Categories and Types

A one-way ANOVA was conducted to determine if the frequency of observed resistive behaviors was different for each of the three behavioral resistance categories. Resistive behaviors were grouped into three categories (Passive, Active, and Inadvertent) with the frequency statistics shown in Table 11. There was a homogeneity of variances, as assessed by Levene's test ($p < .01$). There was a significant effect of the behavioral resistance category on the total frequency of observed resistive behaviors, $F(2, 309) = 4.950$, $p < 0.01$, leading to the acceptance of H1. Data is presented as mean ± standard deviation. Passive resistance had the highest frequency per project (1.94 ± .321), inadvertent resistance was second highest (1.68 ± .201), and active resistance the lowest (0.91 ± .174). Tukey post-hoc analysis revealed that the difference between passive and active resistance was statistically significant ($p < .01$). No other group differences were statistically significant, although active and inadvertent resistance only narrowly missed the 95% confidence interval ($p = .063$).

Table 11

Frequency of Resistive Behavior Categories

Category	Types (Code)	Description	Per Project Frequency	Total Frequency	Total Percentage
Passive	A-D	Reluctant, Delay, Hide Info., Avoid Edu.	1.94	202	43%
Active	E-H	Argue, Subvert, Rumors, Termination	0.91	95	20%
Inadvertent	I-L	Revert, Misguided Appl., Force, External	1.68	175	37%

Further investigation of individual resistive behavior types was also performed. A one-way ANOVA was conducted to determine whether the frequency of behaviors observed differed for the twelve types of resistive behavior (N = 104 for each group) as previously defined in the methodology section (Table 2). There was a homogeneity of variances as assessed by Levene's test ($p < .01$) and the observed frequencies for each resistive behavior type is shown in Table 12. Behavior frequency was statistically significantly difference between resistive behavior types, $F(11, 1236) = 13.335$, $p < .01$, leading to the acceptance of H2. Tukey post-hoc analysis of the twelve resistive behaviors is summarized in Table 13 to identify statistically significant differences between bi-variate groupings of resistive behavior types.

Table 12

Frequency of Resistive Behavior Types

Type (Code)	Description	Per Project Frequency	Total Frequency	Total Percentage
I	Reversion	1.02	106	22%
A	Reluctant Compliance	0.67	70	15%
E	Arguing & Open Criticism	0.58	60	13%
C	Lack of Transparency	0.54	56	12%
B	Delaying	0.52	54	11%
L	Influenced by External Resistance	0.29	30	6%
F	Obstructing / Subverting	0.22	23	5%
D	Restricting Education	0.21	22	5%
J	Misguided Application	0.21	22	5%
K	Forcing the Change	0.16	17	4%
G	Spreading the Negative Word	0.10	10	2%
H	Termination (Voluntary or Involuntary)	0.02	2	0%

× = not significant at the 90% confidence level
* = significant at the 90% confidence level
✓ = significant at the 95% confidence level

Table 13

Tukey Post-Hoc Testing of Resistive Behavior Type Bi-Variate Differences

Type (Code)	Description	A	B	C	D	E	F	G	H	I	J	K
A	Reluctant Compliance											
B	Delaying	×										
C	Lack of Transparency	×	×									
D	Restricting Education	✓	×	×								
E	Arguing & Open Criticism	×	×	×	*							
F	Obstructing / Subverting	✓	×	×	×	*						
G	Spreading the Negative Word	✓	✓	✓	×	✓	×					
H	Termination (Volun. or Invol.)	✓	✓	✓	×	✓	×	×				
I	Reversion	*	✓	✓	✓	✓	✓	✓	✓			
J	Misguided Application	✓	×	×	×	*	×	×	×	✓		
K	Forcing the Change	✓	*	✓	×	✓	×	×	×	✓	×	
L	Influenced by External	✓	×	×	×	×	×	×	×	✓	×	×

× = not significant at the 90% confidence level
* = significant at the 90% confidence level
✓ = significant at the 95% confidence level

Mapping Resistive Behaviors across the Project Delivery Lifecycle

A one-way ANOVA was conducted to determine if the frequency of resistive behaviors was different for each phase of AEC project delivery. The AEC project delivery lifespan was divided into four segments (N = 104 for each), where each segment was defined as follows: RFP Development (from scope development through the completion and release of the RFP document to the industry community), Evaluations (including all owner evaluation activities from compliance review, to written proposal evaluations, to interviews, to final selection of the highest rated vendor firm), Contract Negotiations (all planning and contracting discussions from when the highest rated firm is identified until final contract award is made), and Project Execution (from contract award into initial project startup and all elements of project delivery through contract closeout). Homogeneity of variances was observed via Levene's test ($p = .003$). Results did not

indicate a statistically significant effect at the 95% confidence level and H3 was therefore rejected; however, it is noted that the difference in resistive behavior frequency for the four project phases was significant at the 90% confidence level ($p = .072$).

Table 14

Resistive Behaviors across the AEC Project Delivery Lifecycle

	Frequency of Displayed Resistance Behaviors					
Organizational Role	RFP Develop.	Evaluation & Selection	Contract Negotiations	Project Execution	Total Role Frequency	Total Role Percentage
Contracting Officer	54	43	70	52	219	46%
Project Manager	57	44	87	65	253	54%
Total Phase Frequency	111	87	157	117	472	
Total Phase Percentage	24%	18%	33%	25%		

Resistive Behavior Frequency by Personnel Type

A t-test was performed to compare the mean frequency of resistive behaviors displayed by contracting officers and procurement officers. The raw frequency results for each of these two personnel types is provided in Table 14. Contracting officers were found to account for 46 percent of total resistive behaviors observed, whereas project managers were the source of the remaining 54 percent. Results of the t-test did not identify a statistically significant mean frequency difference for the groups ($p = .603$). Based on this test result, H4 was reject and the null hypothesis was accepted.

CHAPTER 5

DISCUSSION

CHANGE COMMUNICATION STUDY

The use of information and communication technology in the AEC industry has the opportunity to greatly improve the training resources required for successful implementation of new project delivery strategy. The following sections discuss potential benefits of utilizing an ICT-based process training tool beyond its ability to minimize technical barriers to implementation. The first section discusses the potential to provide greater standardization of project delivery strategy within AEC owner organizations, and the second section discusses residual benefits of shifting training resources from technical to strategic components.

Potential for Greater Standardization of Project Delivery Strategy

Overcoming the technical barriers to project delivery implementation (such as employee feelings of uncertainty, negative self-efficacy, and a lack of clarity regarding task appropriateness and sequencing) requires clear and consistent training communication to be provided to frontline personnel. Yet a key challenge within the AEC industry is that one-time communication of training materials is not sufficient; rather, training content must be consistently delivered across multiple project repetitions across the AEC owner organization. Training content not only must be delivered to separate project teams over time, but must even be repeatedly provided to refresh the habits of frontline personnel who have previous experience with the new project delivery strategy due to the

potentially long durations of AEC projects. Augmenting training content through the utilization of information and communication technologies holds a unique potential to address these challenges by facilitating standardization of technical training content that is continuously-available across numerous distributed AEC projects simultaneously. Standardization of new project delivery strategy is critical because AEC owners cannot afford variability in the application of new project delivery strategies across each individual project effort due to the unpredictable project performance that would result.

Benefits of Shifting Training from Technical to Strategic

Deployment of ICT-based training content has a significant impact on the working relationship between process managers and frontline personnel, which has the potential residual benefit of optimizing process-based delivery of individual AEC projects. The basis of this working relationship is predicated on two major aspects of technical training that process managers must deliver to each AEC project team: the first aspect is to provide step-by-step explanatory training to answer the basic "How to?" concerns held by frontline personnel who are attempting to perform new work tasks, and the second technical training aspect is to address the project-specific considerations of how to best apply the new project delivery processes to meet the unique set of requirements for each AEC project. While the first technical training aspect is virtually identical for each AEC project, the second requires project managers to address the specific needs of each individual project, which is challenging due to the limited amount of in-person training

time is available for process managers to devote to each of the multiple AEC projects they are assisting simultaneously.

