



## AN ABSTRACT OF THE THESIS OF

Joshua D. Hille for the degree of Master of Science in Industrial Engineering presented on May 13, 2016.

Title: Towards a Conceptual Change Model to Support Organizational Change Efforts.

Abstract approved: \_\_\_\_\_  
Chinweike I. Eseonu

“Perception is reality.” ~ Lee Atwater

Many projects fail because employees and managers have different understandings of project “success” or “value”. Other projects fail because managers are unable to effectively align organizational values with those of their employees. This problem is widely understood, but there is little empirical research that specifies the nature and effect of this variation in the way managers and employees define project “success” and “value”. This research provides empirical support for the assumed difference between managers and employee definitions of project “success” and “value”. This research also proposes a novel approach to organizational change that harnesses empirical knowledge of the gap in project success definition to develop a strategy for organizational change that is based on changing individual mindset. This approach deviates from the current one-size-fits all, group-focused approach, in which over 70 percent of change projects result in failure.

The objective of this thesis is twofold. First, definitions of successful organizational change projects are characterized by individuals at different levels of the

Rasmussen Socio-technical Framework, and by individuals from academic and non-academic organizations. Second, an approach is developed for promoting individual conceptual change as a means to achieve self-sustaining improvements that propagate through the organization. Given the nascence of this work on achieving conceptual change as a means for organizational-level change, there is a need for a model that guides research and practice. Furthermore, there is a need to address other factors including metacognitive, motivational, and affective processes that are integral to facilitating conceptual change. Research findings identify key discrepancies between how individuals at different Rasmussen socio-technical levels define value in change projects as well as variations between individuals from academic and non-academic organizations. Furthermore, this thesis highlights the importance of ensuring both the human and technical aspects of a project are satisfied, as well as discussing the applicability of the proposed Conceptual Change Model to an organizational change project. Conclusions provide suggestions for managers and academic professionals to improve the success of organizational change projects.

©Copyright by Joshua D. Hille  
May 13, 2016  
All Rights Reserved

Towards a Conceptual Change Model to Support Organizational Change Efforts

by  
Joshua D. Hille

A THESIS

submitted to

Oregon State University

in partial fulfillment of  
the requirements for the  
degree of

Master of Science

Presented May 13, 2016  
Commencement June 2016

Master of Science thesis of Joshua D. Hille presented on May 13, 2016

APPROVED:

---

Major Professor, representing Industrial Engineering

---

Head of the School of Mechanical, Industrial, and Manufacturing Engineering

---

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

---

Joshua D. Hille, Author

## ACKNOWLEDGEMENTS

The author expresses appreciation to Dr. Chinweike Eseonu for his help and support. Dr. Eseonu has demonstrated continued guidance and mentorship as I completed research during both my undergraduate and graduate degrees. The author acknowledges Jesus Christ from whom all things are given by grace. The author expresses sincere appreciation to his mom, dad, sister, and grandparents for financial and emotional support. Also, thank you to Dr. Bryony DuPont for her input as I sought to define my research goals. Finally, thank you to Ted Hand for his support and input throughout my research.

## CONTRIBUTION OF AUTHORS

Waleed Mirdad and Bivek Gurung were involved with the thematic analysis presented in Chapter 4. Waleed Mirdad and Jeremy Melamed assisted with the development of the Conceptual Change Model and writing of Chapter 5.

## TABLE OF CONTENTS

	<u>Page</u>
1. Introduction.....	1
1.1. Motivation .....	1
1.2. Research Objectives .....	3
1.3. Research Context.....	4
1.4. Case Study Industry Partner .....	5
1.5. Research Methodology.....	7
1.6. Key Findings and Conclusion .....	10
1.7. Thesis Organization.....	13
2. Literature Review.....	14
2.1. Change Management .....	14
2.2. Conceptual Change.....	20
2.2.1. Theory of Accommodation .....	21
2.2.2. REACT Learning Strategy .....	22
2.3. Change Management and Conceptual Change in Engineering .....	23
2.3.1. Single-Loop and Double-Loop Learning .....	24
2.3.2. Conceptual Change Model.....	25
2.4. Lean Manufacturing .....	31
3. Research Methodology .....	34

## TABLE OF CONTENTS (Continued)

	<u>Page</u>
3.1. Instrument Design .....	36
3.1.1. Survey Design .....	36
3.1.2. Interview Design .....	40
3.1.3. Instrument Approval .....	42
3.2. Data Collection.....	42
3.3. Research Analysis .....	44
3.3.1. Cronbach's Alpha.....	44
3.3.2. Shapiro-Wilk Test .....	45
3.3.3. Mann-Whitney U Test.....	46
3.3.4. Thematic Analysis.....	46
4. First Manuscript: An Investigation of the Effect of Job Role on Perception of Value and Success in Organizational Transformation.....	49
4.1. Introduction .....	49
4.2. Background and Literature Review .....	51
4.3. Methodology .....	60
4.3.1. Survey Design .....	60
4.3.2. Data Collection Procedures.....	62
4.3.3. Construct Reliability .....	64
4.3.4. Data Analyses.....	65
4.4. Results and Discussion.....	67
4.4.1. Variations between Academic and Industry-based Participants .....	68
4.4.2. Rasmussen Socio-technical Level Variations .....	71
4.5. Discussion .....	75
4.5.1. Academic and Industry Organization and NAICS Code Variations.....	75
4.5.2. Rasmussen Socio-technical Level Variations .....	77

## TABLE OF CONTENTS (Continued)

	<u>Page</u>
4.6. Conclusion.....	82
4.6.1. Implications for Engineering Managers.....	82
4.6.2. Implications for Researchers.....	84
4.6.3. Limitations .....	85
5. Second Manuscript: Using The Lens of Conceptual Change to Assess Success of a Change Management Project .....	88
5.1. Introduction .....	88
5.2. Change Conceptualization.....	89
5.2.1. From Macro to Micro Implementation Strategies.....	89
5.2.2. Single to Double-Loop Learning .....	90
5.2.3. Need for a Practical Framework .....	91
5.3. Conceptual Change Model .....	91
5.3.1. Stage 1: Preparation .....	95
5.3.2. Stage 2: Preconception Awareness .....	97
5.3.3. Stage 3: Generate Meaningful Conflict.....	97
5.3.4. Stage 4: New Concept Introduction .....	98
5.3.5. Initial Assessment .....	99
5.3.6. Stage 5: Validation.....	100
5.3.7. Stage 6: Transfer .....	101
5.3.8. Final Assessment.....	101
5.4. Case Study .....	102
5.4.1. Methodology .....	103
5.4.2. Results.....	105
5.5. Conclusion.....	113
6. Conclusions and Future Work .....	115

TABLE OF CONTENTS (Continued)

	<u>Page</u>
6.1. Summary .....	115
6.2. Conclusions .....	116
6.3. Implications for Engineering Managers .....	119
12.1. Future Research Opportunities .....	122
12.2. Weaknesses and Improvement Opportunities.....	123
Bibliography.....	124
Appendices.....	138
Appendix A: Survey 1 .....	139
Appendix B: Interview Transcripts .....	147
Appendix C: Manuscript 1 IRB Documents .....	161
Appendix D: Manuscript 2 IRB Documents .....	167

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Annual change management publication counts between 1975 and 2015 (n = 159).	17
2. Change management articles by industry (n = 44). .....	18
3. Conceptual change model. Source: (Mirdad et al., 2015).....	27
4. Research logic model. ....	35
5. Survey response collection timeline. ....	43
6. Variations in change management success definition between company, management, and staff levels. ....	78
7. Company, management, and staff level scope of consideration. ....	83
8. Proposed conceptual change model. Source: (Mirdad et al., 2015).....	94
9. Conceptual change model contribution map.....	95
10. Factors impacting the conceptual change preparation stage. Source: (Limón, 2001). ....	96

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Rasmussen Socio-technical Framework level definitions. Source: (Rasmussen, 1997). .....	3
2. Research objectives, and corresponding research questions and test tools.....	8
3. Descriptions used in industry classification. Source: (NAICS Association, 2016). ..	19
4. Variables to be considered before training. Source: (Limón, 2001). .....	29
5. Survey construct definitions.....	37
6. Survey questions modified based on Farris (2006) and Farris et al. (2008). .....	39
7. Interview questions developed for organization relocation case study.....	41
8. Rasmussen socio-technical framework level definitions. ....	50
9. Change management literature review search terms.....	52
10. Change management success factors (n = 25). .....	53
11. Summary of constructs for Survey 1.....	59
12. Response rate of target groups. ....	63
13. Number of survey participants in each comparison group.....	64
14. Cronbach's alpha values for constructs in Survey 1. ....	65
15. Sample survey responses and assigned themes.....	66

## LIST OF TABLES (Continued)

<u>Table</u>	<u>Page</u>
16. Mann-Whitney U test assumption explanations. ....	67
17. Summary statistics for all survey responses (n = 67).....	68
18. Prevalence of qualitative themes for “value” as defined by academic and industry respondents.....	69
19. Variables impacting change project success rated by academic professionals and industry practitioners.....	70
20. Value themes used to describe success in change projects by three Rasmussen socio-technical levels. ....	72
21. Variables impacting change project success rated by staff, management, and company levels.....	74
22. P-value results from comparison of staff and management, staff and company, and management and company level individuals. ....	75
23. Comparison of differences between technology industry and non-technology industry survey participants. ....	86
24. Initial assessment sample questions. ....	100
25. Final assessment sample questions. ....	102
26. Fulfilment of gaps in the literature from Chapter 4 results. ....	118
27. Fulfilment of gaps in the literature from Chapter 5 results. ....	118

## LIST OF APPENDIX FIGURES

<u>Figure</u>	<u>Page</u>
11. Survey cover page. ....	140
12. Survey section one. ....	141
13. Survey section 2. ....	142
14. Survey section 3-1. ....	143
15. Survey section 3-2. ....	144
16. Survey section 3-3. ....	145
17. Survey section 4. ....	146

## LIST OF APPENDIX TABLES

<u>Table</u>	<u>Page</u>
28. Manager email interview transcript. ....	147
29. Manager email interview transcript. ....	151
30. Staff-level individual email interview transcript.....	154
31. Staff-level individual phone call interview transcript.....	157

## 1. INTRODUCTION

### 1.1. Motivation

One seemingly consistent characteristic of change projects across time is their high failure rate. About 70% of organizational change projects fail, a rate that has changed little since the 1970s (Ashkenas, 2013). Although change management has been prevalent in the literature for over 40 years (Lawrence, 1969), it is still a significant challenge for practitioners (Barker, 2015; Jackson, 2005). Several theories and techniques have been developed to aid practitioners in organizational change. Examples include the “Big Three” Model (Kanter, Stein, & Jick, 2003), the Eight-Stage Process for Successful Organizational Transformation (Kotter, 1996), and Luecke’s Seven Steps (2003). Yet there continues to be a wide range of approaches and methods that could be perceived as confusing and unapproachable for managers.

Many of the current change management techniques focus on macro-level change – affecting business processes, organizational policy, and management techniques. However, there is an emerging research emphasis on micro-level change as an effective means to achieve macro-level effects (Mazur, McCreery, & Chen, 2012; Mazur, McCreery, & Rothenberg, 2012). In this research, micro-level change refers to an effort to change behavior at the individual level (Erez & Gati, 2004). The work by Mazur, McCreery, & Rothenberg (2012) identifies conceptual change as a key driver to effectively implement change, as it is driven from the bottom-up rather than the traditional top-down approach. This means that a transition in employee mindset results in buy-in to new ideas, resulting in more effective and successful change. Although there have been some studies focused

on micro-level change (e.g. Judge, Thoresen, Pucik, & Welbourne, 1999), there is a need for a more comprehensive understanding of effective change management strategies at all levels within an organization. Current research lacks a prescriptive method for achieving this conceptual change in change management projects. A prescriptive method refers to a methodology that defines a specific approach for achieving conceptual change with sufficient flexibility that the approach can be utilized in a wide range of industries and applications. Instead, recent research is largely definitional and descriptive of change (e.g. Matesic, 2009; Mitchell, 2013), change management (e.g. Hayes, 2014), and success in change management projects (e.g. Chrusciel & Field, 2006; S. White, 2007). There remains a need for empirically tested guidelines that can help change implementation managers effect micro-level conceptual change in support of macro-level change.

Much of the research in change management suggests methods for achieving successful organizational change, yet success is rarely defined and clarified (Maurer, 2014b). Further, current definitions vary widely and could be largely dependent on an individuals' job role within an organization. This means that success, and, by extension, actions perceived as supporting success, could be disjointed and counteracting, where not properly managed. For example, a manufacturing manager may feel a change project was successful if production throughput and quality remained consistent, while manufacturing employees may feel a change project was successful if they and their colleagues kept their jobs while not losing any benefits or pay. Attention to this potential variation in project success definition is key to ensuring positive employee morale while fulfilling commitments to the bottom line.

## 1.2. Research Objectives

This research seeks to characterize and define success in change management projects, as the literature lacks a clear definition. Definitions of success are provided by individuals representing three of the six levels of the Rasmussen Socio-technical Framework (Table 1) and from both academic and non-academic organizations. This classification system was selected to enhance understanding of definitional variations across individuals with different backgrounds. Reaching a shared understanding of organizational change project success and developing a prescriptive method for implementation will help clarify the change management literature and methods for practitioners and other researchers. The second objective of this research is to begin to validate a conceptual change model developed by Mirdad, Hille, and Melamed (2015) that can be applied to aid organizational change project success.

Table 1. Rasmussen Socio-technical Framework level definitions.

Source: (Rasmussen, 1997).

<b>Rasmussen Socio-technical Level</b>	<b>Definition</b>
Government	Concerned with developing laws and regulations
Regulator	Concerned with defining industry standards which are based on laws and regulations
Company	Concerned with governing company policies and procedures based on industry standards (e.g. CEO level)
Management	Concerned with implementing company policies and procedures (excluding CEO level)
Staff	Concerned with performing work processes

### **1.3. Research Context**

Much of the change management research completed by engineering researchers has studied methods for effective lean implementation, particularly in the healthcare industry. In the past decade, healthcare-specific publications have suggested conceptual change as an effective method for implementing and sustaining lean (e.g. Mazur, McCreery, & Rothenberg, 2012; Mazur, Rothenberg, & McCreery, 2011). Another work identifies success factors in Kaizen events – a lean tool that requires significant personnel and organizational change (Farris, Van Aken, Doolen, & Worley, 2008). Lean is a particularly important area of change management research because it has been shown to yield significant organizational benefit, yet as few as 10% of implementation attempts are successful (Baker, 2002; Bhasin, 2008). Much of this failure is attributed to a lack of effective organizational culture change (Badurdeen & Gregory, 2012; Bhasin, 2012; Zarbo, 2012).

As implementing lean is a form of organizational change – often requiring changes in mindset, new technology integration, and process modification – it is expected that the broader body of knowledge on change management should be helpful in identifying strategies for improving lean success. Lean principles and tools are applied to achieve lean success. Lean principles are broadly applicable to any project in many different environments, while lean tools can be case-specific, like those developed for new product development (Hille & Eseonu, 2015a). Analogous to lean principles, this work is broadly applicable to any change scenario. This research seeks to support lean implementation by gaining a better understanding of conceptual change, while building on previous work

completed by authors such as Mazur, McCreery, & Rothenberg (2012; 2011), Farris, Van Aken, Doolen, & Worley (2008), and Mirdad, Hille, & Melamed (2015).

This work references a few terms which require clearer definition. *Organizational culture* is defined as “consistent, observable patterns of behavior in organizations...that provide not only a shared view of ‘what is’ but also of ‘why is’” (Watkins, 2013). However, there remain numerous aspects of and approaches to defining organizational culture (Watkins, 2013). *Effective* is defined as “producing a result that is wanted” (“Effective,” 2016). Finally, *conceptual change* is achieved when “pre-instructional conceptual structures of the learners [are] fundamentally restructured in order to allow understanding of the intended knowledge” (Duit & Treagust, 2003). In this thesis, *pre-instructional conceptual structure* is defined as a learner’s previous knowledge of the concept which is to be taught. *Intended knowledge* is the information learned and skills gained regarding the concept which is to be taught. The following section is an overview of the industry partner discussed in a case study in Chapter 5.

#### **1.4. Case Study Industry Partner**

The primary case study for this research was completed with the participation of a company based in the Northwest region of the United States. The company is subsequently referred to as “the technology company”. The research is specifically focused on a manufacturing group within the technology company. The manufacturing group employs 18 office personnel and 21 manufacturing personnel. The manufacturing group being studied (referred to as Group Y henceforth) assembles and tests reference design platforms for internal and external distribution. Both internally and externally distributed platforms are

used to validate and debug new software implementations. It should be noted that customers are internal (e.g. other departments within the technology company) or external (e.g. computer, tablet, phone manufacturing companies). Group Y does not have direct contact with the final end-consumer. Group Y operates a high-mix, low-volume manufacturing process, with new products being introduced each week. Many of the products are similar but are not identical. The differences are due to minor software or hardware design changes.

Chapter 5 is focused on one organizational-level change made within Group Y in the year before this study was conducted. This change was a relocation, which was driven by a low occupancy rate of the original building. The building was sold after the relocation, although a leaseback option was included in the sale to allow some non-manufacturing operations to stay in the original location. Over the course of eight months, Group Y identified a new location, which was 145 miles from the original location and moved the entire manufacturing operation related to Group Y. The new site was a vacant manufacturing space already owned by the technology company. The relocation coincided with a change in the scope of products they dealt with. The manufacturing floor space decreased by about 60% to 32,500 square feet. The new floor space could accommodate the manufacturing lines required by the new product scope.

Twelve office employees and 10 manufacturing employees left the company as a result of the relocation. Two office employees left Group Y but stayed with the technology company in the original manufacturing plant location. Approximately 80% of the employees who left the group had been with the company over 10 years. The departure of these employees represented a significant loss of experience and skill in both

manufacturing and office operations within Group Y. The following section introduces a broad overview of the methodology applied for this research.