Process managers must prioritize their managerial effort in order to maximize the training content received by each AEC project team. From process manager's perspective, providing step-by-step explanatory training becomes repetitive because the content is largely the same on a project-by-project basis. Prior to using ICT to distribute training content, much of the in-person interaction time between process managers and AEC project teams was spent explaining step-by-step aspects of how to carry out individual tasks within the new project delivery process. Interview feedback indicated that this type of training occupied the majority of project manager work time, which did not leave much time to devote the appropriate level of detail and depth to answer project-specific implementation questions.

Information and communication technologies provide the solution to address this challenge in multiple ways. First, hosting training material on a single web-based platform creates a central repository for frontline employees to access technical training content. Online accessibility of the content via a web-based platform also enables continuous availability of training content, which provides self-paced and repeatable training access to frontline personnel. Process managers are able to utilize the online training content to fundamentally shift their working relationship with frontline personnel by utilizing the PTT content to answer nearly all initial technical questions prior to in-

person interactions. A result is that frontline employees may be better prepared for in-person training sessions, which can be more focused on providing greater depth and detail regarding the project-specific applications. This shift in training focus optimizes the managerial efforts of process managers, which has the potential to increase the effectiveness of in-person training interactions to maximize the performance of each individual AEC project within the larger organizational change effort.

CHANGE READINESS AND CHANGE ADOPTION STUDY

The discussion first considers the results of the correlation analysis and the associations between various change management factors and project team change readiness and change adoption. Then the discussion addresses implications of the best fit models and associated relative analysis for change practitioners within AEC owner organizations.

Implementation Approach

Among the four categories of change management factors, the highest correlation found with the dependent variables was for Implementation Approach. Both the individual factors of Change Message Delivery and Change Agent Involvement had strong and statistically significant positive correlations with Change Readiness ($p < 0.01$). Change Adoption had a strong positive correlation with Change Agent Involvement ($p < .01$) and a medium correlation with Change Message Delivery ($p < .01$). These results enable the acceptance of H8a,b and H8a,b, which is consistent with previous literature (Armenakis

et al. 1999, Armenakis and Bedeian 2009, Kinicki and Kreitner 2006, Walker *et al.* 2007).

Project Characteristics

Certain project characteristics were found to have statistically significant correlations with the outcome variables. Project Type and Value had low negative correlations with Change Readiness, which lead to the acceptance of H1a and H2a, but Project Duration did not have a statistically significant correlation (reject H3a and accept the null hypothesis). For Change Adoption, all three predictors had statistically significant negative bi-variate correlations such that H1b, H2b, and H3b were accepted. Only two medium-strength correlations were included among the project characteristic factors, which indicated that larger project values and durations are associated with lower levels of change adoption. This may be a consideration for change practitioners who are faced with the deciding between upcoming project opportunities as candidates for change implementation.

Organizational Expectations

Organizational expectations were found to correlate more with Change Adoption than Change Readiness. The predictors Implementation Duration Expectation and Organizational Shift Expectation had a medium ($p < 0.01$) and weak ($p < 0.05$) positive correlation with Change Adoption, respectively. Change Readiness was only found to

have a statistically significant correlation with Implementation Speed Expectation (0.250, $p < 0.05$).

Personnel Characteristics

The factors within Personnel Characteristics had the lowest correlation with the outcome variables; in fact, the only statistically significant correlation was a medium positive association between personnel Position Level and Change Readiness ($p < 0.01$). The low level of correlation between personnel characteristics and Change Readiness and Adoption was somewhat of a surprise. Much previous literature (as well as the authors' own intuition) supported the concept that successful change management is significantly impacted by the aspects of the personnel who are implementing the change. One potential explanation is that the critical factors of personnel characteristics were simply excluded from this study, and future research may consider alternative personnel factors such as an individual's predisposed openness to change (Kinicki & Kreitner 2006), personal efficacy beliefs (Chreim 2006), trust and relationship between employees and supervisors (Washington and Hacker 2005), education level, and other factors.

Implications for Change Practitioners

The main recommendation arising from this study is that change practitioners should focus on the implementation approach for the change. Recommendations within the implementation approach include investing effort into effectively apportioning the Change Message Delivery and properly engaging Change Agent Involvement in change

implementation activities. Implications of the best fit models and relative weight analysis for practitioners include which change management factors should be emphasized to enhance change readiness and change adoption levels within public AEC owners.

Change practitioners who are interested in proactively enhancing change readiness among AEC project teams should focus primarily on Change Message Delivery and Change Agent Involvement. Organizations should have a system that ensures consistent and proper delivery of the change message for any project teams that are tasked with implementing a new project delivery process. The change message should at a minimum be delivered as a one or two hour lecture or discussion session; however, this study found that the more organizations will foster greater change readiness if they emphasize a multi-hour or even full day session to deliver a change message that is change- and project-specific while also discussion long term organizational aspects of organizational change. It is also important for practitioners to remember that direct previous implementation experience by a frontline employee does not equate to expertise in the new processes, especially in a project-based industry where no two projects share the same constraints and requirements. Instead, it is likely that multiple project implementation experiences along with continuous change message delivery will further enhance change readiness among employees.

Boosting the level of Change Adoption, or the extent to which the initial change objectives were actually carried out during implementation, was found to mainly depend

upon Change Agent Involvement. AEC owner organizations are recommended to identify a formal group of change agents to act as champions of change implementation across multiple projects over time. Furthermore, practitioners must consider the appropriate level of change agent involvement in day-to-day project level activities of change implementation, which may be constrained by change agent availability, their position within the organization, and credibility level within the organization. This study found that higher levels of change agent involvement on the project level correlated with a higher level of both change readiness and adoption. Further research is recommended to identify the most profile of the most effective change agent groups for implementing new project delivery processes within AEC owner organizations.

RESISTANCE TO CHANGE STUDY

Active, Passive, and Inadvertent Resistance

This study yields an important finding in regard to the overall frequency and category of resistive behaviors encountered when implementing new project delivery tactics within owner organizations. Of all the individual resistive behavior instances observed, the Passive Resistance category accounted for 43 percent of the total, far outstripping either of the remaining categories, Active and Inadvertent. In comparison, Active Resistance was only observed to account for 20 percent of total resistive behavior instances observed. This finding may be useful to practitioners who are tasked with implementing change within an AEC owner organization; for example, practitioners must be cognizant of the fact that only a minority of resistive behaviors they encounter are expected to be

actively confrontational. Rather, practitioners must be conscious of the passive behavior types that may hinder their efforts for change implementation, which can be more difficult to identify and overcome.

Top 5 Resistance Types and Response Strategies for Change Practitioners

Quantifying the individual resistive behavior types provides further recommendations to change practitioners to both be prepared for the type of resistance they may encounter and be armed with potential solution strategies to overcome each of these types. The top five most frequently encountered resistive behavior types identified in this study were: Reversion (22%), Reluctant Compliance (15%), Arguing or Open Criticism (13%), Lack of Transparency (12%), and Delaying or Stalling (11%). For the sake of brevity, the discussion is limited to addressing the implications and solution strategies of these top five resistance types, particularly since these behaviors were more than twice as common as any of the remaining behavior type (i.e. the sixth most frequency behavior type was project members being Influenced by External Resistance at 6%).

Reversion

First, the resistive behavior type that was encountered with the highest overall frequency was Reversion, wherein the lead project personnel changed the new project delivery processes back to their organization's traditional practices during the implementation. This type of resistance may be either inadvertent, where personnel simply lack the training information and therefore revert back to doing what they know within their

traditional job function, or purposeful when employees are still committed to old behaviors and may not be convinced of new practices. This form of resistive behavior is rooted in Lewin's (1947) concept of unfreezing the organization's current "way of doing things," which consists of letting go of previous habits, behaviors, and preferences, to then enable the transition to new methods.

In order to overcome this barrier and create employee readiness to change, which is defined as the extent to which employees hold accept and positive views about the change (Jones *et al.* 2005), the literature recommends a few approaches. For one, Beer and Eistenstat (1996) noted the role of management is to clarify that the proposed change is both necessary and the best one to achieve the organization's goals. Cameron and Quinn (1999) further supported this notion by recommending that management must not only show the advantages of changing but also the disadvantages of not changing. Providing this type of information within the change message is important to create the readiness where personnel begin to support the change effort (Armenakis *et al.* 1999). Another viewpoint on the issue of Reversion is that management must consider the organization's history with previous change efforts. If the organization has a long history of frequent change attempts and multiple failed efforts, then the change may be perceived as another "flavor of the month" and is taken less seriously (Emiliani and Stec 2004). Overcoming this perception is best done by building credibility through visible and public support of formal and informal leaders within the organization (Armenakis *et al.* 1999).

Reluctant Compliance

The second most frequently encountered type of resistive behavior was Reluctant Compliance, where employees do not support the change with enthusiasm, but rather act in a guarded and doubtful manner and perform the minimum required activities during change implementation. One potential cause of this behavior is because change represents uncertainty and personal may fear the unknown (Bourne *et al.* 2002). Personnel may also worry that they (or the organization) are not capable of making the necessary changes in their daily job-function to be successful (Judson 1996). In order to reduce uncertainty levels and increase change readiness, management is recommended to communicate to personnel that the appropriate level of training and education will be provided to ensure success (Galpin 1996). Beyond providing the necessary training, management should also be visible to answer change-related questions (Covin and Kilmann 1990). Leaders must be willing to "roll up their sleeves" and become directly involved in the change implementation, attending training with employees, and listening to employee feedback both in times of support and dispute (Self and Schraeder 2008).

Arguing & Open Criticism

Openly verbal defiance, disagreement, and criticism of the change was the third most frequent resistive behavior encountered on the 52 observed AEC projects. Previous literature notes that argument may come from employee disagreement with the proposed change initiative's appropriateness (Walker *et al.* 2007) or the need for the change in the first place (Armenakis *et al.* 1993). Change practitioners are recommended to address

these concerns by identifying and publically communicating "small wins" in implementation. Cameron and Quinn (1999) proposed that showing measured progress as the change effort unfolds will build employee beliefs that the change is appropriate and necessary to achieve improved performance. Carter (2008) suggested that change practitioners should promote successful change in visible, public venues to celebrate the progress being made. Regular, two-way communication specific to the change initiative and employee's concerns may lower resistance by increasing understanding and engagement (Whelan-Berry and Somerville 2010).

Lack of Transparency

The fourth most frequently encountered resistive behavior type was Lack of Transparency, wherein employees were observed hiding or withholding useful information during implementation. Potential sources of this behavior include employees having low personal valence such that they feel threatened by the change and do not understand "what's in it for me?" David (2006) argued that valance issues stem employee perceptions of negative change outcomes, including a fear of the loss of authority, status, reward, autonomy, control, relationships, or even the loss of the opportunity "to do what one does best." Change practitioners must be cognizant of communicating how employees will benefit from the change and ensure they are able to take advantage of positive opportunities that may arise from change implementation (Self and Schrader 2008). Schweiger and DeNisi (1991) specific recommended face-to-face presentations to

employees by change practitioners to show the benefits and issues related to the change effort.

Delaying

Employees who were observed to be Delaying often were agreeing verbally with the change and associated implementation tasks, but then were dragging their feet and not following through. This type of avoidant behavior is indicative of a lack of enthusiasm from employees who are dodging active participation. Diagnosing the source of this resistive response type is difficult, and much previous research has been devoted to the natural or inherent personal attributed and disposition that various individuals may have related to change. For example, some Nikolaou *et al*. 2007) considered certain individuals to have high "openness," which would result in being more open minded and willing to attempt new things. Kotter and Schlesinger (1979) similarly proposed that some individuals may simply possess a low tolerance for change.

One of the most widely recognized strategies used to overcome resistance is allowing individuals to participate in directly in the change process, both in terms of change planning and implementation (Holt *et al.* 2003). Change practitioners are recommended to be selected with which individuals are asked to participate early on during change efforts and focus on building a coalition of supporters for the change (Cameron and Quinn 1999). Selectively looking for volunteers and organizational members that have enthusiasm for the change is a recommended starting point (Cameron and Quinn

97

specifically recommend identifying opinion leaders), and then encouraging supporters across the timeline of implementation makes it easier to recruit additional supporters to join in making the change successful.

Resistance across the Project Delivery Lifespan

Of particular interested to AEC owner organizations may be the timing of *when* the organization encountered resistive behaviors among their project teams. In order to understand the timing of resistance within an AEC setting, each of the 52 AEC projects in the sample was divided into four phases of project delivery: RFP Development, Evaluation & Selection, Contract Negotiation, and Project Execution. The researchers noted the timing of each resistive behavior instance that was encountered according to these four phases, and the overall frequency results were shown in Table 14. The AEC project phases that encountered the most resistance were, in order: Contract Negotiations (33%), Project Execution (25%), RFP Development (24%), and Evaluation & Selection (18%). The fact that Contract Negotiation was the most frequently resisted project phase of the change implementation was unexpected. This was partially due to the fact that within the timeline of an AEC project, the Contract Negotiation phase has on average the shortest duration of all the four phases, meaning that the higher frequency of resistive behaviors was occurring in a more concentrated setting. The authors note that this finding is perhaps due to the fact that for the specific PDTs being implemented, the new Contract Negotiation process implemented was the largest departure from the owner organization's traditional practices. Although this is a theoretical conclusion, the

implication would be that the larger a departure the change is from traditional practices, the more resistance that will be encountered.

Procurement vs. Operations Personnel

By tracking the lead Procurement and Operations personnel from the owner organization for each project, the results provided feedback as so which internal department within the owner organization was more likely to display resistive behaviors against the implementation of new project delivery tactics. As is shown in Table 14, the Operations Personnel (Project Managers) were the source of slightly more than half the overall observed resistive behaviors (54%) as compared to the Procurement Personnel (Contracting Officers) who accounted for the remaining 46%. The small difference between resistive frequency of these two departments was found to be statistically insignificant via t-Testing; therefore, is was concluded that there is no significant difference in the frequency of resistive behaviors displayed by Project Managers vs. Contracting Officers.

CHAPTER 6

CONCLUSIONS

CHANGE COMMUNICATION STUDY

Many public organizations are changing the fundamental methods by which they are procuring, planning, awarding, and delivering architectural, engineering, and construction services. Continuing challenges in the economic climate have led movement towards alternative project delivery strategies, such as best value procurement and other value-based project delivery techniques. Yet changing from a traditional project delivery environment is difficult to accomplish, and implementation of this change is met with many barriers from an organizational change perspective.

The research objectives of this study were to (1) develop the framework of an ICT-based process training tool to assist owner organizations with the implementation of a new project delivery strategy, (2) demonstrate the ability of such an ICT-based process training tool to reduce technical barriers to implementation, and (3) enable the amount of in-person training resources to be shifted from technical project-level components towards strategic organizational-level aspects of implementation. These objectives were met via (1) a detailed description and screenshots of the PTT, the multimedia technologies utilized within it, and organization of training content, (2) survey feedback from expert groups suggesting the positive impact of the PTT on reducing technical barriers to the implementation of a new project delivery strategy, and (3) a shift in

process manager work time from in-person responsibilities towards strategic-level efforts and test applications that demonstrated a 61 percent reduction in in-person training effort.

Contributions of the study include a framework for a process training tool to support implementation of a new project delivery strategy within owner organizations that purchase AEC services, including the information and communication technologies utilized within the tool. Industry practitioners are recommended to develop a central repository of training content to assist their individual project teams with role- specific information at each stage of the project delivery process. The training content can be effectively organized via the use of information and communication technologies, such as online platforms, easily navigable web pages, and distributed interactive multimedia technology. Key barriers that commonly impact AEC organizations were also described in addition to the key participant roles involved that must be addressed within the implementation effort.