### **1.5. Research Methodology**

This section provides a brief overview of the methodology applied for this research. A more thorough summary of the methodology can be found in Chapter 3. This thesis is based on results from one internet survey (Chapter 4) and one set of interviews with employees of Group Y (Chapter 5). The focus of the survey was on defining success and identifying success factors in organizational change projects. This focus is in support of the first objective of this thesis (see Table 2). The focus of the interviews was on determining the level of conceptual change achieved during the Group Y relocation based on the Conceptual Change Model (presented in Section 5.3) developed by Mirdad, Hille, and Melamed (2015). This focus was in support of the second objective of this thesis. Table 2 includes research questions and test tools corresponding with the two research objectives. Specific constructs and questions used in the internet survey and interviews are presented in Section 3.1.1 and Section 3.1.2, respectively.

Table 2. Research objectives, and corresponding research questions and test tools.

Research Objective	Research Questions	Test Tool
Define and characterize success in change management projects	How does successful change management characterization vary between academia and industry?	Internet survey
	How is successful change management characterized at the different organizational levels of the Rasmussen Socio-technical Framework?	
	Can literature-derived lean implementation success factors be used to characterize the success of change management projects?	
Validate the Conceptual Change Model developed by Mirdad, Hille, and Melamed (2015)	Does effective conceptual change impact the success of change management projects?	Industry partner interviews
	Do successful change management projects utilize the steps captured in the proposed Conceptual Change Model to effectively implement conceptual change?	

Survey participants included both academic professionals, whose research focuses on change management, and industry practitioners. Industry practitioner participants included Group Y employees as well as other individuals (not employed by the industry partner) who had been involved with an organizational change project in the past two years. Participants for the interviews included four Group Y employees – two management-level and two staff-level individuals. Participants were selected based on their involvement in the relocation project.

The survey developed for this research (see Chapter 4) consisted of two primary sections. First, survey participants were provided an essay box in which they were asked to respond with their definition of success (e.g. value) in a change project of their choosing. The second section included questions based on nine constructs identified as potentially having an impact on change project success, as well as one construct to characterize the perceived success of a change project. Constructs were based on two studies of Kaizen

events by Farris (2006) and Farris et al. (2008). Each question was based on a seven-point Likert scale (1 = “strongly disagree”, 2 = “disagree”, 3 = “tend to disagree”, 4 = “tend to agree”, 5 = “agree”, 6 = “strongly agree”, 7 = “not applicable”). To ensure internal reliability, the survey included multiple questions for each construct. Cronbach’s alpha values were used to assess internal reliability (Cronbach, 1951).

Five of the nine constructs identified as potentially having an impact on change project success resulted in a Cronbach’s alpha value above 0.700. One construct resulted in a value between 0.600 and 0.700, and three constructs resulted in Cronbach’s alpha values below 0.600. The literature suggests that constructs with Cronbach’s alpha values below 0.600 should be removed from the study (e.g. DeVellis, 1991). As such, only six of the nine constructs identified as potentially impacting change project success were studied. The entirety of the survey is presented in Appendix A.

Parametric and non-parametric statistics were calculated for the survey results. All data sets were determined to be non-normal based on results from the Shapiro-Wilk test (Shapiro & Wilk, 1965). Therefore, a non-parametric test (Mann-Whitney U) was used to identify statistically significant differences between groups of interest (e.g. staff and management-level employees).

Variations between groups of interests were also identified for responses to the survey participants’ definitions of success in a change project. Thematic analysis was first utilized to identify common themes among responses. Following this, the frequency of each theme mentioned by the groups of interest (e.g. staff and management-level employees) was determined. This frequency was used to compare the potential level of

concern and interest a specific group has with a certain theme. Further details of this analysis can be found in Section 3.3.4.

The interviews conducted for this research (see Chapter 5 for results) were used to determine the level of conceptual change achieved during the relocation of Group Y. Three interviews were conducted through email and one was completed over a phone call. A transcript of the phone call interview was produced by the interviewer the day of the interview. Interview participants were initially asked to describe the relocation project. If the interviewee did not mention specific aspects of the Conceptual Change Model, the interviewer asked specific follow-up questions to identify the achieved level of conceptual change. Transcripts for all four interviews can be found in Appendix B.

Thematic analysis was used to identify similarities and differences in responses from the four participants. To begin the analysis, the researcher reviewed each transcript and recorded any themes or important pieces of information in an Excel spreadsheet. As a second step, the researcher reviewed the transcripts to classify responses into stages from the Conceptual Change Model. Next, comparisons were made between responses from each of the four candidates. Key differences and similarities were recorded. Finally, conclusions were drawn based on the variations in responses. Further details of the thematic analysis can be found in Section 3.3.4.

## **1.6. Key Findings and Conclusion**

Conceptual change is a promising method to foster long-term success of organizational change projects. Before developing a method to improve change project success, the researcher sought to better understand the effect of job role on an individual's perception

of project success. Previous research has defined success through both organizational metrics like product quality, productivity, and cycle time, as well as employee impacts like achieving new behavioral patterns, user satisfaction, and acceptance by employees (Fernandez & Rainey, 2006; Jones, Jimmieson, & Griffiths, 2005; Pettigrew, Woodman, & Cameron, 2001; Self & Schraeder, 2009; Stelzer & Mellis, 1999); however, there is a need for better understanding of employee-defined descriptions of change project success and the factors that drive employee perceptions.

The results of the first manuscript (Chapter 4) suggest that there remain some key variations between how staff, management, and company-level employees view organizational change projects. Staff often appear to be unaware of organizational-level project impacts. As a result, staff more often view change projects as unsuccessful when compared to management and company-level employees. Furthermore, employees place more emphasis on personal satisfaction than on standardized metrics like *financial health* or *goal satisfaction*. Although key performance metrics are important tools for management and company-level employees to track progress, employee satisfaction is also a key aspect of an organization's financial success (Chi & Gursoy, 2009; Koys, 2001).

The Rasmussen Socio-technical Framework is a model of hierarchical levels of individuals, including government, regulators, company, management, and staff (Rasmussen, 1997). Descriptions of these five levels are presented in Table 1. The framework is used as a basis for employee classification. In addition to variations between individuals at different levels of the Rasmussen Socio-technical Framework, discrepancies between industry practitioner and academic professional responses were identified. Individuals from academia appear to view change projects as more successful on average

and may better understand how abstract variables like *team attitude* impact projects. This is likely due to a greater awareness of research that discusses similar factors of project success (e.g. Farris et al., 2008). There remains an opportunity for researchers to bridge the gap between academia and industry by studying how to improve change project success based on the definitions of success identified in this research (see Section 4.4.2).

The Rasmussen classification is also useful in the drive toward micro-level change strategies. Individual conceptual change has been proposed as an approach to support organizational change project success (e.g. Mazur, McCreery, & Rothenberg, 2012). To build upon recent work in this area, a conceptual change model is developed in the second manuscript (Chapter 5), followed by a case study analyzed through the lens of the model. The researchers found that conceptual change was limited in the case study of Group Y. Neither staff nor management was satisfied with the move and many employees left the technology company as a result. However, it is of interest that the project could be considered successful based purely on standard metrics. On-time-delivery was maintained throughout the relocation and quality reached satisfactory levels shortly after. This pinpoints a key aspect of organizational change projects – that is, both the human and process aspects of a project must be satisfied. If process metrics are the only successful result of a project, employees may suffer, resulting in further long-term challenges.

There appears to have been a lack of common understanding between staff and management-level employees during the relocation of Group Y. In any change project, it is important that management is as transparent with information as possible. In the case of Group Y, management seems to have believed this was achieved, although staff has a different view. This pinpoints a need for further research to understand how management

can best gauge employees' understanding of a project and ensure information is being shared appropriately.

### **1.7. Thesis Organization**

This thesis is organized in the manuscript format. This means that the focus is on two research manuscripts – Manuscript 1 and Manuscript 2. Chapter 1 is an outline of this thesis, including identification of a need for this research, description of the case study industry partner, discussion of the research approach, and summary of the conclusions. Chapter 2 is a review of the change management and conceptual change literature, with specific discussions about these topics in engineering and lean manufacturing. Chapter 3 contains the methodology for the survey and interviews, including survey and interview question development, participant identification, and data analysis methods. Chapter 4 contains the first manuscript – An Investigation of the Effect of Job Role on Perception of Value and Success in Organizational Transformation. Chapter 5 contains the second manuscript – Using the Lens of Conceptual Change to Assess Success of a Change Management Project. Both manuscripts have been submitted for publication in research journals. Chapter 6 contains a summary of the research findings, discussion of implications, and opportunities for future work.

## **2. LITERATURE REVIEW**

The focus of this chapter is on a detailed review of previous research findings from the last 40 years of literature on change management, conceptual change, and lean manufacturing. Lean manufacturing is selected as a focus area because much of the emerging research on conceptual change is focused on lean transformation projects. The focus of Section 2.1 is on change management. Discussion of change management includes an overview of primary theories and identification of the publication frequency of change management articles over the past 40 years. This section also includes a summary of the most commonly studied industries in the change management literature. The focus of Section 2.2 is on two theories of conceptual change: the Theory of Accommodation and the REACT Learning Strategy. These theories, among others, were utilized to develop the Conceptual Change Model by Mirdad, Hille, and Melamed (2015), which is presented in Section 5.3. Finally, a short introduction to lean manufacturing is provided, as it is a key area of future research for applying the Conceptual Change Model.

### **2.1. Change Management**

Moran and Brightman (2001) define change management as “the process of continually renewing an organization’s direction, structure, and capabilities to serve the ever-changing needs of external and internal customers”. Change can be characterized by its rate of occurrence, how it comes about, and its scale (Todnem, 2005). The rate of occurrence can be further divided into three categories: (1) incremental change, a situation in which small, incremental changes are achieved; (2) punctuated equilibrium, a situation in which rapid change occurs at non-standard intervals; and (3) continuous transformation, a situation in

which change is a continuous, nonlinear function through time (Burnes, 2009). Continuous transformation is the most recent change theory and is supported by many authors in recent literature (e.g. Burnes, 1996; Rieley & Clarkson, 2001; Todnem, 2005). Continuous transformation is argued to be a more effective approach to change since it ensures organizations are constantly looking for and are aware of advances in their fields and competitive requirements. The continuous transformation mindset is unlike incremental or punctuated equilibrium in which complacency to change can quickly arise and which requires major reforms to change management systems (Todnem, 2005).

Modern change management literature developed out of the seminal work of Lewin (1947), which is based in the social sciences and psychology literature. Lewin (1947) argues that effective change processes require “unfreezing” of a priori knowledge; that is, individuals must first be forced to question initial beliefs (i.e. generate dissatisfaction). This can then be followed by the actual change, and concluded with “refreezing” to ensure the change is maintained. Much of the change management literature following this seminal publication has ties to this “unfreeze, change, refreeze” model, including work in healthcare (e.g. Mazur, McCreery, & Rothenberg, 2012; Mazur et al., 2011), education (e.g. Duit & Treagust, 2003), and government (e.g. Jones, Jimmieson, & Griffiths, 2005). Strong theoretical models developed in the area of conceptual change also have ties to the work by Lewin (1947), including the single-loop to double-loop learning model (see Argyris, 1976), the Theory of Accommodation (see Posner, Strike, Hewson, & Gertzog, 1982), and the conceptual conflict model (see Nussbaum & Novick, 1982).

A state-of-the-art matrix analysis was created to guide the review of the change management literature. The state-of-the-art matrix methodology uses categorical matrices

to draw meaningful information about trends, focus areas, and research gaps from a review of large quantities of articles (Beruvides & Omachonu, 2001). For this thesis, the researcher used Academic Search Premier and Google Scholar to search for the term “change management”. This search identified 159 articles focused on this topic. For most articles, the title was enough to determine relevance. However, if the title was not sufficiently specific, the abstract was reviewed to clarify the focus of the article.

Figure 1 is a chronological summary of the publications identified in the aforementioned search. The long-term trend of the change management literature has been increasing from a low of one article published between 1975 and 1978, to a high of 32 articles published between 1999 and 2002. Following the 1999 to 2002 range, there is approximately a 30 percent decrease in publications in the 2003 to 2006 range. The three most recent ranges (2003-2006, 2007-2010, and 2011-2015) have reached a relatively constant publication rate of around seven articles per year.

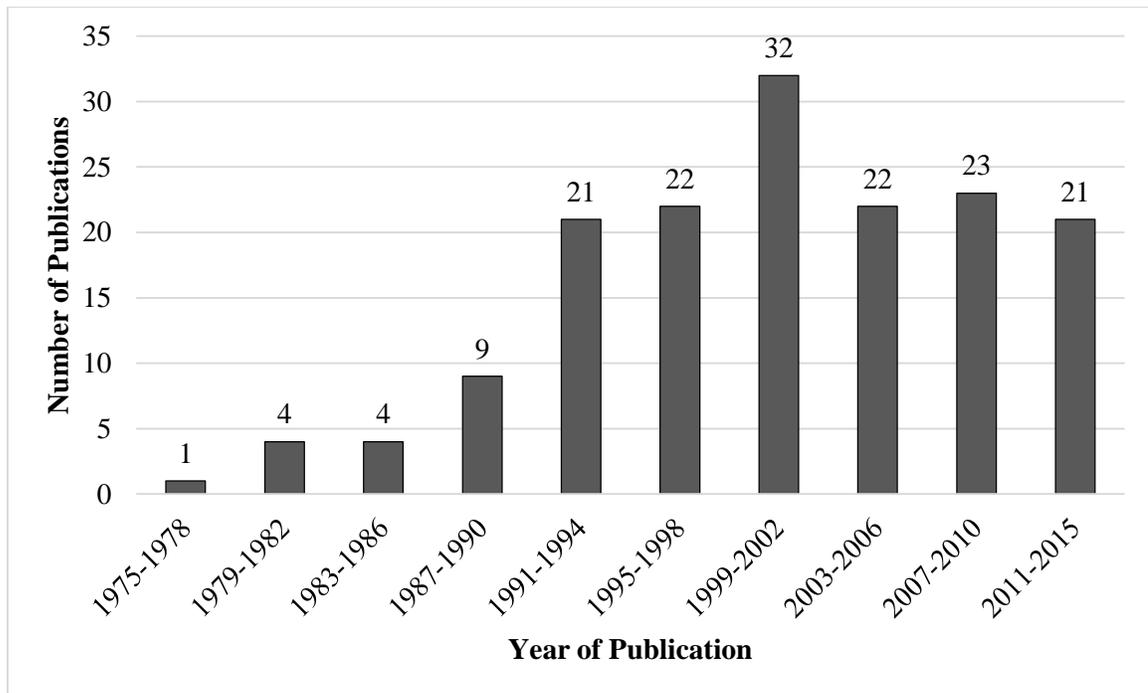


Figure 1. Annual change management publication counts between 1975 and 2015 (n = 159).

Figure 2 was developed based on the results of the state-of-the-art matrix to identify the industries of focus in the articles reviewed. Industry descriptions are included in Table 3. Descriptions are taken from the North American Industry Classification System (NAICS) codes. Industries with only one publication were included in the “other” category.

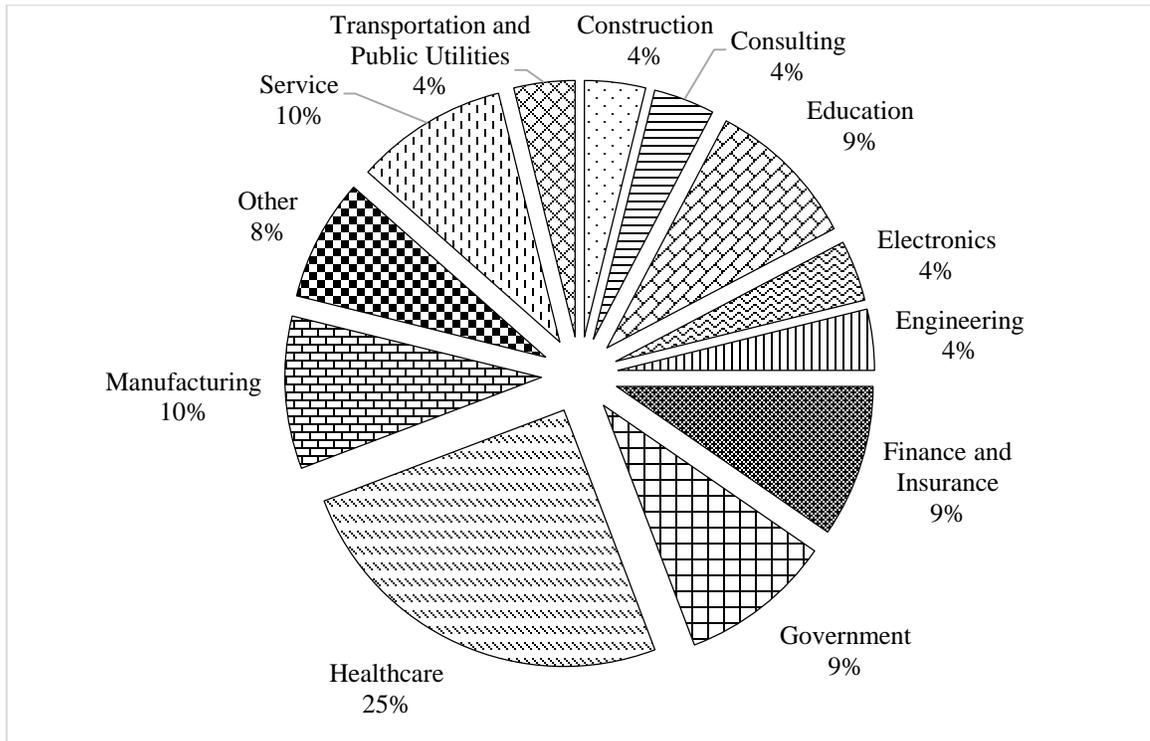


Figure 2. Change management articles by industry (n = 44).

Table 3. Descriptions used in industry classification. Source: (NAICS Association, 2016).

<b>Industry</b>	<b>Description</b>
Construction	Establishments primarily engaged in the construction of buildings and other structures (e.g. highways and utility systems).
Consulting	Establishments in which the primary function is to provide professional advice.
Education	Establishments in which the primary function is to provide instruction and training.
Electronics	Establishments involved with the design or manufacture of electronic devices.
Engineering	Establishments in which the primary function is to design, build, or conduct research on machines, devices, systems, or materials. Not specific to any industry.
Finance and insurance	Establishments in which the primary function is to conduct or facilitate financial transactions.
Government	Federal, state, and local government agencies that administer, oversee, and manage public programs and have executive, legislative, or judicial authority over other institutions within a given area.
Healthcare	Establishments in which the primary function is to provide medical care/services to individuals.
Manufacturing	Establishments in which the primary function is to mechanically, physically, or chemically transform materials, substances, or components into new products.
Service	Establishments in which the primary function is to provide services. Examples include restaurants, hotels, telecommunications organizations, sales, etc.
Transportation and public utilities	Establishments in which the primary function is to provide utility and transportation services.