Future research is recommended to apply similar ICT-based process training tools across multiple AEC owner organizations. Documentation of the specific implementation approaches will be valuable to understand the relationship between implementation approach, training content delivery, and specific organizational characteristics that may be unique, or broadly consistent, across various public owners. Future research is recommended to follow a longitudinal case study methodology to better define the

dynamics involved in sustaining a new project delivery strategy over numerous project-level applications.

CHANGE READINESS AND CHANGE ADOPTION STUDY

The objective of this research was to identify the relationship between a variety of change management factors within AEC owner organizations and the change readiness and adoption levels experienced during change implementation efforts. An action research method was employed to collect data from a sample of 46 AEC projects across fourteen public owners. Nine individual change management factors were measured for two key individuals (the owner's contracting officer and project manager) on each project. These factors were distributed across four characteristic categories, including the Project, Personnel, Organizational Expectations, and Implementation Approach. Among these characteristics, Implementation Approach was found to have the highest correlation with Change Readiness and Adoption Levels.

Variable selection testing via three methods of hierarchical multiple regression was performed with all statistically significant correlating predictors for each outcome variable. Results indicated that 50.1% of the variance in Change Readiness Level was explained by Change Message Delivery, Change Agent Involvement, Project Type, and Position Level, with a statistically significant relationship (F = 22.834, $p < .001$). The selected best fit model then underwent relative weight analysis to more accurately define the relative importance of the four predictor variables in explaining the observed variance

in the outcome variables. Relative weight identified that Change Message Delivery (RW = 0.1942) and Change Agent Involvement (RW = 0.1854) accounted for nearly 38% of the total variance in Change Readiness Level, whereas Project Type and personnel Position Level explained a far lesser (yet statistically significant, $p < 0.05$) amount of the variance. These results imply that emphasizing these factors may be able to improve the change readiness level of the project-level personnel within AEC owner organizations.

Analysis of the second outcome variable, Change Adoption Level, identified a statistically significant best fit model consisting of Change Agent Involvement and Project Duration that explained 43.9% of the variance in the dependent variable (F = 34.823, $p < .001$). The dominant predictor was revealed by RWA to be Change Agent Involvement (RW = 0.3858), suggesting that AEC owner organizations may better achieve their change objectives by designating a formal group of change agents and directly involving them in project-level change management efforts.

Contributions

This study contributes to the organizational change literature by providing empirical evidence of the relationship between change management factors and the two outcome variables of Change Readiness and Change Adoption. These outcome variables represent critical aspects of the change management experience, both in terms of the amount of effort that must be expended to address organizational barriers (overcoming resistance

and fostering readiness) as well as the extent to which the implementation objectives are met.

Another contribution is to the architectural, engineering, and construction literature. Results from develop an understanding of how specific characteristics within a public owner can impact change implementation directly across the delivery phases of an AEC project. By showing multiple organizational characteristic areas to have difference correlations with project team change readiness and change adoption, results from this study support the notion that change within the AEC industry must be measured beyond traditional project performance indicators and should be considered as a complex, multi-dimensional task that is impacted by change management activities (i.e. change message delivery and change agent involvement).

Finally, this study contributes to the field of organizational change research by linking practice-based research with the concepts of organizational theorists. Many researchers have noted the divide between practice and theory and called for studies to bridge this divide (Beer and Eisenstadt 1996, Durand 2006, Pettigrew *et al.* 2001). Others have noted a lack of diversity of widely reported research methodologies (typically self-report studies) which provides a "limited perspective" of organizational change and resistance to change, therefore recommending more practice-based methods such as action research and case studies that are geared towards providing practical guidance to change practitioners (Erwin and Garman 2010). This study relied on the work of organizational

theorists to define change management factors for study as well as the aspects of change readiness (and resistance) and adoption, and linked theory to practice by utilizing action research in a practice-based, longitudinal case based approach for a number of AEC projects.

Limitations & Recommendations for Future Research

Limitations of the study are described along with recommendations for future research areas. First, this study was limited to the context of public sector AEC owner organizations and the results may consequently only be considered valid within this context. Future research is recommended to collect data from a range of private AEC owner organizations across many geographical regions. Exploring the difference in results (if any) between public and private organizational change factors would enrich behavioral understanding of change management efforts across industry types.

Second, the authors acknowledge that other factors influence Change Readiness and Adoption Levels beyond the nine factors measured in this study. Best fit models revealed that the nine change management factors measured in this study accounted for only 50.1% and 43.9% of the variance in Change Readiness and Adoption Levels, respectively. Other factors to consider in future research include: transformational leadership behaviors (Jansen *et al*. 2009), emotional intelligence (Harms and Crede 2010, Zhang and Fan 2013), additional aspects of organizational culture such as trust,

bureaucracy, and values (Luecke 2003), and the historical frequency and performance of organizational change efforts at the organization (Walker *et al.* 2007).

Third, the data collection around readiness and adoption levels was limited to the behavioral dimension of resistance to change, which is restricted to the forms of resistance as that can be observed in their manifestation (Fiedler 2010). Future research can also investigate the underlying reasons that cause resistance to change, specifically regarding the cognitive and affective dimensions of resistance (Bovey and Hede 2001a,b, Oreg 2006).

Finally, the impact of bias must be considered. The action research method employed in this study had the benefit of reducing the amount of self-report responses that commonly known to be affected by participant bias (Mir and Pinnington 2014). However, it is recognized that direct researcher participation in change management efforts may have exposed researchers themselves to bias as they experienced the daily pressure to perform and meet project-level deliverables. Yet the authors propose the exposure this kind of bias was merited due to the benefits gained via the immersive research experience and the ability to observe organizational change dynamics in a first-hand and longitudinal manner across all aspects of AEC project delivery. Future studies could be designed to have two (or more) perspectives from each project team, potentially by augmenting researcher observations with self-report data collected directly from organizational members such as

contracting officers and project managers, and also by tracking project success criteria such as cost and schedule growth and project quality.

RESISTANCE TO CHANGE STUDY

The objective of this study was to measure the frequency, type, and timing of behavioral resistance to change within AEC owner organizations. Data collection followed an action research methodology to track individual instanced of resistive behavior encountered across the lifespan of 52 AEC projects within sixteen public owners. Passive resistance was found to be the most frequently encountered resistance category (43%), inadvertent types of resistance were the second most frequent (37%), and active resistance was the least commonly encountered (20%). These results present interesting challenges for change practitioners due to the fact that passive resistance can be more difficult to identify, and therefore more difficult to overcome, than other resistance categories.

Twelve individual types of resistive behaviors were specifically documented and the five most frequently occurring behaviors among project teams were found to be reversion (22%), reluctant compliance (15%), arguing & open criticism (13%), lack of transparency (12%), and delaying (11%). An implication for change practitioners is to be prepared for the potential need to provide continual change-related training and delivery of the change message to project personnel in order to combat the tendency to revert back to traditional modes of business.

An important finding was the frequency of resistive behaviors across the project delivery lifespan, where Contract Negotiation was found to be the phase with the highest overall frequency and concentration of resistive behaviors encountered. This is an important finding due to potential implications regarding the relationship between change magnitude and resistance. For change practitioners, this knowledge can enable better preparation for individual phases of change management.

Contributions

This study provides empirical evidence of both the broad categories and individual types of resistive behavior encountered within AEC owner organizations during change implementation on their projects. In addition to the frequency and type of resistive behaviors, this study also empirically documented the timing in which these behaviors were encountered across the phases of AEC project delivery lifespan. Such findings provide support for change implementation within the context of the AEC industry. These results are also directly value to change practitioners by arming them with the knowledge of what types of resistive behaviors to look for during change implementation and how to plan their change management approach in order to overcome specific resistance types in such a way that creates greater change readiness among AEC project teams.

Limitations & Recommendations for Future Research

This study was limited to the resistive behaviors displayed by two lead individuals from the owner organization for each project – the contracting officer and the project manager. Yet a larger cast of stakeholders were present on the owner's side for each project, and future research can delve into greater organizational depth by extending the observations to additional project stakeholders.

The very nature of certain resistive behavior categories was also a limitation under the action research methodology employed for data collection. Passive resistance behaviors, for example, are generally more difficult to identify and observe than the Active or Inadvertent behavior categories. Yet since the study was limited to observable behaviors that were identified and documented by participating researchers, it is certainly possible that even more passive resistance occurred than was collected. The implication would be that passive resistance may have an even higher frequency than the 43 percent noted in this study. In fact, the overall results may be subject to a depressive bias where even more resistive behaviors (of all categories and types) may have occurred on the projects beyond researcher observation.

Since this methodology limited data collection to the exposure and involvement of the researchers' participation level, future research may increase the breadth of data collection by including self-report surveys of multiple change recipients within the owner organization's project team. Selecting a multi-hierarchical and several job function

viewpoint would capture the thoughts, impressions, and observations of directly participating change recipients in real time within a practice-based setting.

Another limitation is that the data measure of resistive behavior frequency did not account for the level or intensity of the resistance in relation to the specific type or timing of the resistive behaviors encountered. For example, there was no differentiation in codification between a change recipient who voiced a civil, level-headed, and rational argument against the change and a change recipient who argued in a louder, more boisterous, emotional, and impassioned manner. Future research is recommended to investigate the intensity of the resistive behavior types and timing within the project, as the intensity of resistance may be directly proportional to change agent effort levels in their attempts to overcome resistance and foster greater change readiness among AEC project teams.

It is also acknowledged that this study was limited to the behavioral dimension of resistance to change. The two other dimensions of cognitive and affective resistance were beyond the scope of this study, mainly due to a research design the centered on directly observable resistance phenomena in the form of behaviors. Future research in the AEC industry may consider additional research designs to account for the cognitive and affective viewpoints of owner personnel throughout the change implementation process.

REFERENCES

Agius, H., Angelides, M. (1999). Developing knowledge-based intelligent multimedia tutoring systems using semantic content-based modeling. *Artificial Intelligence Reviews*, 13, 55-83.

Ahn, M., Adamson, J., Dombusch, D. (2004). "From Leaders to Leadership: Managing Change." *Journal of Leadership & Organizational Studies*, 10, 112-123.

Alavi, M., Leidner, D. (2001). Technology-mediated tutoring systems using semantic content-based modeling. *Information Systems Research*, 12(1), 1-10.

Allen-Meyer, G. (2001). What's in a name? Approaching organizational change. *Strategy & Leadership*, 29(6), 4-7.

Altrichter, H., Kemmis, S., McTaggart, R., Zuber-Skerritt, O. (2002). "The concept of action research." *The Learning Organization*, 9(3), 125–131.

Alvesson, M. (2002). *Understanding Organizational Culture*. London: Sage Publications, Ltd.

Ankrah, N.A., Proverbs, D., and Debrah, Y. (2008). "Factors influencing the culture of a construction project organization: An empirical investigation." *Engineering, Construction and Architectural Management,* 16(1), 26-47.

Armenakis, A., Bedeian, A. (1999). "Organizational Change: A Review of Theory and Research in the 1990s." *Journal of Management*, (25)3, 293-315

Armenakis, A., Harris, S. (2009). "Reflections: our Journey in Organizational Change Research and Practice." *Journal of Change Management*, 9(2), 127-142.

Armenakis, A., Harris, S., Feild, H. (1999). Making Change Permanent: A Model for Institutionalizing Change Interventions. *Research in Organizational Change and Development*, Vol. 12, 97-128.

Armenakis, A., Bernerth, J., Pitts, J., Walker, J. (2007). Organizational Change Recipients' Beliefs Scale: Development of an Assessment Instrument. *The Journal of Applied Behavioral Science*, Vol. 43, pp. 481-505.

Bacharach, S., Bamberger, P., & Sonnenstuhl, W. (1996). "The organizational transformation process: Dissonance reduction and logics of action in the aftermath of deregulation." *Administrative Science Quarterly*, 41, 477–506.

Balogun, J. (2005). "Managing Change: Steering a Course between Intended Strategies and Unaniticipated Outcomes." *Long Range Planning*, 29(2006), 29-49.

Balogun, J., Hope Hailey, V. (2004). *Exploring Strategic Change, 2nd Edition*. London, UK: Prentice Hall.

Baloian, N., Pino, J., Hoppe, H. (2000). A teaching / learning approach to CSCL. *Proceedings of the 33rd Hawaii International Conference on Systems Sciences*, 447-456.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall

Bandura, A., and Locke, E. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology,*Vol. 88, pp. 87-99.

Barnes, F., Blackwell, C. (2994). Taking Business Training Online: Lessons From Academe. *Journal of Applied Management and Entrepreneurship*, 9(1), 3-20.

Barrett, P. and Sexton, M. (2006). "Innovation in Small, Project-Based Construction Firms." *British Journal of Management*, 17, 331-346.

Battilana, J., Gilmartin, M., Sengul, M., Pache, A., Alexander, J. (2010). "Leadership competencies for implementing planned organizational change." *The Leadership Quarterly*, 21, 422-438.

Beer, M. and Eisenstat, R. (1996). "Developing an organization capable of implementing strategy and learning." *Human Relations*, 49, 597-619

Beer, M. and Nohria, N. (2000). *Breaking the code of change*. Harvard Business School Press, Boston, MA.

Betts, M. and T. Wood-Harper (1994). "Reengineering Construction: A New Management Research Agenda." *Construction Management and Economics*, 12, 51–556.

Beckman, M. (1996). The Web goes interactive. *Macworld*, 13(7), 92-99.

Belassi, W. and Tukel, O., 1996. "A new framework for determining critical success/failure factors in projects." *International Journal of Project Management*, 14(3), 141–151.

Bluedorn, A. C. and Denhardt, R. B. (1988). "Time and organizations." *Journal of Management*, 14, 299-320.

112

Bolognese, A. (2002). *Employee resistance to organizational change*. Winthrop University; Rock Hill.

Bommer, W., Rich, G., and Rubin, R. (2005). "Changing attitudes about change: longitudinal effects of transformational leader behavior on employee cynicism about organizational change." *Journal of Organizational Behavior*, 26, 733-753.

Bouchlaghem, D. and Whyte, J. (2004). ''IT innovation within the construction organization." *Construction Management and Economics*, 32(2), 1-12.

Bovey, W. and Hede, A. (2001a). "Resistance to organizational change: the role of cognitive and affective processes." *Leadership & Organization Development Journal*, 22(8), 372-82.

Bovey, W. and Hede, A. (2001b). "Resistance to organisational change: the role of defence mechanisms." *Journal of Managerial Psychology*, 16(7), 534-548.

Bourne, M., Neely, A., Platts, K., and Mills, J. (2002). "The success and failure of performance measurement initiatives." *International Journal of Operations & Production Management*, 22(11), 1288-1310.

Bradley, W. (2011). A Conceptual Framework for the Design and Evaluation of Online Learning Modules in Professional Training and Academic Education in Business. *The Business Review*, 18(1), 20-27.

Burnes,B. (2004). *Managing Change in Organizations*, 4th Edition. Harlow: Prentice Hall.

Cameron, K.S. and Quinn, R.E. (1999). *Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework*. Addison-Wesley, Reading, MA.

Carty, G. (1995). "Construction." *Journal of Construction Engineering and Management*, 121(3), 319–328.

Cho, C. and Gibson, G.E. (2001). "Building Project Scope Definition Using Project Definition Rating Index." *Journal of Architectural Engineering*, 7(4), 115-125.

Chreim, S. (2006), "Managerial frames and institutional discourses of change: employee appropriation and resistance." *Organization Studies*, 27(9), 1261-87.

Chua, D., Kog, Y., Loh, P., Jaselskis, E., 1997. "Model for construction budget performance – neural network approach." *Journal of Construction Engineering and Management*, 12(3), 214–222.

Clark, J., Ellett, C., Bateman, J., Rugutt, J. (1996). "Faculty receptivity/resistance to change, personal and organizational efficacy, decision deprivation and effectiveness in research I universities." Paper presented at the *Twenty-first Annual Meeting of the Association for the Study of Higher Education*, Memphis, TN, October 31-November 3.