Healthcare is the most commonly studied industry within the change management literature. Nearly 70% of the healthcare-focused articles were published after 2007, suggesting that healthcare is a relatively recent area of study that has quickly become prevalent in the literature. Manufacturing is the second most commonly studied industry in the change management literature. Unlike healthcare, there is a wider spread in publication dates of articles that focus on the manufacturing industry, with dates ranging from 1979 to

2008. This is expected as manufacturing is a more traditionally studied industry in the industrial engineering literature.

In addition to the state-of-the-art matrix review of the broad change management literature, a focused review of change project success was conducted. Ten articles (published between 1999 and 2014) were identified which discuss results of successful organizational change initiatives. In these articles, successful initiatives are primarily classified into two groups – one focuses on impacts to the organization and one on impacts to employees. Impacts to the organization include metrics such as product quality, productivity, and cycle time (Pettigrew et al., 2001; Stelzer & Mellis, 1999). Impacts to employees include achieving new behavioral patterns, user satisfaction, and acceptance of employees (Fernandez & Rainey, 2006; Jones et al., 2005; Self & Schraeder, 2009). Although each of these articles outlines characteristics of success, none provides a clear definition of success. The literature largely focuses on developing methods to achieve change project success. Without a complete understanding of the end goal of a project (i.e. defining success), achieving success can be difficult (Chidester & Grigsby, 1984).

## **2.2. Conceptual Change**

Efforts to instill conceptual change have roots dating back to the early 1900s when work generally focused on education (Posner et al., 1982). These conceptualization techniques have the ultimate goal of modifying deep-rooted conceptions among students, to properly align with scientific theory (Duit & Treagust, 2003). This is in response to the realization that students entering a classroom are not “blank slates”, but instead hold a belief about how the world works that is based on their previous exposure to phenomena (Duit &

Treagust, 2003). It is important to recall the “unfreeze, change, refreeze” approach here, as a “blank slate” is modified during the “unfreeze” stage. Two conceptual change models, the Theory of Accommodation and the REACT Learning Strategy, are discussed in the following sections.

### 2.2.1. Theory of Accommodation

The earliest conceptual change model found in the literature review for this research, the Theory of Accommodation, was developed by Posner, Strike, Hewson, and Gertzog in 1982. The Theory of Accommodation has since been updated in more recent works (e.g. Strike & Posner, 1992). The model postulates that the following conditions must be achieved to promote conceptual change (Posner et al., 1982).

1. *Dissatisfaction with the current concept.* The learner must identify that the current concept is dysfunctional and is at odds with more relevant scientific findings.
2. *The new concept must be intelligible.* The learner must be able to understand the underlying theory of the new concept.
3. *The new concept must be initially plausible.* The new concept cannot be accepted until it appears that it can reasonably describe the real-world event or characteristic being modeled.
4. *The new concept should be fruitful.* The learner must recognize that the application of the new concept will be useful and beneficial to their view of the world.

The great benefit of the Theory of Accommodation is its simplicity and the thorough development of applicable scenarios (Strike & Posner, 1992). As such, it has been

widely applied and referenced in the literature, with much of the work focused on K-12 education conceptualizations of defining engineering (e.g. Montfort, Brown, & Whritenour, 2013), chemical solutions (e.g. Ültay, Durukan, & Ültay, 2015), characterizing motion (e.g. Carrejo & Reinhartz, 2014), and physical science concepts (e.g. Hennessey, 1993), among others. The following section is focused on the REACT Learning Strategy, which builds upon the Theory of Accommodation.

### 2.2.2. REACT Learning Strategy

While the Theory of Accommodation is the most prevalent theory in the conceptual change literature, it is primarily theoretical and does not provide guidelines for implementation and application. The REACT learning strategy, developed by Crawford (2001), operationalizes the Theory of Accommodation through five steps.

Step 1. *Relate*: connect the new concept with the learner's preconceptions

Step 2. *Experience*: show the learner how the new concept is applied in the real world

Step 3. *Apply*: use the new concepts in a simulated or real environment

Step 4. *Cooperate*: discuss the new concept with other learners

Step 5. *Transfer*: apply the new concept to an environment that has not been explicitly taught in class

These five steps were applied in the work by Ültay, Durukan, and Ültay (2015) to achieve conceptual change in university-level students' views of chemical mixtures and solutions. Through a pretest and posttest consisting of fill-in-the-blank and open-ended questions, the researchers found many students effectively adopted the scientifically

correct belief of chemical mixtures and solutions. Students scored an average of 36% higher on the posttest results. Although the results suggest an improvement, Ültay et al. (2015) note that a single week of teaching was not enough to completely alter students' preconceptions. Further teaching would be needed to achieve a permanent shift in mindset. On a positive note, the REACT learning strategy remains broadly applicable, as it neither focuses on a specific group of learners or type of concept. The strategy could be applied to other concepts in different environments, including outside academia.

The following section discusses change management and conceptual change theories applied in engineering research. Compared with the education environment, this research trend is relatively nascent and represents an opportunity for further research.

### **2.3. Change Management and Conceptual Change in Engineering**

Much of the change management and conceptual change literature originated from research in fields like psychology and education. However, there has been an increase in the application of these theories to engineering change problems in the past decade. This is likely due to the increasing expectation that change is inevitable (Winklhofer, 2002), and that a quick response to environmental change can help ensure an organization continues to be profitable and relevant to consumers (Harker, 1996; Holahan, Aronson, Jurkat, & Schoorman, 2004; Jiao, Alon, Koo, & Cui, 2013).

The author reviewed 29 articles focused on change management published in the *Engineering Management Journal*, *Journal of Engineering and Technology Management*, and *Journal of Management in Engineering* between 1991 and 2015. Identified articles referenced a range of industries including healthcare (e.g. Mazur, McCreery, &

Rothenberg, 2012; Schell & Kuntz, 2013), aerospace (e.g. Kotnour & Matkovitch, 1999), automotive (e.g. Ford, 2001), and construction (e.g. Dallavalle, 1991; Sanders, 2003).

Few of the reviewed articles directly reference any of the most prominent change management and conceptual change theories. Instead, the engineering change literature largely focuses on either developing suggestions for effectively implementing change in a specific scenario, or describing how change impacts an organization. Harker (1996) describes methods to effectively manage the organizational turnaround process by analyzing three firms undergoing this transition. Harker (1996) concludes that being aware of the industry, planning effectively, identifying a leader, ensuring all employees are continuously learning, and maintaining new learnings is integral to succeeding in an organizational turnaround process. Further work is needed to identify if the conclusions are universally applicable to other types of change projects.

Unfortunately, few articles focus on enhancing the key conceptual change theories developed in the psychology and education fields. One approach to applying early, psychology-based theory to industrial engineering has been completed in the healthcare industry. The following section introduces this approach to achieving micro-level change.

### 2.3.1. Single-Loop and Double-Loop Learning

Mazur, McCreery, & Chen (2012) and Mazur, McCreery, & Rothenberg (2012) discuss conceptual change through the lens of the single-loop to double-loop learning model developed by Argyris (1976). Single-loop learning behavior “consists of detection and correction of error, but without addressing the underlying values that drive action and govern behavior” (Mazur, McCreery, & Rothenberg, 2012). Alternatively, double-loop learning behavior focuses on root-cause elimination through reflection, discussion with

colleagues, and problem-solving. The goal of double-loop behavior is to eliminate issues identified in the workplace rather than ignoring them until they occur again.

Unfortunately, there is concern that double-loop behavior is rarely carried out. Through direct observations in a healthcare environment, Mazur, McCreery, & Chen (2012) found that healthcare professionals exhibited single-loop behavior 94 times and double-loop behavior 12 times. Single-loop behavior is often exhibited by healthcare professionals because it can be easier and faster. While this is true in the short-term, Mazur, McCreery, & Chen (2012) argue that double-loop behavior will be better for employees and the organization in the long run. As improvements are implemented as a result of double-loop behavior, issues will eventually be reduced, resulting in higher quality and better service.

To achieve double-loop behavior, conceptual change must occur. The transition from single-loop to double-loop behavior is a fundamental shift in how one views and responds to the environment, whether that is in the workplace or elsewhere. The following section provides an overview of a proposed model to achieve conceptual change through training initiatives.

### 2.3.2. Conceptual Change Model

Mirdad, Hille, and Melamed (2015) developed a model (Figure 3) to assist industry practitioners in achieving conceptual change in employees. The model is divided into two primary perspectives, “Application Strategy for Trainer” and “Trainee Condition”. Application Strategy consists of six steps that describe a training environment in which a manager could introduce a new topic and achieve understanding and acceptance of the new concept. The four stages under Trainee Condition were identified in the work by Posner et

al. (1982) and describe a conceptualization transition in trainees. Although the model is partially based on the work described in Section 2.2, which has historically been applied to educational environments, it is expected to be broadly applicable to other industries (see Mirdad et al., 2015). One objective of the proposed Conceptual Change Model is to foster successful change management projects by developing buy-in and interest from employees.

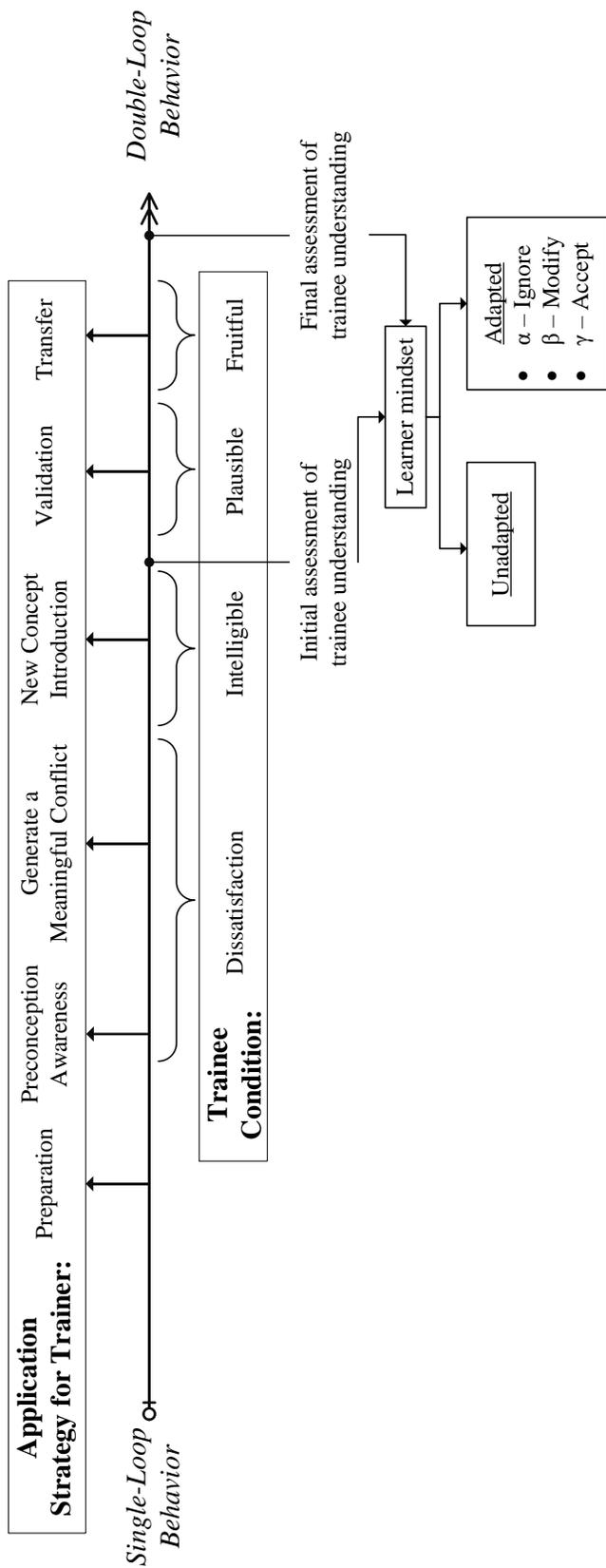


Figure 3. Conceptual change model. Source: (Mirdad et al., 2015).

The six stages captured in the Application Strategy were developed out of the work by Crawford (2001) and Nussbaum & Novick (1982). The goal of these stages is to achieve the conditions proposed by Posner et al. (1982) as described in Section 2.2.1. Following is a brief summary of the six stages, in addition to the two assessments occurring after the fourth and sixth stages.

*Stage 1. Preparation:* Before training can begin, a number of steps need to be carried out to complete the preparation stage. Preparation involves understanding key variables that contribute to conceptual change. Limón (2001) proposed variables related to the learner, the social context of the training, and the trainer that must be considered before carrying out a conceptual change training scenario (Table 4). The goal of this stage is to consider each of the variables to mitigate the chance that they hinder the success of conceptual change.

Table 4. Variables to be considered before training. Source: (Limón, 2001).

Variables related to the learner	Prior knowledge
	Motivation and interests
	Epistemological beliefs (about learning and teaching and about the subject-matter to be learned)
	Values and attitudes towards learning
	Learning strategies and cognitive engagement in the learning tasks
	Reasoning abilities
Variables related to the social context in which learning takes place	Roles of peers
	Teacher-learner relationships (individual)
	Teacher-learners relationship (group)
Variables related to the teacher	Domain-specific subject-matter knowledge
	Motivation and interests
	Epistemological beliefs about learning and teaching
	Values and attitude towards learning and teaching
	Teaching strategies
	Level of training to be a teacher

*Stage 2. Preconception Awareness:* The goal of this stage is to ensure trainees realize their current conceptions about the topic of interest. To achieve this, trainers should introduce a problem and ask trainees how they would go about solving it. Through classroom discussion, trainees should become aware of their current conceptions.

*Stage 3. Generate a Meaningful Conflict:* To achieve meaningful conflict, trainers must make trainees realize that their current conception does not solve the root cause of the problem introduced in stage two. The goal is not to state this outright, but rather let trainees realize this on their own. The trainer can discuss weaknesses of the trainees' preconceptions and identify why the preconception does not solve the root cause of the identified problem.

*Stage 4. New Concept Introduction:* At this stage, the trainer introduces the new concept. The goal is not to discuss how the new concept solves the problem introduced in stage two, but rather to provide information about the new concept. This stage is not complete until trainees have a strong understanding of the new concept. To gauge the level of understanding, an initial assessment is completed (discussed following stage 6).

*Stage 5. Validation:* The goal of this stage is for the trainer to ensure trainees realize that the new concept solves the problem identified in stage two. This may be accomplished through discussion, presentation of case studies, or simulation.

*Stage 6. Transfer:* In the final stage, trainees begin to understand how the new concept could be applied in their day-to-day lives. This moves away from solving just the problems discussed in the training course. Trainees can be given a week to apply the new concept in their jobs and then asked to reconvene to discuss how the new concept is beneficial. Without realizing the actual benefit in the real world, long-term conceptual change will be limited.

*Assessment:* Two assessments are completed – one after stage four and one after stage 6 – to characterize the level of conceptual change achieved in the training session. The level of success is based on the model proposed by Piaget (1975), which suggests that trainees reflect either adapted or unadapted responses. An unadapted response represents a trainee who does not recognize the conflict between their preconception and the newly proposed concept. Adapted responses, classified in three categories – alpha, beta, and gamma, describe varying levels of acceptance of the proposed concept. Alpha represents a trainee who understands the new concept but does not accept it.

Beta represents a trainee who understands the new concept but adopts a partially modified version of the concept – possibly a fusion with the preconception. Gamma represents a trainee who undergoes complete conceptual change. Assessment could be completed through a simple questionnaire focusing on key characteristics of the new concept and the trainees' views of that concept.

#### **2.4. Lean Manufacturing**

Lean manufacturing was first developed in Japan at Toyota following the conclusion of World War II (Womack & Jones, 1996). The concepts largely didn't spread to the rest of the world until the publication of *The Machine That Changed the World* by Womack, Jones, & Roos (1990). This was followed by the book *Lean Thinking* (Womack & Jones, 1996) which further outlines the concepts of lean into five principles.

- *Identify value:* determine what the customer wants and is willing to support financially.
- *Map the value stream:* visually represent the system or process to identify operations that create value (value add) and operations that use resources but do not create value (non-value add).
- *Create flow:* ensure smooth operations and product transition through the production system.
- *Establish pull:* modify operations so that downstream production operations are triggered by upstream operations to minimize overproduction.
- *Seek perfection:* recognize that implementing lean is never complete. There is always an opportunity for improvement. Create a culture that strives for perfection.

The ultimate goal of any lean application is to improve quality, reduce costs of operations, and reduce time to market (Oppenheim, 2004). This is achieved through a focus on minimizing the prevalence of the seven types of wastes and following the five principles.

Lean researchers continue to identify culture as one of the key characteristics of a successful lean program (Badurdeen & Gregory, 2012; Glover, Farris, Van Aken, & Doolen, 2011; Recht & Wilderom, 1998). Particularly, a culture of continuous improvement, in which employees always seek new opportunities to reduce waste (Glover et al., 2011), is required to sustain lean. It is often difficult to achieve this culture of continuous improvement in an organization. The level of difficulty is exhibited by the low success rates of lean implementation attempts (Baker, 2002). Many authors have identified cultural change as being a key success factor, yet there remain few guidelines for achieving true cultural transformation. One technique suggested by Zarbo (2012) requires management to implement system-level processes (e.g. incentive programs) to achieve this cultural change. In an article published by Glover et al. (2011), management support remains an important characteristic of sustained Kaizen event programs. However, management support is only one of many other identified factors, including goal clarity, goal difficulty, and learning and stewardship.