Coch, L., French, J. (1948). "Overcoming Resistance to Change: *Human Relations*, 1, 512-532.

Coetsee, L. (1999). "From resistance to commitment." *Public Administration Quarterly*, 23, 204–222.

Coghlan, D., Brannick, T., 2002. *Doing Action Research in Your Own Organization*. Sage Publications, London.

Cooke-Davies, T. (2002). "The 'real' success factors on projects." *International Journal of Project Management*, 20(3), 185–90.

Construction Productivity Network (1997). "Human Resources for Construction Innovation: Report of IMI International Workshop." University of Reading, May 19–20.

Coughlan, P. and Coghlan, D. (2002), "Action research for operations management." *International Journal of Operations & Production Management*, 22(2), 220-40.

Coulson-Thomas, C. (2013). "New Leadership and creating the high performance organisation: Part 2." *Industrial and Commercial Training*, 45(2), 92-98.

Covin, T.J. and Kilmann, R.H. (1990). "Participant perceptions of positive and negative influences on large-scale change." *Group and Organization Studies*, 15, 233-248.

Cowan-Sahadeth, K. (2010). "Business transformation: Leadership, integration and innovation - A case study." *International Journal of Project Management*, 28(2010), 395-404.

Cristobal (2011). "Critical Path Definition Using Multicriteria Decision Making: PROMETHEE Method." *Journal of Management in Engineering*, 29(2), 158-163.

Crowley, A. (2000). Is Multimedia Ready for Mainstream? *PC Week*, 16(5), 69.

Dainty, A., Cheng, M. and Moore, D. (2003). "Redefining performance measures for construction project managers: an empirical evaluation." *Construction Management and Economics*, 21, 209–218.

Day, G. S. (1994). "Continuous Learning About Markets." *California Management Review*, 36(Summer), 9–31.

de Wit, A. (1988). "Measurement of project success." *International Journal of Project Management*, 6(3), 164–70.

Delbeq, A., Van de Ven, A., & Gustafson, D. H. (1975*). Group techniques for program planning: A guide to nominal group and Delphi processes*. Glenview, USA: Scott, Foresman and Company.

Denhardt, R., Denhard, J., Aristigueta, M. (2009). *Managing Human Behavior in Public and Nonprofit Organizations*. Thousand Oaks, CA: Sage Publications, Inc.

Dent, E. B., & Powley, E. H. (2003). "Employees actually embrace change: The chimera of resistance." *Journal of Applied Management and Entrepreneurship*, 8, 40–56.

Dodgson, M. and J. Bessant (1996). *Effective Innovation Policy: A New Approach*. Routledge, London.

Durand, R. (2006). *Organizational evolution and strategic management*. London: Sage publications.

Eby, L. T., Adams, D., M., Russell, J. E. A., & Gaby, S. H. 2000. "Perceptions of organizational readiness for change: Factors related to employees' reactions to the implementation of team-based selling." *Human Relations*, 53, 419-442.

El-Sheikh, A. and Pryke, S.D. (2010) "Network gaps and project success." *Construction Management and Economics,* 28(12), 1205–1217.

Emiliani, M.L. and Stec, D.J. (2004). "Leaders lost in translation." Leadership & Organization Development Journal, 26(5), 370-387.

Eriksson, P., Westerberg, M. (2010). "Effects of cooperative procurement procedures on construction project performance: A conceptual framework." *International Journal of Project Management*, 29, 197-208.

Erwin, D., and Garman, A. (2010). "Resistance to organizational change: linking research and practice*." Leadership & Organization Development Journal*, 31(1), 39-56.

Federal Highway Administration. (2002). "Design-build contracting; Final rule." *Federal Register*, 67(237), 75901-75935.

Fiedler, S. (2010). "Managing resistance in an organizational transformation: A case study from a mobile operator company." *International Journal of Project Management*, 28, 370-383.

Fisk, E.R. (2003), *Construction Project Administration*. Prentice Hall, Columbus, OH.

Foote, N. (2001). "The futility of resistance (to change)". *Computerworld*, Accessed at http://www.computerworld.com/s/article/56246/The_Futility_of_Resistance_to_C hange_?taxonomyId=14&pageNumber=1

Ford, J., Ford, L., D'Amelio, A. (2008). "Resistance to change: the rest of the story." *Academy of Management Review*, 33 (2), 362-377.

French, W., Bell Jr, C. (1990). *Organization Development: Behavioral Science Interventions for Organization Improvement 4th Ed*. Prentice Hall, Engewood Cliffs.

Froese, T. M. (2010). The impact of emerging information technology on project management for construction. *Automation in Construction, 19 (2010), 531-538.*

Galpin, T (1996). *The Human Side of Change: A Practical Guide to Organizational Redesign.* Jossey-Bass, San Francisco, CA.

Gareis, R. (2010). "Changes of organizations by projects." *International Journal of Project Management*, 28(2010), 314-327.

Gareis, R., Stummer, M., 2008. *Processes & Projects*. Manz, Vienna.

Giangreco, A. and Peccei, R. (2005). "The nature and antecedents of middle manager resistance to change: evidence from an Italian context." *International Journal of Human Resource Management*, 16(10), 1812-1829.

Gibson Jr., G., Wang, Y., Cho, C., and Pappas, M. (2006). "What is Preproject Planning, Anyway?" *Journal of Management in Engineering*, 22(1), 35-42.

Gilmore, T., Shea, G., Useem, M. (1997). "Side effects of corporate cultural transformations." *Journal of Applied Behavioral Science*, 33, 143-154.

Gransberg, D. D., Barton, R. F. (2007). "Analysis of Federal Design-Build Request for Proposal Evaluation Criteria." *Journal of Management in Engineering*, 23, 105-111.

Gransberg, D. D. and Molenaar, K. (2004). "Analysis of Owner's Design and Construction Quality Management Approaches in Design/Build Projects." *Journal of Management in Engineering*, 30, 162-169.

Gray, B., Stensaker, I., and Jansen, K. (2012). "Qualitative Challenges for Complexifying Organizational Change Research: Context, Voice, and Time." *Journal of Applied Behavioral Science*, 48(2), 121-134.

Griffith, A. and Watson, P. (2004). *Construction Management: Principles and Practice*. Palgrave McMillan, London.

Gummesson, E. (2000). *Qualitative Methods in Management Research*. Sage, Thousand Oaks, CA.

Hallencreutz, J., Turner, D. (2011). Exploring organizational change best practice: are there any clear-cut models and definitions? *International Journal of Quality and Service Sciences*, 3(1), 60-68.

Halpin, D. and R. Woodhead (1998). *Construction Management (2nd edition)*. Wiley, New York.

Harms, P. D. and Crede, M. (2010). "Emotional Intelligence and Transformational and Transactional Leadership A Meta-Analysis." *Journal of Leadership & Organizational Studies*, 17(1), 5-17.

Haseman, W., Nuipolatoglu, V., Ramamurthy, K. (2002). An Empirical Investigation of the Influences of the Degree of Interactivity on User-Outcomes in a Multimedia Environment. *Information Resources Management Journal*, 15(2), 31-48.

Hashmi, M., Guvenli, T. (2001). Multimedia Content on the Web: Problems and Prospects. *Managerial Finance*, 27(7) 34-41.

Hegazy, T. (2006). "Simplified Project Management for Construction Practitioners." *Cost Engineering*, 48(11), 20-28.

Hendersen, K. M. and Evans, J. R. (2000). Successful implementation of six sigma: Benchmarking General Electric Company. *Benchmarking*, 7 (4), 260-281.

Hendry, C. (1996). "Understanding and creating whole organizational change thorugh learning theory." *Human Relations*, 49, 621-641.

Herscovitch, L., & Meyer, J. P. (2002). "Commitment to organizational change: Extension of a three-component model." *Journal of Applied Psychology*, 87, 474–487.

117

Hiltz, E., Wellman, B. (1997). Asynchronous learning networks as a virtual classroom. *Communications of the ACM*, 40(9), 44-49.

Hoff, C. (2006). Why lean manufacturing is no get-rich-quick program. Retrieved from: http://www.thefabricator.com/article/shopstrategies/why-lean-manufacturing-is-no-get-rich-quick-program-part-i.

Hofstetter, F. (1995). *Multimedia Literacy*. New York: McGraw-Hill

Holmes, G., Wenrich, J. (1997). Revisiting cable TV in the classroom. *Educational Media and Technology Yearbook*, 22, 138-144

Holt, D., Self, D., Thal Jr., A., Lo, S. (2003). Facilitating organizational change: a test of leadership strategies. *Leadership & Organization Development Journal*, 24/5.

Holt, D., Armenakis, A., Field, H., Harris, S. (2007). "Readiness for Organizational Change: The Systematic Development of a Scale." *The Journal of Applied Behavioral Science*, 43(2), 232-255.

Huan, Y., and Shih, H. (2011). "A new mode of learning organization." *International Journal of Project Management*, 32 (5/6), 623-644.

Hughes, M. (2011). "Do 70 Per Cent of All Organizational Change Initiatives Really Fail?" *Journal of Change Management*, 11(4), 451-464.

Hultman, K. E. (2006). *Values-driven change: Strategies and tools for long-term success*. iUniverse, Lincoln, NE.

Jansen, J., Vera, D., and Crossan, M. (2009). "Strategic leadership for exploration and exploitation: The moderating role of environmental dynamism." *The Leadership Quarterly*, 20(2009), 5-18.

Jergeas, G. (2006). "Ten Critical Principles for Successful Design-Build Projects." *Cost Engineering*, 48(11), 29-34.

Jick, T. (1996). Note on Recipients of Change. *Harvard Business School Background Note*. (Revised from original November 1990 version).

Johnson, J. W. (2004). "Factors affecting relative weights: The influence of sampling and measurement error." *Organizational Research Methods*, 7, 283-299. doi: 10.1177/1094428104266018

Johnson, J. W., & LeBreton, J. M. (2004). "History and use of relative importance indices in organizational research." *Organizational Research Methods*, 7, 238-257. doi: 10.1177/1094428104266510

Jones, R. A., Jimmieson, N. L., & Griffiths, A. 2005. "The impact of organizational culture and reshaping capabilities on change implementation success: The mediating role of readiness for change." *Journal of Management Studies*, 42, 361-386.

Jorgensen, F., Boer, H, Gertsen, F. (2003). "Jump-starting continuous improvement through self-assessment." *International Journal of Operations & Production Management*, 23(10), 1260-1278.

Judson, A. (1991). *Changing Behavior in Organizations: Minimizing Resistance to Change*. Cambridge, MA: Basil Blackwell.

Kanter, R., Stein, B., Jick, T. (1992). *The Challenge of Organizational Change: How Companies Experience It and Leaders Guide It*. New York, NY: Free Press.

Kelsey, K. (2000). Participant interaction in a course delivered by interactice compressed video technology. *American Journal of Distance Education*, 14(1), 63-74.

Kim, T.-G., Hornung, S., & Rousseau, D. M. (2011). "Change-supportive behavior: Antecedents and the moderating role of time." *Journal of Management*, 37, 1664-1693.

Kinicki, A, Kreitner, R (2006). *Organizational Behavior: Key Concepts, Skills, & Best Practices*. New York, NY: McGraw-Hill Companies

Kotter, J. (1995). Leading change: Why transformation efforts fail. *Harvard Business Review*, Vol. 52, 59-67.

Langley, A. (1999). "Strategies for theorizing from process data*." Academy of Management
Review*, 24, 691-710.

Lee, H. (2005). Enhancing Education Through Technology? *Journal of American Academy of Business*, 7(1), 327-330.

Lehtiranta, L., Karna, S., Junnonen, J., Julin, P. (2014). "The role of multi-firm satisfaction in construction project success." *Construction Management and Economics*, 30, 463-475.

Leonard, N., Beauvais, L., Scholl, R. (1999). "Work Motivation: The Incorporation of Self-Concept-Based Processes." *Human Relations*, 52(8), 969-998

Levy, S.M. (2000), *Project Management in Construction*. McGraw-Hill, New York, NY.

Lewin, K. (1947). "Frontiers in group dynamics: Concept, method and reality in social science." *Human Relations*, 1, 5–41.

Lewin, K. (1951). *Field theory in social science*. Greenwood, Westport, CT.

Lines, R. (2004), "Influence of participation in strategic change: resistance, organizational commitment, and change goal achievement." *Journal of Change Management*, 4(3), 193-215.

Lines, R. (2005), "The structure and function of attitudes toward organizational change." *Human Resource Development Review*, 2, 1-25.

Lines, B., Perrenoud, A., Smithwick, J., Sullivan, K. (2014). "Implementing New Project Delivery Strategies: Development of a Web-Based Multimedia Tool to Support Owner Project Team Training." *International Journal of Construction Education and Research.*

Linstone, H., Turloff, M. (1975). *The Delphi method: Techniques and applications*. London, UK: Addison Wesley.

Loosemore, M., Dainty, A. and Lingard, H. (2006). *Human Resource Management in Construction Projects*. Thomson South-Western, London.

Luecke, R. (2003). *Managing Change and Transition*. Boston, MA: Harvard Business School Press.

Mabin, V., Forgeson, S. and Green, L. (2001). "Harnessing resistance: using the theory of constraints to assist change management." *Journal of European Industrial Training*, 25(2-4), 168-91

Malisch, W. and Suprenant, B. (2012). "Beware of Risk Transfer: Part 2." *Concrete Contractor*, August/September 2012, 12-13.

Maurer, R. (1996). *Beyond the Wall of Resistance: Unconventional Strategies that Build Support for Change*. Ausin, TX: Bard Books, Inc.

McCloskey, D., Antonucci, Y., Schug, J. (1998). Web-based vs. traditional course development: Identifying differences in user characteristics and performance

outcomes. *Proceedings of the International Business Schools Computing Association Annual Conference*, Denver, CO.

McClure, P. (2005). "Correlation Statistics: Review of the Basics and Some Common Pitfalls." *Journal of Hand Therapy*, 378-380.

McGrath, J. E., & Rotchford, N. L. (1983). "Time and behavior in organizations." *Research in Organizational Behavior*, 5, 57-101.

Medina, C.C., Lavado, A.C., Cabrera, R.V. (2005). "Characteristics of Innovative Companies: A Case Study of Companies in Different Sectors." *Creativity and Innovation Management*, 14(3), 272-287.

Migliaccio, G.C., Gibson, G.E., O'Connor, J.T. (2008). "Changing Project Delivery Strategy: An Implementation Framework." *Public Works Management & Policy*, 12(3), 483-502.

Migliaccio, G. C., Shrestha, P. P., Clarke, M., O'Connor, J. T., & Gibson, G. E. (2006, October). *Final report 0-4661-5 to Texas Department of Transportation*. Austin: University of Texas at Austin, Center for Transportation Research.

Miller, J. B., Garvin, M. J., Ibbs, C. W., & Mahoney, S. E. (2000). "Toward a new paradigm: Simultaneous use of multiple project delivery methods." *Journal of Management in Engineering*, 16(3), 58-67.

Mir, F. A., and Pinnington, A. H. (2014). "Exploring the value of project management: Linking Project Management Performance and Project Success." *International Journal of Project Management*, 32(2014), 202-217.

Mishra, A. K., & Spreitzer, G. M. (1998). "Explaining how survivors respond to downsizing: The roles of trust, empowerment, justice and work redesign." A*cademy of Management Review*, 23, 567–588.

Molenaar, K. R., & Gransberg, D. D. (2001). "Design-builder selection for small highway projects." *Journal of Management in Engineering*, 17(4), 214-223.

Mumby, D. K. (2005). "Theorizing resistance in organization studies: A dialectical approach." *Management Communication Quarterly*, 19, 9–44.

O'Connor, J. T., Gibson, G. E., & Migliaccio, G. C. (2004a, August). *CDA procurement process model, Report 0-4661-P1 to Texas Department of Transportation*. Austin: University of Texas at Austin, Center for Transportation Research.