Lean culture change is similar to a number of other types of change projects. A brief review of the literature reveals similarities in success factors for both lean culture change and traditional change management projects (e.g. management changes, organization relocation, etc.), with both effective leadership (Gill, 2002; Glover et al., 2011; Schell & Kuntz, 2013) and new learnings (Glover et al., 2011; Kotnour &

Matkovitch, 1999) appearing in the two literature bases. These two approaches seek to achieve micro-level change – conceptual change in employees. To the author’s knowledge, the approach taken by Mazur, McCreery & Chen (2012) and Mazur, McCreery, & Rothenberg (2012) (described in Section 2.3) is the only suggested method in the lean literature for achieving culture change through conceptualization learnings. To further support sustained lean implementation, a greater understanding of conceptual change and methods for achieving it are needed.

Chapter 1 was an overview of the motivation behind this research and a discussion of the case study industry partner. Chapter 2 was a review of the literature. Topics reviewed include change management, conceptual change, and lean manufacturing. The following chapter (Chapter 3) outlines the research methodology utilized for Manuscript 1 (Chapter 4) and Manuscript 2 (Chapter 5).

### **3. RESEARCH METHODOLOGY**

The methodology for this research was developed using a logic model to define research questions, theoretical constructs, research methods, expected outcomes, and significance and impact (Figure 4). Logic models are used for planning large projects and are an effective method to gain a broad understanding of a complex system (W.K. Kellogg Foundation, 2004). The objective of producing a logic model for this research was to define the key research questions and determine the theoretical constructs and data collection methods that could answer these questions.

The following sections discuss the methodology used for the research presented in Chapter 4 and Chapter 5. Section 3.1.1 describes the development of the survey used in Chapter 4. Section 3.1.2 describes the development of the interview questions used in Chapter 5. Section 3.1.3 discusses the Institutional Review Board approval of this research. Section 3.2 includes a timeline of data collection for both the survey and interview responses. Finally, Section 3.3 provides an overview of the data analysis techniques used for both the survey and interview results.

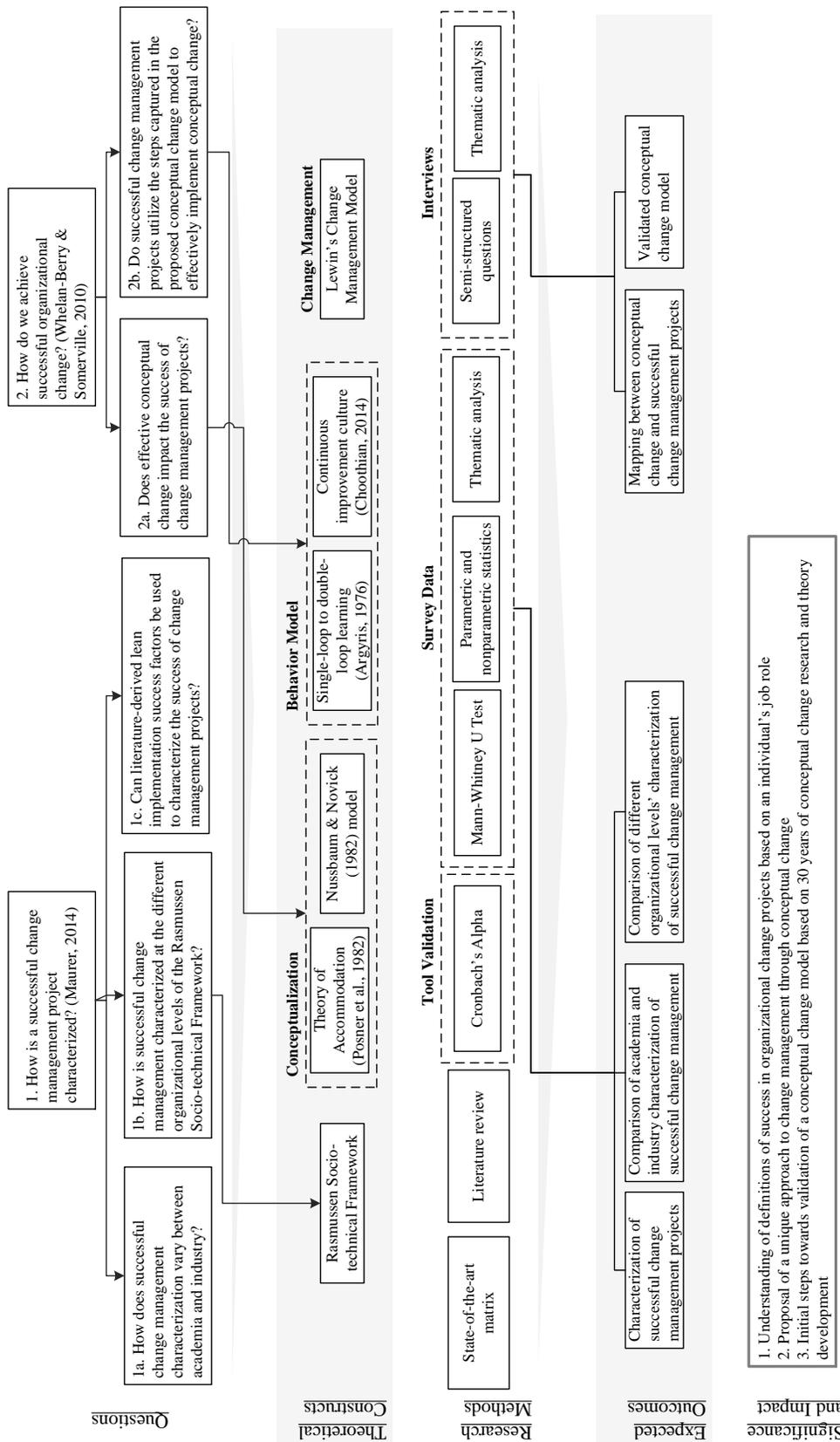


Figure 4. Research logic model.

### **3.1. Instrument Design**

The following sections include an overview of the design of research instruments used in Manuscript 1 (Chapter 4) and Manuscript 2 (Chapter 5). Discussion of the theoretical basis, survey development, and acceptance of studies by the Oregon State University Institutional Review Board is included.

#### **3.1.1. Survey Design**

One internet survey was created using the Qualtrics online survey tool. The focus of the survey was on defining success in organizational change projects. The survey included 23 multiple choice questions and one text entry. The multiple choice questions were based on a 7-point Likert scale (1 = “strongly disagree”, 2 = “disagree”, 3 = “tend to disagree”, 4 = “tend to agree”, 5 = “agree”, 6 = “strongly agree”, 7 = “not applicable”). A “not applicable” option was included instead of a neutral value because some authors suggest a neutral value can be over-selected when included (Weems & Onwuegbuzie, 2001). The 23 multiple choice questions were used to identify the impact of nine success factors on organizational change projects, as well as one factor measuring perceived project success. The success factors are based on a study by Farris (2006) and Farris et al. (2008). The study constructs and their definitions are presented in Table 5.

Table 5. Survey construct definitions.

<b>Construct</b>	<b>Definition</b>
Goal Clarity	“Team member perceptions of the extent to which the [change project’s] improvement goals have been clearly defined” (Farris, 2006).
Goal Difficulty	“Team member perceptions of the difficulty of the improvement goals set” for the team (Farris, 2006).
Appropriateness	The suitability of the methodology applied to solve the defined problem (Farris, 2006).
Impact on Organization	The significance of the change project outcomes to the overall organization.
Project Team Autonomy	“The amount of control over event activities that is given to [project] members” (Farris, 2006).
Management Support	“The support that senior leadership provided to the team, including materials and supplies, equipment, and assistance from organizational members” (Farris, 2006).
Action Orientation	“The relative percentage of team activities spent in hands on improvement activities...versus brainstorming and discussing solutions” (Farris, 2006).
Internal Processes	“Team member ratings of the internal harmony and coordination of their team” (Farris, 2006).
Attitude	Project team member perceptions of the potential value of the project to the organization, employees, and themselves.
Perceived Success	The perceived extent to which the change project achieved expected purposes.

The researcher designed two versions of the survey. Version 1 was distributed to employees of Group Y in the industry partner technology company. The focus of Version 1 was on the relocation of Group Y. Version 2 was sent to industry practitioners outside the technology company and to researchers who study change management. The focus of Version 2 was on an unspecified organizational change project in which the survey participant had been engaged in the past two years. The questions in Version 1 were identical to those in Version 2; however, Version 1 specifically referred to the relocation project. Participants in Version 2 responded based on an organizational change project of

their choosing. Version 2 of the survey can be found in Appendix A. Version 1 of the survey is not included in the appendices to maintain the anonymity of the industry partner.

The goal of the survey was to identify how value is defined in successful organizational change projects and to determine how success factors identified in the existing literature impact the success of the projects being considered here. Survey participants self-identified in one of the six levels of the Rasmussen Socio-technical Framework. Participants also classified their organizations as academic or non-academic. Finally, participants were asked to identify the North American Industry Classification System (NAICS) code that best describes their organization.

The 23 multiple choice questions were developed to characterize ten aspects of organizational change projects. Questions were based on constructs identified by Farris (2006) and Farris, Van Aken, Doolen, and Worley (2008) in studies of Kaizen events. As Kaizen events are a type of change project, the constructs could be used in the present study. Survey questions were modified for the context of an organizational change project. The original survey questions, modified survey questions, and corresponding constructs are presented in Table 6.

Table 6. Survey questions modified based on Farris (2006) and Farris et al. (2008).

<b>Construct</b>	<b>Survey Question from Farris (2006) and Farris et al. (2008)</b>	<b>Modified Survey Question for Current Research</b>
Goal Clarity	Our team has clearly defined goals.	The project team had clearly defined goals.
	The performance targets our team must achieve to fulfill our goals are clear.	The performance targets the project team had to achieve to fulfill the project goals were clear.
Goal Difficulty	Our team's improvement goals are difficult.	The project team's goals were difficult to achieve.
	It will be hard to improve this work area enough to achieve the team's goals.	It took a lot of effort to achieve the project team's goals.
Appropriateness	How appropriate was this tool for the team's objectives?	The project was right and proper for the organization. The right methods were applied in achieving the change.
Impact on Organization	This Kaizen event had a positive effect on this work area.	The project had a positive effect on the organization.
	This work area improved measurably as a result of this Kaizen event.	The area of the organization that was changed improved measurably as a result of the project.
	This Kaizen event has improved the performance of this work area.	The project improved the performance of the organization.
Project Team Autonomy	Our team had a lot of freedom in determining what changes to make to this work area.	The project team had a lot of freedom to determine how to approach the project.
	Our team was free to make changes to the work area as soon as we thought of them.	The project team had control over the scope of the project.
Management Support	Our team had enough materials and supplies to get our work done.	The project team had enough contact with management to complete the project.
	Our team had enough help from others in our organization to get our work done.	The project team had enough help from others in the organization to complete the project.

Table 6 (Continued). Survey questions modified based on Farris (2006) and Farris et al. (2008).

Construct	Survey Question from Farris (2006) and Farris et al. (2008)	Modified Survey Question for Current Research
Action Orientation	Our team spent as much time as possible in the work area.	The project team spent a lot of time discussing ideas before implementing them.
	Our team spent very little time in our meeting room.	The project team was primarily focused on implementing the project and did not spend too much time on analysis.
		The project team was primarily focused on analysis and did not spend too much time on implementation. (REVERSE CODED)
Internal Processes	Our team communicated openly.	The project team communicated openly.
	Our team valued each member's unique contributions.	The project team valued each member's unique contributions.
	Our team valued the diversity in our team members	The project team valued the diversity of the team members.
Perceived Success	Overall, this Kaizen event was a success.	Overall, this change project was a success.
Attitude	In general, members of the team believe in the value of this Kaizen event.	In general, members of the project team believe in the value of the change project.
	Most of our team members think that this Kaizen event is a good strategy for this work area.	Most of the project team members think the change project was a good strategy for the department implementing the change.
		Most of the project team members think the change project was a good strategy for the organization.

### 3.1.2. Interview Design

A semi-structured interview was developed to determine the level of conceptual change achieved by Group Y employees during the organization relocation. General questions were initially asked to allow Group Y employees describe their understanding of the move. If the response did not include discussion of aspects of the Conceptual Change Model, specific follow-up questions were asked to identify if the stages of the Conceptual Change Model were achieved. All questions developed for the interviews and the corresponding Conceptual Change Model stages are presented in Table 7. Organization-identifying words are removed to ensure anonymity of the industry partner. Questions were not necessarily asked in order or verbatim due to the variable nature of interviews. Full transcripts of interviews are included in Appendix B.

Table 7. Interview questions developed for organization relocation case study.

<b>Conceptual Change Model Stage</b>	<b>Interview questions</b>
N/A (general questions)	Could you tell me about the move from [original location] to [new location] (reasons, timeline, affected parties, etc.)?
	What were your thoughts/feelings about the move from [original location] to [new location]?
	What were most people's thoughts/feelings about the move from [original location] to [new location]?
Preconception Awareness	What would you say were the [Group Y]-specific reasons for being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)
	Were most people aware of the [Group Y]-specific reasons for being located in [original location]? (Explain the reason for your answer.)
	What would you say were the [technology company]-specific reasons for [Group Y] being located in [original location]? (Explain your response – e.g. I was aware of reason A because...)
Generate Meaningful Conflict	Could you talk a bit about any positive or negative issues ([Group Y] or [technology company]-specific) related to being located in [original location]?
	If you were located in [original location], would you say you were happy in [original location]? Why?
New Concept Introduction	Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?
	Who/what entity initiated the move? (Explain your response – e.g. I was aware of this because...)
Validation	Did most people feel that the move would help eliminate some issues with [Group Y]? Why? (Please explain your response.)
	Did most people feel that the move would help eliminate some issues with [technology company] as a whole? Why?
Transfer	Would you say most people felt they were involved in the implementation of the move? (Explain your response using examples where possible.)
	Do you feel you were involved in the planning of the move?
	Were you able to see the impact that the move had on your colleagues? How did it impact them?
	Were you able to see the impact the move had on [Group Y] business processes? How did it impact them?

### 3.1.3. Instrument Approval

The survey and interview research instruments were submitted to Oregon State University's Institutional Review Board (IRB). The two research instruments were submitted as separate reviews. The IRB reviewed both sets of documents and determined the research to fulfill all federal, institutional, and ethical guidelines. The survey research (IRB number 6932) was accepted on June 30, 2015; the interview research (IRB number 7014) was accepted on October 16, 2015.

## **3.2. Data Collection**

Figure 5 provides a summary of the survey distribution and responses received. Initially, distribution was limited to technology organizations and groups, and change management researchers (Group 1, Group 2, and Group 3). However, following a low response rate from targeted groups, the survey was expanded to any person who had been involved with an organizational change project (Group 4). As organizational change projects can be fairly similar across organizations and industries (e.g. management changes, manufacturing location changes, new technology implementation, etc.), the results can still be used to define value in successful projects. Additionally, the categorization of survey participants allows the researchers to investigate the effects of background and job role on definitions of success in organizational change projects.

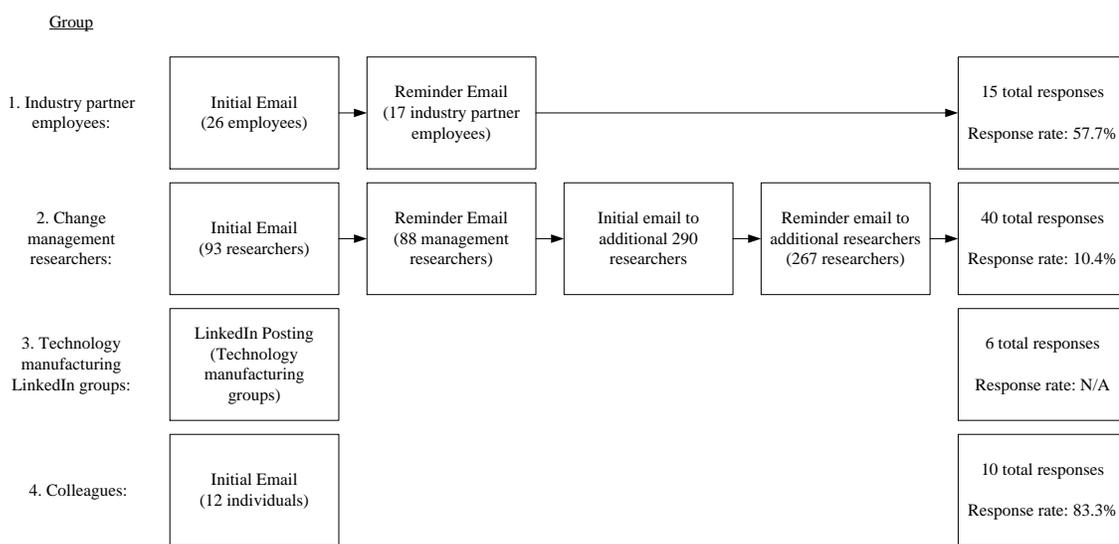


Figure 5. Survey response collection timeline.

Interview participants were identified with the assistance of a manager at the industry partner organization. The manager was asked to identify two individuals (one at the staff level and one at the management level) that were involved in the Group Y relocation. The researcher then identified an additional staff-level and management-level individual to participate in the interviews. The goal of this two-party approach of participant identification was to limit biases of the researcher or manager based on previous knowledge of the interview participants.

After agreeing to participate in the interview, interview participants were given the choice between a phone and email interview. Three participants elected to complete the interview through email and one elected to complete the interview over the phone. For the phone interview, a transcript was completed by the interviewer on the same day the interview was completed.

### **3.3. Research Analysis**

The following section is an overview of the statistical and qualitative analyses used in Chapter 4 and Chapter 5. The Cronbach's alpha metric, used to determine the internal consistency of a construct, is described in Section 3.3.1. The Shapiro-Wilk test, used to determine normality of data, is described in Section 3.3.2. The Mann-Whitney U test, used to identify statistically significant differences between two groups of data, is described in Section 3.3.3. Thematic analysis, used to analyze the value definition survey responses and the interview transcripts, is described in Section 3.3.4.

#### **3.3.1. Cronbach's Alpha**

Cronbach's alpha is a metric used to determine the internal consistency of a construct (Cronbach, 1951) and can be calculated using Equation 1 (Wiseman, 2011). The resultant value (between 0.00 and 1.00) is a quantitative representation of how well a set of survey questions measures the same construct or variable. A higher value generally corresponds to stronger internal consistency, although values above 0.900 can indicate other characteristics of the study. For example, including a large number of items per construct or including parallel items can result in a high Cronbach's alpha value (Panayides, 2013).

$$\alpha = \frac{K}{K-1} \left( 1 - \frac{\sum_{i=1}^K s_i^2}{s_T^2} \right) \quad (1)$$

Where:

$K$  = number of items

$s_i^2$  = variance of the  $i^{\text{th}}$  item

$s_T^2$  = variance of the total score formed by summing all the items

A value below 0.700 generally indicates poor internal consistency of a set of variables. It is common practice to delete one or more items to determine if the Cronbach's alpha value can be increased (e.g. Wiseman, 2011). If the value can be increased, the deleted items are removed from the rest of the analysis. A value between 0.600 and 0.700 can be used for newly developed and modified constructs, although data analyses of future data sets should test for the Cronbach's alpha value (DeVellis, 1991).

Six of the nine variables identified as potentially impacting change project success have a Cronbach's alpha value greater than 0.600. Three of the variables (*project team autonomy*, *goal difficulty*, and *action orientation*) have a Cronbach's alpha value below this threshold. The three variables with Cronbach's alpha values below 0.600 were removed from the study. Future work will modify the survey questions for future research endeavors to understand the impact of these three variables on change project success.

### 3.3.2. Shapiro-Wilk Test

The Shapiro-Wilk test is used to test a data set for normality (Shapiro & Wilk, 1965). Although originally developed for samples sizes less than 50, modern software algorithms allow for use of the test with data sets between three and 5000 data points (Razali & Wah,

2011). The Shapiro-Wilk test has been shown to be the most powerful test for all types of distributions and sample sizes when compared with other common normality tests, such as the Kolmogorov-Smirnov test, the Lilliefors test, and the Anderson-Darling test (Ghasemi & Zahediasl, 2012; Razali & Wah, 2011).

### 3.3.3. Mann-Whitney U Test

The Mann-Whitney U test, also known as the Wilcoxon rank sum test, tests for differences in mean ranks between two data sets (Mann & Whitney, 1947; McKnight & Najab, 2010).

The Mann-Whitney U test requires the fulfillment of three assumptions (Nachar, 2008).

1. Data must be measured at the continuous or ordinal level
2. The two data sets must be randomly drawn from a target population
3. Observations must be independent

One of the benefits of the Mann-Whitney U test is that it does not require an assumption of normality. If normality is achieved, a parametric test, like the independent samples t-test, should be used instead (McKnight & Najab, 2010). Another benefit of the Mann-Whitney U test is that it can be used for small samples sizes (greater than five) (Nachar, 2008).

### 3.3.4. Thematic Analysis

Thematic analysis was utilized to identify common themes in qualitative data collected for Chapter 4 (defining value in organizational change projects) and Chapter 5 (introducing the Conceptual Change Model). Although computer-aided qualitative analysis is becoming more prevalent in the literature (Cope, 2014), both data sets include relatively limited data

points, so manual analysis was completed. For value definitions collected through the survey used in Chapter 4 (defining value in organizational change projects), a list of common themes was developed based on a cursory review of the survey responses. Following this list development, two researchers assigned one or more themes to the survey responses. If a survey response appeared to be lacking an appropriate theme, a new theme was added to the list of potential options. The theme assignments were then reviewed to identify assignments which were at least 50% in agreement between the two reviewers. A third reviewer analyzed the responses if there was greater than a 50% difference in theme classification based on the first two reviews. Following this third iteration, a theme was assigned to a response if at least two of the three researchers assigned the theme

A similar thematic analysis approach was used to analyze the interview data presented in Chapter 5. One researcher reviewed the interview transcripts to identify any potential themes or key concepts. Following this, the interview transcripts were analyzed in specific consideration of the Conceptual Change Model proposed in Section 5.3. Quotes exemplifying the final five stages of the model were recorded. Finally, similarities and differences were identified across interview participant responses, with particular attention given to variations between individuals at different levels of the Rasmussen Socio-technical Framework.

An Investigation of the Effect of Job Role on Perception of Value and Success in  
Organizational Transformation

By  
Joshua D. Hille, Chinweike I. Eseonu

Submitted for publication in a peer-reviewed journal

## **4. FIRST MANUSCRIPT: AN INVESTIGATION OF THE EFFECT OF JOB ROLE ON PERCEPTION OF VALUE AND SUCCESS IN ORGANIZATIONAL TRANSFORMATION**

### **4.1. Introduction**

Between 60 and 90 percent of change projects result in failure (Beer & Nohria, 2000; Burnes & Jackson, 2011; Strebel, 1996). Yet, change remains necessary for organizations to remain competitive and thrive (Burnes, 2011). According to Hammer and Champy (1993), change is not just a necessity, but is the new normal for thriving, resilient businesses. Considering the central role of change in organization success and the high levels of failure, the objective of this article is to understand how successful change management projects are characterized by individuals at different levels of the Rasmussen Socio-Technical Framework, and by individuals from both academic and non-academic organizations. The Rasmussen Socio-Technical Framework (Table 8) is an outline of the broad levels that make up an organization (Rasmussen, 1997). This approach is helpful as it highlights potential conflicting objectives, motivators, and requirements for the planning and leading aspects of management.

Table 8. Rasmussen socio-technical framework level definitions.

<b>Rasmussen Socio-technical Level</b>	<b>Definition</b>
Government	Concerned with developing laws and regulations
Regulator	Concerned with defining industry standards which are based on laws and regulations
Company	Concerned with governing company policies and procedures based on industry standards (e.g. CEO level)
Management	Concerned with implementing company policies and procedures (excluding CEO level)
Staff	Concerned with performing work processes

There has been limited research to identify the relationship between the level at which an individual works within an organization and the individual's perceptions of a change project. Strebel (1996) recognizes that management and employees view change quite differently, but this commentary is largely qualitative and based on personal experience. Strebel (1996) suggests that top-level managers seek change as an opportunity to grow a business, while employees often fear change because it "is disruptive and intrusive" (Strebel, 1996). Other researchers, like Komodromos & Halkias (2015), use empirical analysis, with a mixture of quantitative and qualitative analysis, to identify staff-level perceptions of successful change projects. Komodromos & Halkias (2015) identified a difference between staff and management levels and suggest that organizational justice, or fairness, is a key factor in employee perception of success (Komodromos & Halkias, 2015). However, the focus is solely placed on staff satisfaction, instead of the broader array of organizational actors captured in the Rasmussen Socio-Technical Framework. Similar to Komodromos & Halkias (2015), Yu (2009) studied employee perception of organizational change, but did not investigate the effect of organizational levels. By solely

focusing on the staff level, Yu's (2009) study does not include vital information about managerial and other organizational actors. This exclusion produces an incomplete picture of all individual's view of a change.

The focus of this article is on improving our understanding of change management by investigating the effect of hierarchy-influenced differences in perceptions of change. The ability to tailor change management plans to employee personal currencies can empower managers to better motivate employees and improve the probability of success. Furthermore, since individuals from academia often support and provide insight for industry, it is particularly important to understand the differences between how these groups understand the concept of "value" (or ideal true-north goals) in change management projects.

The following section is an overview of the literature focused on success in change management projects. Next, the methodology for this research is discussed. Following, results and discussion are introduced. Finally, conclusions are reached to identify implications for engineering managers and engineering management researchers.

## **4.2. Background and Literature Review**

The change management literature is increasingly focused on the development of success factors to aid practitioners in change project implementation. Although there has been some work to summarize these success factors (e.g. Levasseur, 2010), there remains a need for research that thoroughly reviews the change management literature with a focus on determinants of success. Using the search terms listed in Table 9, the researchers reviewed article titles and abstracts in EBSCO Host and Google Scholar databases for relevance to

change management. Following the point at which articles were no longer relevant, 30 more articles were reviewed to limit exclusion of potentially seminal work. Twenty-five articles (published between 1985 and 2015) identified and discussed change management project success factors. The researchers reviewed the full text of these articles and noted any success factors mentioned by the authors of each reviewed article. Similar success factors were grouped to create the list of success factors in Table 10. For example, “senior management support” and “management support” were combined under “management support” in Table 10.

Table 9. Change management literature review search terms.

<b>Search Term</b>	<b>Database</b>	<b>Articles Reviewed</b>
Change management success	EBSCO Host	340
	Google Scholar	230
Change management success factors	EBSCO Host	80
	Google Scholar	120

Table 10 includes all success factors that were mentioned by four or more articles reviewed by the researcher. The listed definitions are included for clarity and do not necessarily represent the definition specified in each article. Additionally, measures of each success factor are included as practical tools that managers can use to assess the effectiveness of their organizations in change projects. Following is a brief discussion of each of the success factors listed in Table 10.

Table 10. Change management success factors (n = 25).

Success Factor	Qty.	Description	Proposed Measures
Management Support	11	Project is identified as a top priority by all levels of management (Nah, Lau, & Kuang, 2001; Stelzer & Mellis, 1999)	Resources allocated. Employee perception of management support.
Communication	7	"Communication efforts precede and accompany the improvement program" (Stelzer & Mellis, 1999)	Employee satisfaction with the level of communication.
Training	4	"Knowledge...is acquired and transferred throughout the organization" (Stelzer & Mellis, 1999)	Kirkpatrick's training evaluation framework (Kirkpatrick, 1975).
Culture	4	The "existing beliefs, norms, and patterns of behavior" (Zeira & Avedisian, 1989)	Survey to measure employees' openness to change (e.g. Wanberg & Banas, 2000).
Business Processes	4	"Processes...put into place need to be repeatable and sustainable" (Arbab Kash, Spaulding, Johnson, & Gamm, 2014)	Case-specific. Example measures include quality, product throughput, required labor hours, etc.
End-user Involvement	4	"Importance and personal relevance of a system to a user" (Bhatti, 2005)	Survey of customer's perception of involvement. Number of suggestions provided by end users.

Many researchers identify management support as one of the primary factors for change project success. This is unsurprising, as management is often the catalyst for a change initiative – providing resources, incentives, and managing logistics across groups within an organization (Wiersema & Bantel, 1992). Management, particularly upper management, is also needed to ensure the change project supports broader business objectives (Nah et al., 2001). Proposed measures for management support include the level of resources allocated and employee perception of management support. Resources include the number of individuals working on the project and monetary resources. Perception of

support is particularly important because employees rely on strong leadership to buy-in to organizational vision and direction. Furthermore, effective leadership has been shown to impact project success rates (Geoghegan & Dulewicz, 2008; Tuner & Müller, 2005). Effective managers not only assign tasks (management) but also define a purpose for that task (leadership) (Murray, 2009).

Twenty-eight percent of the articles reviewed for this study list communication as an important success factor. Without communication, lower-level managers and staff can feel left out and unaware of the change project. Effective communication ensures distribution of knowledge and an understanding of why changes are beneficial and needed (Stelzer & Mellis, 1999; Wiseman, Eseonu, & Doolen, 2014). Communication involves both sharing information about the change project with all stakeholders and soliciting their input (SanAgustin, 2014). By providing input in the project, staff often exhibit investment in the project (SanAgustin, 2014). When staff participates in the planning and execution of the project, they are more likely to want to see the project succeed (Lines, 2004). Employees' satisfaction with the level of communication is a proposed measure for sufficient communication. This is a better measure of communication than simpler measures such as number of emails or meetings because the perception of communication is the key variable, rather than actual communication completed. An adequate level of communication is based on the needs of the employees, not on an assumed appropriate level.

Training is another form of communication that often occurs in a more formal and structured setting. Many types of training exist in the literature, with behavior role modeling being one of the more effective (Hille & Eseonu, 2015b). This approach to

training involves “learning some points or principles, observing a model that utilizes the principles..., rehearsing the procedures by role playing, and receiving social reinforcement from the trainer and other members of the group” (I. Goldstein, 1980). One of the most commonly used training evaluation methodologies was developed by Kirkpatrick (1975). Kirkpatrick’s method involves four levels including Reaction, Learning, Behavior, and Results (Kirkpatrick, 1996).

Reaction focuses on understanding how participants feel after training events. The goal is to ensure participant interest in the information provided during training. Learning focuses on how much new or valuable information participants gained during training events. The goal is to use tests or interview questions to measure the amount of information participants internalized during training (Shenge, 2014). Behavior focuses on the extent to which on-the-job performance has changed among training participants. Behavior can be measured using questionnaires or job performance (Smidt, Balandin, Sigafos, & Reed, 2009; Wiseman et al., 2014). Finally, Results focuses on system response variables, which are largely improvements in sales and productivity, cost reduction, and lower employee turnover (Smidt et al., 2009).

Culture can be difficult to characterize because it is built on “basic underlying assumptions” which are not immediately observable (Schein, 1984). However, organizational culture has significant direct impacts on many aspects of organizational performance, including a commitment to corporate values, employee productivity, and profitability (Martin & Siehl, 1983). Thus, it is important to understand the culture of an organization when undergoing a change project. The research team proposes openness to change is a key characteristic of organizational culture that will directly impact change

project success, as the adaptability of a system is an important consideration during a change project (Combe, 2014; Glover et al., 2011). A survey based on the variables tested by Wanberg & Banas (2000) is suggested to quantify culture. Wanberg & Banas (2000) suggest *change acceptance* and *positive view of changes* as two factors in an employee's openness to change. Other additional factors that may impact openness to change include *previous change project experience*, *knowledge of the change*, or *involvement with change*. Further work could build upon the work by Wanberg & Banas (2000) to develop a more thorough measurement of openness to change.

Business processes are required to maintain operation of a business, including supply chain management, process definitions, and process characterizations, like throughput and wait time (Arbab Kash et al., 2014). Sumner (1999) states that successful change projects require business processes that support the new system being implemented. This adaption could help sustain proposed changes once specific initiatives, like training, are concluded (Stelzer & Mellis, 1999). As an example, the best software applications for Enterprise Resource Planning (ERP) system implementations can only meet about 70% of an organization's needs (Jarrar, Al-Mudimigh, & Zairi, 2000). Measuring the consistency and efficiency of business processes is case-specific. Although measures related to business process consistency and efficiency could be case-specific, underlying metrics related to quality, product throughput, and required labor hours can be adapted to many environments.

End-user involvement describes the level of customer involvement in the planning, design, and implementation phases. Effective customer involvement has been shown to be beneficial for many types of projects including product development (Dahlsten, 2004),

service development (Carbonell, Rodríguez-Escudero, & Pujari, 2009; Lundkvist & Yakhlef, 2004), and construction (Huovila & Seren, 1998), as well as general change projects (SanAgustin, 2014). End user involvement ensures project managers are aware of the needs of the end user and helps prepare end users for the implementation of a new system (SanAgustin, 2014). Measuring end-user involvement should be based on the end user's perception of their involvement since customer satisfaction is a key result of this success factor.

Seminal work by Lewin (1947) forms the basis for many of the ideas in the literature on change management. Lewin (1947) argues that effective change processes require “unfreezing” of a priori knowledge; that is, individuals must first be forced to question initial beliefs (i.e. generate dissatisfaction). This can then be followed by the introduction of a new concept and concluded with “refreezing”, to ensure the change is maintained. Much of the change management literature following this seminal publication has ties to this “unfreeze, change, refreeze” model, including work in healthcare (e.g. Mazur, McCreery, & Rothenberg, 2012; Mazur et al., 2011), education (e.g. Duit & Treagust, 2003), and government (Jones et al., 2005). Lewin (1947) also forms the basis for strong theoretical models developed in the area of conceptual change, including the single-loop to double-loop learning model (see Argyris, 1976), the Theory of Accommodation (see Posner et al., 1982), and the conceptual conflict model (see Nussbaum & Novick, 1982).

As shown by Lewin (1947), conceptual change is largely dependent on an individual's previous experiences and personal background. Individuals who are familiar with change may be more accepting of a large organizational change as compared with

individuals who have experienced very little change in their careers and who may have worked in the same position for many years. Limón (2001) builds upon this by identifying variables that contribute to conceptual change, including prior knowledge, motivation, reasoning abilities, and many more. This is a key aspect of conceptual change and is a necessary consideration before implementing organizational change.

Although a large body of existing research focuses on developing methodologies, best practices, and success factors for organizational change, none of the articles reviewed in this research address the potential effects of organizational experience, knowledge of organizational complexities, and other factors that might be influenced by the level at which an individual operates in a company. The Rasmussen Socio-Technical Framework provides an outline of organizational levels that can be used to investigate the effect of organizational level on perceptions of a change project. A thorough understanding of individual's viewpoints at different Rasmussen socio-technical levels is needed to support engineering managers in effective change implementation. *Trust* and *work area improvement* (i.e. receptiveness to change and success of change) have been shown to influence receptiveness to, and success of, change implementation in Kaizen events (Farris et al., 2008), adoptions of e-banking (Shah & Siddiqui, 2006), and acceptance of information technology systems (Lippert & Davis, 2006). As a result, there is a need to understand individual perceptions of "value" provided by change initiatives. Specifically, there is a need to understand differences associated with different organizational levels on the Rasmussen Socio-Technical Framework.

Success factor constructs developed for this research are based on the work by Farris (2006) and Farris, Van Aken, Doolen, and Worley (2008). Farris (2006) and Farris,

Van Aken, Doolen, and Worley (2008) studied Kaizen event effectiveness, which is a lean manufacturing methodology to quickly improve a work area. As Kaizen events are a type of change project, success factors are expected to be broadly applicable to other types of organizational change initiatives. The constructs developed by Farris (2006) are based on project success theory (Belassi & Tukel, 1996; Nicolini, 2002; Pinto & Slevin, 1987) and are related to those identified in the literature review. Table 11 includes a definition of the constructs used in this research as well as the related constructs identified in the literature review. The following section includes a summary of the research methodology for the research in this article.

Table 11. Summary of constructs for Survey 1.