O'Connor, J. T., Gibson, G. E., & Migliaccio, G. C. (2004b, August). *Essential elements of CDA master contract, Report 0-4661-P2 to Texas Department of Transportation*. Austin: University of Texas at Austin, Center for Transportation Research.

Oreg, S. (2006). "Personality, context, and resistance to organizational change." *European Journal of Work and Organizational Psychology*, 15(1), 73-101.

O'Toole L. (1993). Interrorganizational policy studies." *Journal of Public Administration Research and Theory*, 3(2), 232-251.

Ott, S., Parkes, S., Simpson, R. (2008). *Classic Readings in Organizational Behavior*, Fourth Edition. Wadsworth/Thomas Learning, Belmont CA.

Pascale, R., Millemann, M., Vakolar, M. (1997). Changing the way we change. *Harvard Business Review*, Vol. 75, No. 6, 127-39.

Pheng, L., Teor, J. (2004). Implementing Total Quality Management in Construction Firms. *Journal of Management in Engineering*, 20(1), 8-15.

Pettigrew, A. M., Woodman, R. W., & Cameron, K. S. (2001). "Studying organizational change and development: Challenges for future research." *Academy of Management Journal*, 44, 697-713.

Phua, F., Rowlinson, S. (2004). "How important is cooperation to construction project success? A grounded empirical quantification." Eng*ineering, Construction and Architectural Management*, 11(1), 45-54.

Piderit, S.K. (2000). "Rethinking resistance and recognizing ambivalence: a multidimensional view of attitudes toward an organizational change." *Academy of Management Review*, 25, 783-94

Pietroforte, R., & Miller, J. B. (2002). "Procurement methods for US infrastructure: Historical perspectives and recent trends." *Building Research & Information*, 30(6), 425-434.

Piotrow, P., Khan, O., Lozare, B., and Khan, S. (2000). *Health communication programs: A distance-education class within the John Hopkins University School of Public Health and Distance Education Program. Web-Based Learning and Teaching Technologies: Opportunities and Challenges.* Hershey, PA: Idea Group Publishing.

Powell Jr. (2002). "Organizational Change Models." Futurics, 26(3&4), 20-45.

Rafferty, A., Jimmieson, N., Armenakis, A. (2013). "Change Readiness: A Multilevel Review." *Journal of Management*, 39 (1), 110-135.

Schein, E. (1987). *Process Consultation: Lessons for Managers or Consultants*. Addison Wesley Publishing Company, Reading, MA.

Schneider, B., Gunnarson, S., and Niles-Jolly, K. (1994). Creating the climate and culture of success. *Organizational Dynamics*, Spring, 7-19.

Shen, Q., Li, H., Deng, Z. (2001). Intelligent multimedia for expertise-intensive training in construction. *Logistics and Information Management*, 14(5/6), 386-392

Self, D., Schraeder, M. (2009). Enhancing the Success of Organizational Change: Matching Readiness Strategies with Sources of Resistance. *Leadership & Organization Development*, Vol. 30, No. 2, 167-182.

Skulmoski, G. & Hartman, F. (2002). The Delphi method: Researching what does not exist (yet). Proceedings of the International Research Network on Organization by Projects, IRNOP V Conference, Renesse, The Netherlands.

Smollan, R. (2011). "The multi-dimensional nature of resistance to change." *Journal of Management & Organization*, 17(6), 828-849.

Snell, S. J., Tonidandel, S., Braddy, P., & Fleenor, J. (2013). "The Relative Importance of Political Skill Dimensions for Predicting Managerial Effectiveness." *European Journal of Work and Organizational Psychology*. doi:10.1080/1359432X.2013.817557

Sullivan, K. (2011). Quality Management Programs in the Construction Industry: Best Value Compared with Other Methodologies. *Journal of Management in Engineering*, 27(4), 210-219.

Swan, W., Khalfan, M., 2007. "Mutual objective setting for partnering projects in the public sector." *Engineering, Construction and Architectural Management*, 14(2), 119–130.

Tatum, C. B. (1989). "Organising to Increase Innovation in Construction Firms." *Journal of Construction Engineering and Management*, 115, 4.

Thomas, G. and R. Bone (2000). *Innovation at the Cutting Edge: The Experience of Three Infrastructure Projects*. CIRIA Funders Report FR/CP/79, CIRIA, London.

Tichy, N., Ulrich, D. (1984). The Leadership Challenge – A Call for the Transformational Leader. *MIT Sloan Management Review*, Vol. 26, 59-68.

Trader-Leigh, K. (2001). "Case study: identifying resistance in managing change." *Journal of Organizational Change Management*, 15(2), 138-155.

Todnem, R. (2005). "Organisational Change Management: A Critical Review." *Journal of Change Management*, 5(4), 369-380.

Tonidandel, S. and LeBreton, J. M. (2014). "RWA Web: A Free, Comprehensive, Web-Based, and User-Friendly Tool for Relative Weight Analysis." *Journal of Business Psychology*, DOI 10.1007/s10869-014-9351-z.

Tonidandel, S., LeBreton, J. M., & Johnson, J. W. (2009). "Determining the statistical significance of relative weights." *Psychological Methods*, 14, 387-399.doi: 10.1037/a0017735

Tzortzopoulos, P., Sexton, M. and Cooper, R. (2005), "Process models implementation in the construction industry: a literature synthesis." En*gineering, Construction and Architectural Management*, 12(5), 470-86.

U.S. Department of Transportation, Federal Highway Administration (2004). *Report to Congress on public-private partnerships*. Retrieved from: http://www.fhwa.dot.gov/reports/pppdec2004/pppdec2004.pdf

Van de Ven, A., & Poole, M. S. (1995). "Explaining development and change in organizations." *Academy of Management Journal*, 20(3), 510−540.

Walewski, J., Gibson, G. E., & Jasper, J. (2001, October). *Project delivery methods and contracting approaches available for implementation by the Texas Department of Transportation, Report 0-2129-1 to Texas Department of Transportation*. Austin: University of Texas at Austin, Center for Transportation Research.

Walker, J., Armenakis, A., Bernerth, J. (2007). Factors influencing organizational change efforts: An integrative investigation of change content, context, process and individual differences. *Journal of Organizational Change Management*, Vol. 20, No. 6, pp. 761-773.

Wang, Y., and Gibson Jr., G. (2010). "A study of preproject planning and project success using ANNs and regression models." *Automation in Construction*, 19, 341-346.

Washington, M. and Hacker, M. (2005), "Why change fails: knowledge counts.*" Leadership & Organization Development Journal*, 26(5), 400-411.

Wetzel, C., Radtke, R., Stern, H. (1994). *Instructional Effectiveness of Video Media*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Weiner, B.J. (2009). "A theory of organizational readiness for change." *Implementation Science*, 4, 67-75.

Whelan-Berry, K., Somerville, K. (2010). Linking Change Drivers and the Organizational Change Process: A Review and Synthesis. *Journal of Change Management*, 10(2), 175-193.

Winch, G. (1999). "Zephyrs of Creative Destruction: Notes on the Innovation Problem in Construction." *Building Research and Information*, 26(5), pp. 268–279.

Wong, A.K.D. and Zhang, R. (2013). "Implementation of web-based construction project management system in China projects by Hong Kong developers." *Construction Innovation*, 13(1), 26-49.

Xia, B, Chan, A., Zuo, J. Molenaar, K. (2013). "Analysis of Selection Criteria for Design-Builders through the Analysis of Requests for Proposal." *Journal of Management in Engineering*, 29(1), 19-26.

Yun, G., Shin, D., Kim, H., Lee, S. (2011). "Knowledge-mapping model for construction project organizations." *Journal of Knowledge Management*, 15(3), 528-548.

Zammuto, R.F. (2001). "Book review of breaking the code of change." Administrative Science Quarterly, 46(4) 769-798.

Zhang, L., and Fan, W. (2013). "Improving performance of construction projects: A project manager's emotional intelligence approach." *Engineering, Construction, and Architectural Management*, 20 (2), 1950207.