<b>Construct</b>	<b>Definition</b>	<b>Related Literature Review Constructs</b>
Impact on Organization	“Team member perceptions of the impact of the event on the target” organization (Farris et al., 2008).	Stakeholder Support
Attitude	“Team perceptions of the degree to which members gained affect for” the project (Farris et al., 2008).	Readiness for Change
Internal Processes	“Team member ratings of the internal harmony and coordination of their team” (Farris et al., 2008).	Teamwork
Goal Clarity	“Team perceptions of the clarity of their improvement goals” (Farris et al., 2008).	Communication, Training, End-user Involvement
Management Support	“Team perceptions of the adequacy of resources dedicated to the” project (Farris et al., 2008).	Management Support, Resource Availability
Appropriateness	Team perceptions that the project was right and proper for the organization.	Business Plan and Vision, Culture and Values
Project Success	Team perceptions of the overall success of the project.	N/A

### **4.3. Methodology**

Survey analysis is common in studies of this nature (e.g. Farris et al., 2008; García, Rivera, & Iniesta, 2013; Glover et al., 2011). This research used a two-stage, web-based survey to collect data on perceptions of value by individuals at different levels of the Rasmussen Socio-Technical Framework. Survey 1 was created specifically for employees at a technology company that had recently undergone two change projects. The first project was a 145-mile manufacturing site relocation and the second was the implementation of an Enterprise Resource Planning (ERP) system. Survey 2 was sent to industry practitioners and academic professionals recruited through professional societies and personal networks. Participants in Survey 2 were not employees of the technology company. Participants were asked to think of a recent change project in which they were involved. The industry partner-specific survey varied from the general survey because participants were asked to complete the survey based on two specific change projects.

#### **4.3.1. Survey Design**

The surveys contained 23 quantitative questions focused on change project success factors. Surveys also included one qualitative question focused on the definition of “value” in a change project. Employees of the technology company were asked to answer questions for two change projects, so each participant from the technology company received a 46 item survey. The industry partner survey (Survey 1) included one demographic question based on the Rasmussen Socio-Technical Framework. The general survey (Survey 2) included three demographic questions.

The three demographic questions from Survey 2 were included to identify key variations in the definitions of success in change projects provided by different groups. Individuals were asked to identify their organization as primarily academic or non-academic. Participants were also asked to identify themselves as belonging to one of the five levels of the Rasmussen Socio-technical Framework (Rasmussen, 1997). Finally, participants were asked to identify the North American Industry Classification System (NAICS) code that best describes their organizations. Industry partner employees were only asked to identify the Rasmussen socio-technical level that best describes their job roles because answers to the other two demographic questions were already known by the researchers.

Participants were asked to select the Likert scale response to indicate their opinions of the change project they had identified. Quantitative data was collected through a seven-point (1 = “strongly disagree”, 2 = “disagree”, 3 = “tend to disagree”, 4 = “tend to agree”, 5 = “agree”, 6 = “strongly agree”, 7 = “not applicable”) Likert scale to measure the importance of the six constructs for project success. A neutral value was excluded because some researchers suggest it can be over selected when included (Weems & Onwuegbuzie, 2001). The researchers recognize there are differing points of view in the literature on this subject (e.g. Garland, 1991) and have included a Not Applicable option to address some of the concerns with using the “neutral” option.

Constructs are unit-weighted composite scores based on survey items. Unit-weights have been shown to have strong predictive validity compared to multiplicative composites (Bobko, Roth, & Buster, 2007). Furthermore, benefits of multiplicative responses are

limited (Trauer & Mackinnon, 2001). All constructs except *project success* are based on items and constructs designed and tested by Farris (2006).

In addition to the quantitative constructs listed in Table 11, a qualitative question was included in the survey which asked participants to define value (i.e. the desired result of a project) based on the change project they identified. The goal of this question was to not just define success factors, but also understand how different groups characterize a successful change project.

#### 4.3.2. Data Collection Procedures

Target participants were categorized into two groups. The first group includes academic professionals involved in change management research. The second group includes employees of the industry partner and industry practitioners who had been involved with a change project in the two years preceding the study. Participants in Group 1 were identified through searches of databases and research publications related to change management. As a first step, 93 potential participants were identified through a search for “change management researchers” on Google. An additional 305 potential participants were identified by searching for “change management” on business school websites located in the United States. Biographies, curriculum vitae, and journal publications were reviewed to ensure each potential academic participant identified through the Google and business school website searches had experience with change management research. Experience was based on publications in change management-specific journals (e.g. *Journal of Change Management*), mentioning of a research focus in change management in an individual’s biography, or involvement in a change project as noted in an individual’s curriculum vitae.

Recruitment for the second group was focused on industry practitioners. In addition to the industry partner participants, the authors used postings on social networks (LinkedIn) and personal emails to colleagues to bolster the number of participants with non-academic positions. Social network contacts were identified through membership in groups, such as the Change Management Forum and Change Consulting, Change Management & Transformation Strategy. Table 12 outlines the response rates for the three groups contacted through separate means.

Table 12. Response rate of target groups.

<b>Group</b>	<b>Targeted Participants</b>	<b>Completed Responses</b>	<b>Response Rate</b>
Academic professionals	383	39	10.2%
Individuals contacted through personal emails	38	22	57.9%
Individuals contacted through social network posts	N/A	6	N/A

Participants were categorized based on their broad industry affiliation and level on the Rasmussen Socio-Technical Framework (Table 13). The industry practitioner group consists of employees of the technology company, and participants recruited through personal emails and social network posts. The overall sample size ( $n = 67$ ) is informative for research of this nature.

Table 13. Number of survey participants in each comparison group.

	<b>Group</b>	<b>No. of Participants</b>
Academia/Industry	Academic	39
	Professionals	
	Industry Practitioners	28
Rasmussen Socio-technical Level	Company	6
	Management	34
	Staff	24

#### 4.3.3. Construct Reliability

The reliability of the constructs used in the quantitative survey questions has been validated in previous research (Farris, 2006). However, the researchers made modifications to fit the context of the change projects considered in this research. Cronbach's alpha is a measure of internal consistency of constructs and is a quantitative representation of how well items measure the same construct (Cronbach, 1951). Listwise items with "Not Applicable" responses were deleted, in keeping with common practice in the literature (Enders, 2004). However, it should be noted that there are a few proposed methods to handle missing data in Cronbach's Alpha calculations (see Holman, Glas, Lindeboom, Zwinderman Aeilko H, & de Haan, 2004; Zhang & Yuan, 2015). Calculated values are displayed in Table 14. Values above 0.700 are generally accepted in the literature (Nunnally, 1978), yet high values do not necessarily represent a stronger study. A high alpha value (greater than 0.900) can be achieved by using many items per construct or including parallel items (Panayides, 2013). Parallel items are items which are repeated in the survey (Panayides & Walker, 2013). All constructs in this study are based on a limited number of items and do not include parallel items. As such, the few high Cronbach's alpha values are not of concern. It has

been suggested that values above 0.600 can be used for newly developed and modified constructs (DeVellis, 1991).

Table 14. Cronbach's alpha values for constructs in Survey 1.

<b>Construct</b>	<b>Cronbach's Alpha</b>
Impact on Organization	0.960
Attitude	0.911
Internal Processes	0.857
Goal Clarity	0.774
Management Support	0.711
Appropriateness	0.668

#### 4.3.4. Data Analyses

The results for one of the change projects specified in the industry partner survey was removed to ensure data independence. Data independence could not be confirmed if both change projects were included because one individual would be answering questions for two different data sets (i.e. two change projects). The change project which received more responses (i.e. organization relocation) was selected to be included in the analysis. Responses from participants at the technology company are included both in the industry practitioners group for industry-academia classification, and in the management and staff levels, based on responses to the Rasmussen demographic question.

Due to the relatively small number of qualitative data points ( $n = 67$ ) across all survey responses, responses were analyzed manually using Excel 2013. The team used triangulation based on three independent analyses of qualitative responses to develop a list of themes that could be used to characterize each response. Between one and four themes

were assigned to each response based on the extent of the response. The team started the thematic analysis with two independent reviews. A third reviewer analyzed the responses if there was greater than a 50% difference in theme classification based on the first two reviews. Following this third iteration, a theme was assigned to a response if at least two of the three researchers assigned the theme. Table 15 includes two examples of responses and the themes that were assigned.

Table 15. Sample survey responses and assigned themes.

Survey Response	Assigned Themes
“Reaching or exceeding the change objective, without excess stress to the organization, in a way that the change is sustainable in the longer run.”	Goal Satisfaction; Minimal Disruption; Consistency
“Improved communication, reducing the time to complete tasks by half in 6 months.”	Communication; Performance Improvement

Quantitative data analysis was completed using IBM SPSS Statistics Version 22. Results were tested for normality using the Shapiro-Wilk test (Shapiro & Wilk, 1965), which is recommended by some researchers as a highly reliable test for normality (Ghasemi & Zahediasl, 2012). All data was found to be non-normal, with a p-value less than 0.05. Due to the non-normality of the data, the Mann-Whitney U test was selected to determine statistically significant differences between data sets. The Mann-Whitney U test is applicable when a small sample size is available (as low as five data points) (de Winter, 2013; Nachar, 2008), and the data is ordinal and non-normal (Nachar, 2008). The Mann-Whitney U test is often applied in situations where participants are self-selected (Jadva, Freeman, Tranfield, & Golombok, 2015; Segovia, Jennex, & Beatty, 2009; D. J. White, 2009), which is common when seeking survey participants through online survey methods

(Choothian, 2014). The Mann-Whitney U test is used to identify differences in the mean ranks of two data sets. Two assumptions required by the Mann-Whitney U test (Nachar, 2008) are listed in Table 16 along with an explanation of fulfillment.

Table 16. Mann-Whitney U test assumption explanations.

Assumption	Explanation
There is independence within groups.	Each survey participant completed only one survey and did not impact responses from other survey participants.
The data scale is either ordinal or continuous.	Data is ordinal based on the Likert scale used in the survey.

#### 4.4. Results and Discussion

Parametric statistics (mean, standard deviation) and nonparametric statistics (median, range) were calculated for data collected from all survey participants (Table 17). All median values fall between a value of four (tend to agree) and five (agree). Responses ranged from one (strongly disagree) to six (strongly agree). The majority of participants (84.4%) perceived their projects as successful.

Table 17. Summary statistics for all survey responses  
(n = 67).

Variable	Median (Range)	Mean (Std. Dev.)
Impact on Organization	5.00 (1.00 - 6.00)	4.26 (1.55)
Attitude	4.83 (1.00 - 6.00)	4.33 (1.39)
Internal Processes	4.67 (1.00 - 6.00)	4.66 (1.06)
Goal Clarity	4.50 (1.00 - 6.00)	4.38 (1.33)
Management Support	4.50 (1.00 - 6.00)	4.48 (1.29)
Appropriateness	5.00 (1.00 - 6.00)	4.43 (1.23)
Project Success	5.00 (1.00 - 6.00)	4.59 (1.67)

#### 4.4.1. Variations between Academic and Industry-based Participants

Table 18 contains a categorization of respondents based on their definitions of value. Many similar descriptions of value in change projects appeared in the qualitative data supplied by individuals from academia and industry. The two most commonly referenced themes by individuals from academia and individuals from industry include *goal satisfaction* and *customer/employee well-being*. The greatest disparity between individuals from academia and individuals from industry is seen for the themes *minimal disruption* (20% difference), *goal satisfaction* (13% difference), *performance improvement* (11% difference), and *customer/employee well-being* (10% difference). The themes *consistency* and

*communication* are rarely mentioned by either group, but may be implied in other themes. For example, to achieve *minimal disruption*, a change team must exhibit *consistency*, and to achieve *customer/employee well-being*, effective *communication* is required.

Table 18. Prevalence of qualitative themes for “value” as defined by academic and industry respondents.

Theme	Academia (n = 39)		Industry (n = 28)
Goal Satisfaction	59%	$\Delta = -13$	46%
Customer/Employee Well-being	36%	$\Delta = +10$	46%
Performance Improvement	18%	$\Delta = +11$	29%
Minimal Disruption	5%	$\Delta = +20$	25%
Financial Health	18%	$\Delta = -7$	11%
Consistency	10%	$\Delta = -6$	4%
Communication	5%	$\Delta = -5$	0%

The quantitative results presented in Table 19 are similar to the variations between academic professionals and industry practitioners seen in the qualitative analysis. Table 19 contains the six survey variables for industry and academia participants. The greatest variation in response is for *attitude* in which the median value for participants from academic organizations is 0.67 higher than for participants from industry organizations. The second highest variation is for *management support* in which the median value for individuals from industry organizations is 0.50 points higher than for individuals from academic organizations. The variables *impact on organization* and *internal processes* were each ranked 0.33 points higher by individuals from industry than by individuals from academia. The final three variables (*goal clarity*, *appropriateness*, and *project success*) each have no difference in median values between individuals from industry and academia.

Mann-Whitney U test p-values are presented for each of the variables shown in Table 19. Statistically significant p-values are indicated with an asterisk. Assuming an alpha value of 0.05, only *attitude* was found to have a statistically significant difference between academic and industry organizations, with a p-value of 0.049. All other calculated p-values were above the 0.05 level; the smallest being *internal processes* with a p-value of 0.257.

Table 19. Variables impacting change project success rated by academic professionals and industry practitioners.

Variable	Academic Organizations (n = 40)		Industry Organizations (n = 35)		Academia – Industry P- Value
	Median (Range)	Mean (Std. Dev.)	Median (Range)	Mean (Std. Dev.)	
Impact on Organization	5.00 (1.00 - 6.00)	4.47 (1.40)	4.67 (1.00 - 6.00)	4.05 (1.68)	0.384
Attitude	5.00 (1.67 - 6.00)	4.67 (1.27)	4.33 (1.00 - 6.00)	4.02 (1.44)	0.049*
Internal Processes	5.00 (1.00 - 6.00)	4.79 (1.09)	4.67 (1.67 - 6.00)	4.54 (1.04)	0.257
Goal Clarity	4.50 (1.00 - 6.00)	4.27 (1.32)	4.50 (1.00 - 6.00)	4.47 (1.35)	0.443
Management Support	4.50 (1.00 - 6.00)	4.34 (1.26)	5.00 (1.00 - 6.00)	4.61 (1.32)	0.282
Appropriateness	5.00 (1.00 - 6.00)	4.55 (1.11)	5.00 (1.00 - 6.00)	4.32 (1.35)	0.534
Project Success	5.00 (1.00 - 6.00)	4.42 (1.52)	5.00 (1.00 - 6.00)	4.76 (1.20)	0.447

#### 4.4.2. Rasmussen Socio-technical Level Variations

The industry-academia comparison is useful for research focus. For the next comparison, the research team categorized responses based on the Rasmussen socio-technical level of each participant in the organization. This classification is useful for managers and change project planning. Table 20 is a breakdown of themes used by respondents at different levels of the Rasmussen Socio-technical Framework to define “value” in change management projects. There were no survey responses from individuals representing the regulator or government levels. The most common themes mentioned by participants at the company level include *goal satisfaction* (67%), *financial health* (50%), and *customer/employee well-being* (33%). The most common themes mentioned by participants at the management level include *goal satisfaction* (56%), *customer/employee well-being* (35%), and *performance improvement* (18%). The most common themes mentioned by participants at the staff level include *customer/employee well-being* (54%), *goal satisfaction* (42%), and *performance improvement* (33%). As expected, there were differences in the definition of “value” in change management projects at different levels of the Rasmussen Socio-technical Framework. For example, *goal satisfaction* responses decrease (from 67% at the company level to 56% at the management level to 42% at the staff level), while *customer/employee well-being* responses increase (from 33% at the company level to 35% at the management level to 54% at the staff level).

Table 20. Value themes used to describe success in change projects by three Rasmussen socio-technical levels.

<b>Theme</b>	<b>Company (n = 6)</b>		<b>Management (n = 34)</b>		<b>Staff (n = 24)</b>
Goal Satisfaction	67%	$\Delta = -11$	56%	$\Delta = -14$	42%
Customer/Employee Well-being	33%	$\Delta = +2$	35%	$\Delta = +19$	54%
Performance Improvement	17%	$\Delta = +1$	18%	$\Delta = +15$	33%
Minimal Disruption	0%	$\Delta = +15$	15%	$\Delta = +2$	17%
Financial Health	50%	$\Delta = -35$	15%	$\Delta = -11$	4%
Consistency	0%	$\Delta = +9$	9%	$\Delta = -5$	4%
Communication	0%	$\Delta = +3$	3%	$\Delta = +1$	4%

Table 21 contains quantitative results for Rasmussen socio-technical levels. All median results fall between a value of four (tend to agree) and five (agree). The greatest variations in median values are seen between management and staff levels with management scoring *impact on organization*, *appropriateness*, and *attitude* one point higher than staff. Company level individuals scored *attitude*, *appropriateness*, *impact on organization*, and *internal processes* 0.83, 0.75, 0.33, and 0.33 higher than staff level individuals, respectively. Finally, management-level individuals rated *management support*, *impact on organization*, and *project success* 0.75, 0.67, and 0.50 higher than company-level individuals, respectively.

Mann-Whitney U test p-values for each of the variables shown in Table 21 are presented in Table 22. Statistically significant p-values are indicated with an asterisk. Assuming an alpha value of 0.05, there were statistically significant differences between responses from management and staff for the variables *impact on organization* (0.018),

*appropriateness* (0.011), and *project success* (0.03). The remaining calculated p-values for comparisons between management and staff, company and management, and company and staff levels were significantly above the 0.05 level ( $> 0.287$ ).

Table 21. Variables impacting change project success rated by staff, management, and company levels.

Variable	Staff (n = 24)		Management (n = 32)		Company (n = 6)	
	Median (Range)	Mean (Std. Dev.)	Median (Range)	Mean (Std. Dev.)	Median (Range)	Mean (Std. Dev.)
Impact on Organization	4.00 (1.00 - 6.00)	3.74 (1.55)	5.00 (1.00 - 6.00)	4.67 (1.44)	4.33 (2.33 - 6.00)	4.28 (1.57)
Attitude	4.00 (1.33 - 6.00)	4.04 (1.46)	5.00 (1.00 - 6.00)	4.43 (1.46)	4.83 (3.33 - 5.33)	4.61 (0.71)
Internal Processes	4.67 (1.67 - 6.00)	4.60 (1.22)	4.67 (1.00 - 6.00)	4.68 (0.98)	5.00 (3.33 - 6.00)	4.89 (0.98)
Goal Clarity	4.50 (1.00 - 6.00)	4.26 (1.49)	4.50 (1.00 - 6.00)	4.42 (1.29)	4.50 (3.00 - 6.00)	4.33 (1.17)
Management Support	4.50 (1.00 - 6.00)	4.25 (1.41)	4.75 (2.00 - 6.00)	4.67 (1.10)	4.00 (2.00 - 6.00)	4.08 (1.69)
Appropriateness	4.00 (1.00 - 6.00)	3.93 (1.42)	5.00 (1.00 - 6.00)	4.80 (1.01)	4.75 (3.50 - 5.50)	4.58 (0.74)
Project Success	5.00 (1.00 - 6.00)	4.22 (1.38)	5.00 (1.00 - 6.00)	4.94 (1.24)	4.50 (3.00 - 6.00)	4.50 (1.05)

Table 22. P-value results from comparison of staff and management, staff and company, and management and company level individuals.

Variable	P-Value		
	Staff – Management	Staff – Company	Management – Company
Impact on Organization	0.018*	0.494	0.711
Attitude	0.304	0.581	0.77
Internal Processes	0.907	0.705	0.653
Goal Clarity	0.776	0.979	0.711
Management Support	0.287	0.705	0.422
Appropriateness	0.011*	0.384	0.399
Project Success	0.03*	0.854	0.279

#### 4.5. Discussion

This section is organized based on comparisons between the groups of interest. First, variations between academic and industry organizations and between NAICS codes are discussed. Second, variations between Rasmussen socio-technical levels are discussed.

##### 4.5.1. Academic and Industry Organization and NAICS Code Variations

The majority of non-academic survey respondents were employed in manufacturing organizations, and the majority of academic survey respondents were employed in educational services organizations, such as universities. Therefore, many results are similar within individuals from educational services and academic organizations, and individuals from manufacturing and industry organizations. Conclusions for both groups are included in this section to eliminate repetition. Discussion is focused on variation between academic

and industry organizations, but conclusions can be expanded to comparisons between manufacturing organizations and educational services organizations.

The greatest variation in the definition of value in change projects between individuals from academia and industry is seen in the theme *minimal disruption*. It is possible that industry practitioners have a greater focus on *minimal disruption* because they often have much shorter project timelines and swifter positive or negative feedback than academic respondents. Industry practitioners may be much more aware of potential negative impacts because of the potential swiftness of feedback. While in academia, individuals often maintain higher job security (e.g. tenure), possibly resulting in a greater willingness to disrupt a system through change, particularly if the system is outside the university. This finding is concerning because the focus of change managers in industry should be on positive results, rather than just avoiding the negative. Perhaps a reason for the risk averse position in industry is seen in responses to *customer/employee well-being* in the Rasmussen analysis in Table 20. Respondents at the company level had the lowest concern for *customer/employee well-being* (33%). Respondents at the management level mentioned the theme 35% and staff mentioned the theme 54%.

The most often mentioned themes are common across both groups, including *goal satisfaction*, *performance improvement*, and *customer/employee well-being*. However, there remains a disparity in responses for these themes (13% difference between industry and academia on *goal satisfaction*, 11% difference between industry and academia on *performance improvement*, and 10% difference between industry and academia on *customer/employee well-being*). In many areas of study including change projects (Stelzer & Mellis, 1999), product development (Nagesh & Thomas, 2015), and Kaizen events

(García et al., 2013), the literature suggests goal clarity is a key success factor. Academic professionals are likely more familiar with this work, leading to a more frequent listing of *goal satisfaction*. On the other hand, industry practitioners are more focused on *customer/employee well-being* and *performance improvement*. *Customer/employee well-being* is particularly important because customer-related topics (e.g. stakeholder support and end-user involvement) have been shown to impact the success of change projects (Maurer, 2014a; SanAgustin, 2014; Stelzer & Mellis, 1999). This result suggests a need to clarify the impact of change initiatives, research findings, and performance measures on customers, and, by extension, organizational bottom lines, and personal utility.

The only statistically significant difference between academic and industry practitioners for quantitative responses was found for *attitude* (p-value = 0.049), with academic professionals rating the variable 0.67 points higher than industry practitioners. *Attitude* could be considered one of the more abstract variables because survey items in the *attitude* construct focused on participant perceptions of value and benefits of the change strategy. Many of the other constructs were focused on tangible variables such as communication, methods applied, and performance targets. This suggests that academic professionals may have a greater awareness of the more abstract aspects of change projects and must translate research results to the more tangible constructs with which industry practitioners are familiar.

#### 4.5.2. Rasmussen Socio-technical Level Variations

Figure 6 represents the results for the themes for each level. For many of the themes (*goal satisfaction*, *customer/employee well-being*, *performance improvement*, *minimal*

*disruption, and financial health*), there is a clear trend between company, management, and staff levels. This suggests there are differing viewpoints between levels of an organization. The goal of any change project should be to ensure as many employees as possible are satisfied with the results. With such a disparity in definitions of success, this goal appears to be challenging. Communication is one proposed method for achieving a greater level of satisfaction (Wiseman et al., 2014); however, communication was rarely mentioned by any of the respondents. To improve change project success, it is imperative that the disparity seen in Figure 6 is reduced for some of these key themes by improving communication during a change project. Improved communication involves practices such as multi-modal communication, early and consistent info sharing to set and manage change project expectations among employees, and managerial openness to staff input.

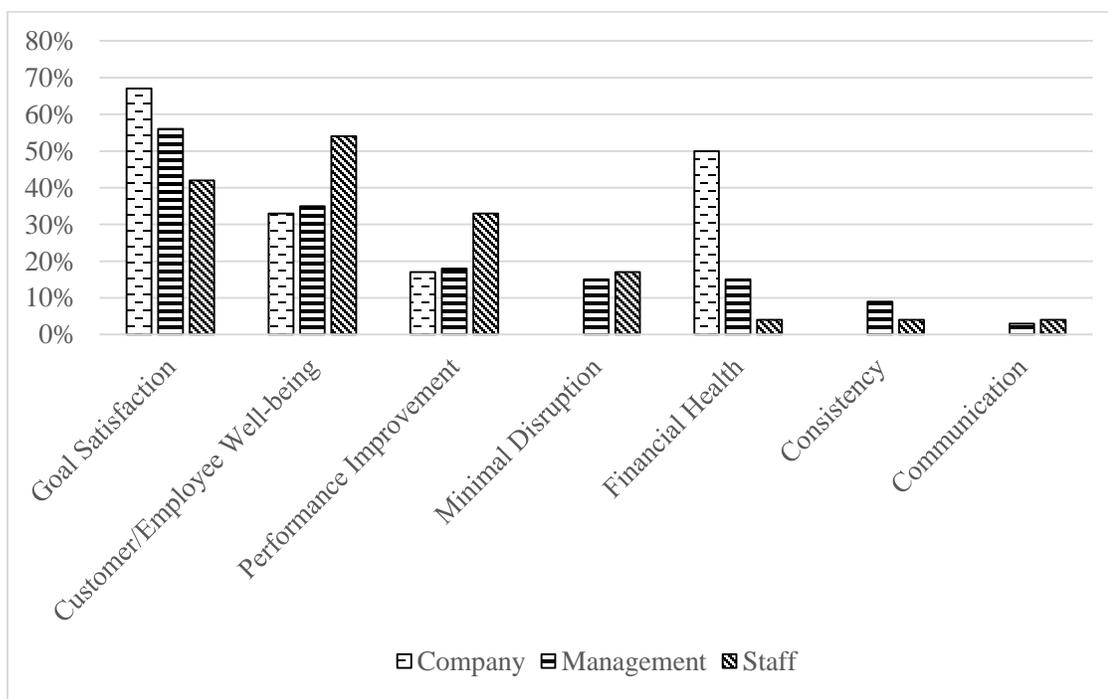


Figure 6. Variations in change management success definition between company, management, and staff levels.

*Goal satisfaction* is mentioned the most frequently by company and management levels, and second-most frequently by the staff level. This mirrors the results from the comparison between academic and industry organizations. Survey participants at all levels are aware of the need to focus on the end-goal of a project.

However, there is a key variation in methods used to satisfy these goals. Respondents at the staff level mentioned the *customer/employee well-being* theme most frequently (54%), followed by respondents at the management (35%) and company (33%) levels. This suggests that staff understand that change projects directly impact them and one of the primary keys to success is their satisfaction. Furthermore, staff is often frequently in direct contact with customers, resulting in a higher response rate for this theme. There is a need for individuals at the management and company levels to recognize that it is imperative employees are satisfied with a change project. The authors submit that without the success of the qualitative, human aspects of a project, the technical aspects will likely fail in the long run. Buy-in and support for a project have been shown to impact the overall success of a project (Mendenhall, Iachini, & Anderson-Butcher, 2013; Wong, 2005). Even if a project is technically successful, a lack of employee satisfaction and buy-in could result in long-term failure.

Another important variation is seen in ratings for the *performance improvement* theme by staff (33%), management (18%), and company (17%) levels. This theme is largely focused on job aspects, such as efficiency, work performance, and overall employee ability. This reinforces the trend of staff-level focus on the direct impacts of change projects on daily work experience. Staff will likely respond positively to change projects that tangibly improve their ability to complete their daily tasks.

A third disparity is seen for the theme *financial health*, which is mentioned more frequently by the company (50%) level than management (15%) or staff (4%) levels. This disparity is largely expected because *financial health* is a key indicator for company level employees (Nasrallah & Qawasmeh, 2009). However, it is concerning that this is the second most frequently mentioned theme. Company level employees appear to focus far less on employees, customers, and specific job performances than they do on overall *goal satisfaction* and *financial health*. Although this is the role of individuals at the company level, it is imperative that the human experience (customer and employee) is incorporated in attempts at goal satisfaction and financial growth. Organizations risk demoralization when employees sense their needs are distant after-thoughts relative to *goal satisfaction* and *financial health* (Sinsky et al., 2013).

Three statistically significant differences were found between management and staff for the variables *impact on organization*, *appropriateness*, and *project success*. There were no statistically significant differences for other comparisons of groups for any of the variables. Management rated *impact on organization* significantly higher than staff (median difference of 1.00), suggesting that management may be more aware of the organizational-level impacts of a change. Furthermore, staff may lack the knowledge of organizational performance to accurately gauge the impact of a change. The variation between these two groups may also be present because staff may not be exposed to the positive benefits of a change at an organizational level. Achieving effective employee engagement, through communication and performance improvement initiatives, has been shown to impact the overall success of an organization (Harvard Business Review Analytic Services, 2013).

Management rated *appropriateness* significantly higher (median difference of 1.00) than staff. One of the survey questions for this variable focused on the fit of the project with the organization. Management may be more aware of the level of impact that the fit of a project has on the success of a change project. The second survey question for this variable asks if the right methods were applied. It could be difficult to understand the impact of the application of the right methods if staff is not entirely involved in the change project. Specific methods may only be known by management, with staff only seeing the impact of the application of those methods. As with *impact on organization*, this suggests that employee engagement may be lacking in change projects since staff is less aware of the impact appropriate methods have on change project success.

*Project success* is the final variable with a statistically significant difference between respondents at the management and staff levels. Respondents at the management level responded with higher averages for *project success* than those at the staff level (4.94 for management compared to 4.22 for staff), suggesting that management may perceive success differently than staff. Management may be more focused on measures of quantitative success like those related to budget as was seen in the definitions of value provided by managers. Conversely, staff appears to focus more on qualitative aspects like employee satisfaction. Success in the qualitative aspects of a project can often be more challenging when compared with achieving and assessing quantitative measures like those related to budget (de Araujo, 2015). This disparity between management and staff, coupled with the challenge of assessing qualitative determinants, may be why there is variation in perceived level of *project success*.

## 4.6. Conclusion

This research identified that six variables tested (*impact on organization, attitude, internal processes, goal clarity, management support, and appropriateness*) have an effect on change management projects. Overall, respondents rated the impact of these factors between four (tend to agree) and five (agree). This aligns with the work by Farris (2008), that found similar results in Kaizen events. This article extends previous research by investigating the relationship between industry and organization level on the perception of change project goals, processes, outcomes, and overall value. The data collected suggests that there remains variation between how academic professionals and industry practitioners define value in change projects and how they view the impact of certain variables on success. Additionally, there are variations between different Rasmussen socio-technical levels. The following two sections provide suggested actions for managers and researchers who seek to improve the success of change projects.

### 4.6.1. Implications for Engineering Managers

Effective communication can be one of the greatest challenges faced by engineering managers (Dickmeyer, 2015). Beyond sharing information, communication requires shared understanding – a general consensus of the organizational environment. Previous research shows the impact of shared understanding and awareness of roles on change projects in healthcare (Schell & Kuntz, 2013), government (Long & Spurlock, 2008; Winklhofer, 2002), and aerospace (Kotnour, Barton, Jennings, & Bridges, 1998). This research identified key variations in the views of management and staff during change

projects. Results suggest that staff are often unaware of the impact a project could, or does, have on the broader organization. As a result, staff more often view these projects as unsuccessful. To effectively manage a group, particularly through a change project, it is imperative that employees are aware of all relevant aspects of a project. Even if a project achieves management's goals, lack of employee satisfaction can adversely affect morale and cause frustration during day-to-day use of a new system.

Many of the differences between individuals at different levels of an organization can be attributed to variations in scope of consideration (Figure 7). Company-level individuals are focused on shareholders and maximizing profitability. Management-level individuals must focus primarily on maximizing their departmental performance. Finally, staff-level individuals are often more concerned with the personal impact of a change, as was seen through the value definition responses. These variations in consideration impact an individual's perception of success.

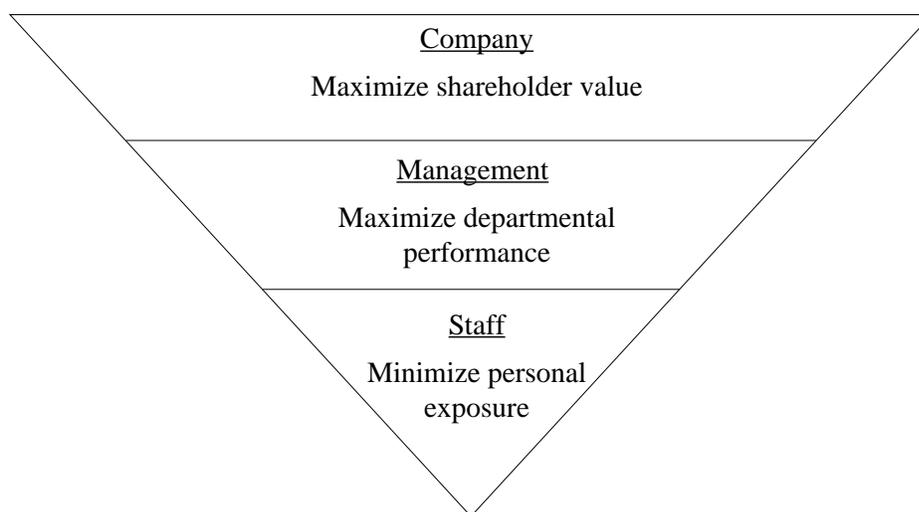


Figure 7. Company, management, and staff level scope of consideration.

It is important that engineering managers recognize employees' focus on qualitative change project success measures. Employees appear to place more emphasis on personal satisfaction (i.e. *customer/employee well-being*) than on *financial health* or *goal satisfaction*. Although *financial health* and *goal satisfaction* are still key metrics that should be considered during a change project, management must also concentrate on *customer/employee well-being*. Change projects are more effective if employee stressors are kept to a minimum (Newton, Teo, Pick, Yeung, & Salamonson, 2013) and strong relationships are built within a team (Jones et al., 2005). Satisfaction relies on effective communication. If employees feel comfortable sharing their views on a change project, management will be better empowered to help minimize employee stressors and improve team cohesion.

#### 4.6.2. Implications for Researchers

An important aspect of research in academia is the assurance that new findings are shared with industry to be put into application. Numerous authors have discussed this importance (Etzkowitz, Webster, & Healey, 1998; Fujisue, 1998; Lacombe, Burock, & Meunier, 2013), highlighting the benefit that academia-industry relationships have on both parties. The change management literature lacks a clear understanding of variations in how individuals from academia and industry view change projects. The findings from this research suggest that individuals from academia appear to be more optimistic in regards to change projects and may better understand how abstract variables like *team attitude* impact projects. Achieving greater alignment between academia and industry will help ensure research is more beneficial to industry practitioners trying to implement new techniques

and ideas. Academic professionals must be aware of the concerns and viewpoints of industry practitioners to understand what areas are in need of research.

Based on the analysis of different Rasmussen socio-technical levels, there appears to be some variation in how different levels within an organization view change projects. As researchers, this creates an opportunity to better understand how to reach a shared understanding through communication, training, or other methods. A framework is needed to help managers share project goals with their employees and to ensure employees feel open to sharing viewpoints during a change project.

#### 4.6.3. Limitations

Individuals self-identified with Rasmussen Socio-technical Framework levels, involvement in academia or industry organizations, and membership in change management social media groups. It is possible that this could introduce error into the study. Furthermore, this work is limited by the sample sizes achieved, particularly for individuals at the company level ( $n = 6$ ). However, fewer responses from individuals at the company level are expected due to their lower representation in the U.S. labor force. In this study, individuals at the company level represent 9.38% of the total sample size, while in the United States, individuals at the company level (i.e. top executives) represent 1.53% of the total labor force (U.S. Bureau of Labor Statistics, 2015). Further work could achieve better statistical power by broadening the sample and increasing the sample size in each industry and category.

Finally, this research originally focused on industry practitioners who worked in the technology industry. However, following a low sample size of participants from the

industry partner (n = 15) and individuals identified through LinkedIn groups (n = 6), the limitation to the technology industry was removed. The next set of identified participants (n = 7) did not necessarily work in the technology industry. A comparison was made between the technology industry group (n = 21) and the general industry group (n = 7) to determine if the data collected was statistically similar. Using the Mann-Whitney U Test (discussed in Section 3.3.3), two of the six tested variables had statistically significant differences in mean ranks between the technology industry group and the general industry group (Table 23). This does not imply that the two data sets cannot be combined; however, it does suggest that this research cannot be used to draw conclusions specific to the technology industry. Future work should investigate specific project types and specific industry types to allow for these conclusions. Following an investigation of project types and industry types, larger conclusions could be made about the overall labor force.

Table 23. Comparison of differences between technology industry and non-technology industry survey participants.

<b>Variable</b>	<b>Significance</b>
Impact on Organization	0.002
Attitude	0.006
Internal Processes	0.836
Goal Clarity	0.756
Management Support	0.959
Appropriateness	0.062

Using the Lens of Conceptual Change to Assess Success of a Change Management  
Project

By

Joshua D. Hille, Waleed K. Mirdad, Jeremy T. Melamed, Chinweike I. Eseonu

Submitted for publication in a peer-reviewed journal

## **5. SECOND MANUSCRIPT: USING THE LENS OF CONCEPTUAL CHANGE TO ASSESS SUCCESS OF A CHANGE MANAGEMENT PROJECT**

### **5.1. Introduction**

Highly adaptive organizations must transform their operations to remain competitive in response to dynamic market conditions, so it is concerning that over 70 percent of change initiatives are unsuccessful (Beer & Nohria, 2000). The goal of this article is to outline an approach to change management that is focused on a culture of continuous improvement through changes at the individual level. The focus on the individual level is a unique approach that has shown promise in research on ethical behavior (Herkert, 2005; Trevio, den Nieuwenboer, & Kish-Gephart, 2014). This is unique because it deviates from the widely used group, or macro-level, approach to change management, but instead focuses on individual conceptual change as an approach to achieving long-lasting change that can become self-sustaining and propagating (Herkert, 2005).

There are several accounts of the challenge of understanding and sustaining change in manufacturing (Blanchard, 2007; Hendrickx, 2015), healthcare (Machado Guimarães & Crespo De Carvalho, 2014), aerospace (Crute, Ward, Brown, & Graves, 2003), and knowledge work environments (Z. Yu, Serban, & Rouse, 2013). A growing body of work builds on theories of conceptualization – the process of individual, cognitive, sense making – as an approach for sustained change and knowledge management. This work largely builds on research in psychology (e.g. Argyris & Schon, 1978), science education (e.g. Ültay et al., 2015), healthcare systems transformation (e.g. Mazur, McCreery, & Chen, 2012; Mazur, McCreery, & Rothenberg, 2012), Kaizen event failures (e.g. Farris et al.,

2008), and lean implementation (e.g. Harris, Stone, Mayeshiba, Compton, & Farrington, 2014).

Given the nascence of this work on achieving individual conceptual change as a means for group-level change, there is a need for a model that guides research and practice. The remainder of this paper is focused on change conceptualization theory, existing models, and research needs. This discussion includes a preliminary model for initiating and supporting organizational change. The paper concludes with an analysis of a case study looking through the lens of the Conceptual Change Model.

## **5.2. Change Conceptualization**

### **5.2.1. From Macro to Micro Implementation Strategies**

The literature suggests that cultural and attitudinal challenges impede continuous improvement initiatives (Crute et al., 2003; Mazur, McCreery, & Rothenberg, 2012). These challenges are often due to a misunderstanding of underlying lean principles (Saad Sarhan, 2013), lack of management commitment (Bhasin, 2012), poor communication (Worley & Doolen, 2006), and inadequate employee engagement (Bateman, Hines, & Lucey, 2004). These challenges largely hinge on individual perceptions of the change process and of the potential effect on personal well-being. It follows that change initiatives must address the individual (micro) level in addition to the current focus on change at the organizational or group (macro) level.

This focus on individual cognitive transformation is increasingly prevalent in the behavioral sciences (e.g. Goldstein, Cialdini, & Griskevicius, 2008), in research on creating

ethical cultures in engineering student cohorts (e.g. Herkert, 2005), and in organizations (e.g. Trevio et al., 2014). Research suggests there is a spectrum of learning behavior that spans from the reactive and workaround based “single-loop” to the proactive and root-cause-based “double-loop” behavior.

### 5.2.2. Single to Double-Loop Learning

Argyris and Schon (1978) suggest that the actions people believe they would take in a given situation often differs from actual behaviors when said situation occurs. Thus, the question for change implementation managers is how to create a resilient system in which the default action is one that supports organizational goals. The underlying assumption is that individuals take pride in their work and diligently attempt to add value to their organizations. However, these individuals are often conditioned to operate in a single-loop learning mindset, in which individuals are dedicated to the timely and accurate completion of work, but do not reflectively analyze problems they encounter (Mazur, McCreery, & Rothenberg, 2012). Though immediately efficient, the single-loop approach fails to determine why the problem occurred and does not increase learning to avoid recurrence.

A number of studies highlight the more proactive double-loop learning approach (Greenwood, 1998; Mazur, McCreery, & Chen, 2012; Mazur, McCreery, & Rothenberg, 2012). An individual who exhibits double-loop behavior questions underlying assumptions of the system (Pahl-Wostl, 2009) and often initiates fundamental change and long-term system improvement. Given the need for continuous improvement, it is important to note that double-loop learners actively seek ways to improve organizational processes even when systemic problems are not present (Mazur, McCreery, & Chen, 2012). Few research

studies have investigated best practices, or processes, for transforming individuals from the single-loop mindset of band-aids and fire-fighting, to the inherently proactive approach of preventing problems from arising in the first place.

### 5.2.3. Need for a Practical Framework

The rise of knowledge work has led to increased employee autonomy and decentralization. Managers must also increasingly focus on identifying and leveraging individual currencies in bids to improve motivation and employee engagement. Given high levels of technical specialization among managers in knowledge work environments (e.g. cardiologist managing the cardiology department, engineering managers managing other engineers, etc.), and the broad spectrum of change theories and guidelines for organizational change and knowledge management, there is a need to identify effective methods for improving double-loop learning behavior. The remainder of this article is focused on developing a conceptual model for the transition from single to double-loop learning behavior.

## 5.3. Conceptual Change Model

Previous theories of conceptual change largely focus on cognitive processes, such as prior knowledge and level of dissatisfaction with preconceptions. There is a need to address other factors including metacognitive, motivational, and affective processes that are integral to facilitating conceptual change (Sinatra & Pintrich, 2003). Additionally, external environmental factors such as trainer characteristics and social factors need to be considered (Limón, 2001). The Conceptual Change Model proposed in this paper expands on the Theory of Accommodation (Posner et al., 1982) to incorporate these missing factors.

The Theory of Accommodation suggests that prerequisites for conceptual change include dissatisfaction with the current concept or paradigm, intelligibility and plausibility of the new concept or paradigm, and practical evidence that the new concept or paradigm is significantly more beneficial, or fruitful, in comparison to the previous concept.

Furthermore, to ensure a more application-focused model, we incorporate conceptual change strategies suggested by Nussbaum & Novick (1982) and Crawford (2001). Nussbaum & Novick (1982) present two case studies describing sixth through eighth-grade students' understanding of the particle model of gasses. The particle model of gasses states that a gas is comprised of small particles with empty space between the particles. The sixth through eighth-grade students effectively adopted the new concept of the particle model into their preconceptions about how air is structured (Nussbaum & Novick, 1982).

Nussbaum & Novick (1982) discuss prescriptive methods to achieve conceptual change, including three stages to guide a teacher. First, an exposing event is taught to achieve awareness of preconception in students. Second, a discrepant event introduces a conflict between preconceptions and a new concept. Third, students seek a new solution to solve the discrepancies identified in Stage 2. The work by Nussbaum & Novick (1982) continues to be referenced in recent literature (e.g. Adbo & Taber, 2014; Dawson, 2014) as a beneficial technique for achieving conceptual change in students.

As with the work by Nussbaum & Novick (1982), Crawford (2001) introduces an applied approach to conceptual change in K-12 students. This theory suggests students must: (1) relate new information to everyday situations; (2) experience how the concept is connected with real-world scenarios; (3) apply the new concept to first-hand activities; (4)

cooperate with each other to share findings and explore reasoning; and (5) transfer new knowledge of the concept to scenarios not described in the classroom. This strategy has been shown to achieve conceptual change by significantly altering the way high school students think about chemical mixtures and solutions (Crawford, 2001).

Figure 8 is a preliminary model for conceptual change that outlines responsibilities of primary actors – trainer and trainee – and provides an evaluation cycle for determining the extent of change in the learner's mindset. The focus of the first process – application strategy – is on the trainer, to identify broad phases of action that the trainer can modify as needed. The focus of the second process – condition – is on the trainee. The condition process includes four cognitive conditions – dissatisfaction, intelligibility, plausibility, and fruitfulness. The cognitive conditions are based on the Theory of Accommodation (Posner et al., 1982) that will be used to iteratively assess the effectiveness of the application strategy. Extant research supports the use of these cognitive conditions in the assessment of conceptual change (Carrejo & Reinhartz, 2014; Hennessey, 1993; Montfort et al., 2013; Ültay et al., 2015). Finally, the focus of the third process – assessment – is to determine the level of adoption of the new concept, as either unadapted or adapted. Unadapted means the trainee does not internalize or understand the new concept, while an adapted trainee either ignores (alpha shift), modifies their current concept (beta shift), or accepts the new concept entirely (gamma shift).

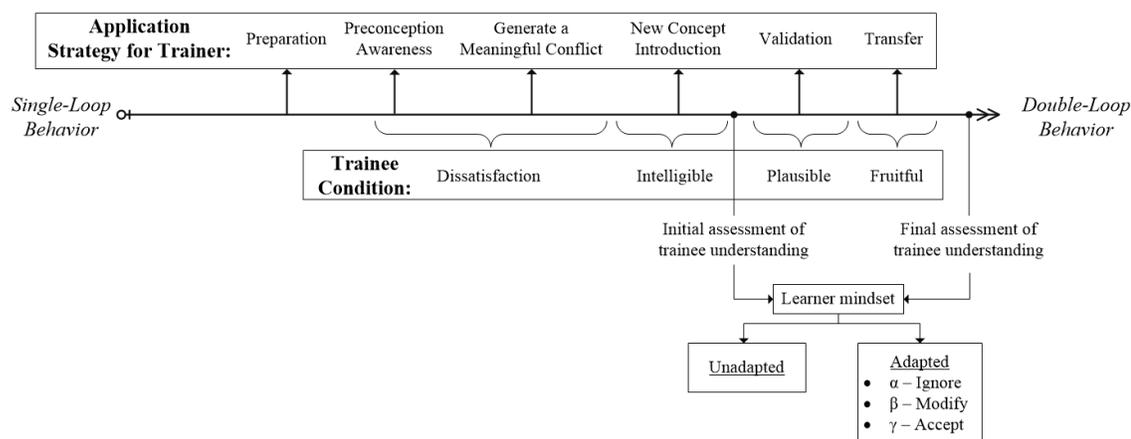


Figure 8. Proposed conceptual change model. Source: (Mirdad et al., 2015).

The application strategy includes six stages. The preparation stage involves identifying and addressing factors that could impact the success of the training. Preconception awareness signifies the beginning of the training session and is an opportunity for the trainee to begin to recognize his/her preconceptions about the concept being discussed. The third stage, generate meaningful conflict, uses results of preconception awareness to highlight deficiencies in trainees' preconceptions. Next, the trainer introduces the new concept as a solution to the deficiencies highlighted in the generate meaningful conflict stage. In stage five, validation, trainees are advised to test the new paradigm in response to issues that would have been addressed using the old paradigm. Finally, in the transfer stage, trainees are able to independently apply new concepts to normal routines, see fruitful results, and share new concepts with colleagues. Figure 9 is a graphic representation of the models and theories referenced to develop the Conceptual Change Model. The following sections discuss these six application strategy stages in more detail.

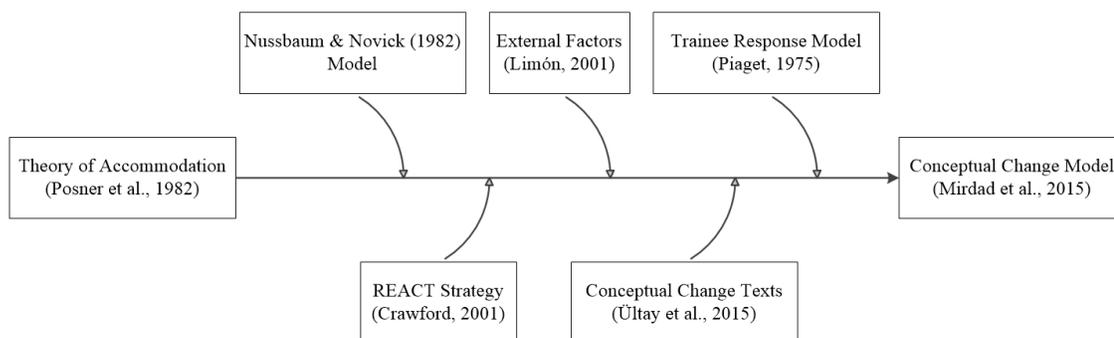


Figure 9. Conceptual change model contribution map.

### 5.3.1. Stage 1: Preparation

The “preparation” stage is used to identify factors that could impact the success of a conceptual change initiative (Figure 10). Limón (2001) groups these factors into three categories. Category 1 factors are related to the learner. These factors include the learner’s prior knowledge, motivation and interest, epistemological beliefs, values and attitudes toward learning, reasoning abilities, and cognitive engagement in the learning tasks. Category 2 factors are related to the learning environment. These factors include peer influence and the relationship between the teacher and the learner (individual and group). Category 3 factors are related to the trainer. These factors include domain specific knowledge, motivation, teaching strategies, epistemological beliefs, and level of training as a teacher. The goal of the preparation step is to set and manage expectations by ensuring trainers are aware of the effects of external factors and to help mitigate any factors that could negatively impact the success of the training process.

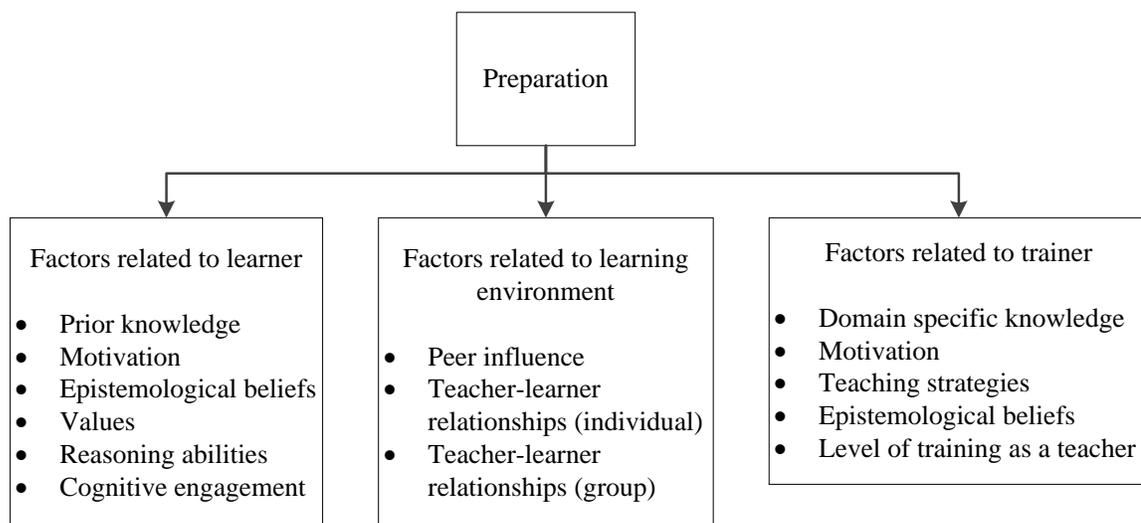


Figure 10. Factors impacting the conceptual change preparation stage.  
Source: (Limón, 2001).

Preparation is an important step because the ability to set and manage expectations improves project success. Participation is a key component in fostering learner engagement, but if clear objectives are not identified for different groups, the project risks being fragmented by individual interests (Laframboise, Nelson, & Schmaltz, 2002). The process of setting expectations provides a clear, realistic vision and action plan to prevent confusion and false starts when training begins. Focusing solely on known obstacles that a project faces without accounting for potential unknown obstacles increases the probability of the change effort being over budget and failing to meet the specified timeline (Kahneman & Lovallo, 1993). If initial goals are not framed based on the fact that many change efforts are unsuccessful, unrealistic expectations could lead to a pessimistic environment, despite progress being made.

### 5.3.2. Stage 2: Preconception Awareness

The goal of the “preconception awareness” stage is to clarify current trainee perceptions of the process, concepts, etc. being considered. To achieve preconception awareness, the trainer creates conditions that allow trainees to identify their current concepts or paradigms through problem-based learning or discussion. This stage is most easily accomplished by inviting trainees to solve a problem using their current concepts. In the case of the single-loop to double-loop transition in a healthcare environment, a sample problem may be a nurse providing an incorrect number of pills to a patient. There are many approaches that may be suggested by trainees to fix this problem. The specific approach is not necessarily as important as ensuring trainees are aware of how and why they would fix the problem.

It is essential to foster an environment in which employees do not feel threatened to share current conceptions. Encouraging trainees to question why fixing the problem is necessary in the first place can also aid in avoiding indifference towards the conceptual change effort (Nussbaum & Novick, 1982). An open discussion of approaches to the concept being discussed as well as introducing potential alternative solutions will support this step.

### 5.3.3. Stage 3: Generate Meaningful Conflict

The goal of the “generate meaningful conflict” stage is to guide trainees to recognize that their current conceptions may not be an ideal solution to the presented problem. Once trainees are aware of their preconceptions, the trainer begins a discussion to identify strengths and weaknesses of the suggested approaches. The goal of this approach is not to

tell trainees that their approach is incorrect, but rather have them reach a conclusion that there may be better solutions to the problem. The trainer's role is to assist in identifying weaknesses of current approaches, but not to degrade any proposed solutions. Trainees should be open to a new concept following the successful generation of meaningful conflict. Providing trainees with data or other evidence showing potential inefficiencies or costs of current approaches is valuable in convincing trainees of the need for change. Also, by highlighting the accomplishments made by other organizational change initiatives, trainers can influence a greater desire for change among trainees.

Where previously held concepts were suboptimal, successful preconception awareness and meaningful conflict stages will result in trainee dissatisfaction. Dissatisfaction is often characterized by a questioning of basic assumptions in the previously held concept. It relies on trainees developing "a store of unsolved puzzles or anomalies...and [losing] faith in the capacity of his current concepts to solve these problems" (Posner et al., 1982).

#### 5.3.4. Stage 4: New Concept Introduction

Next, the trainer moves to the "new concept introduction" stage, in which the trainer proposes the new concept as a solution to the problem initially identified in the "preconception awareness" stage. It is imperative that trainees fully understand the new solution; otherwise, further model stages will not be successful (Nussbaum & Novick, 1982). Without a clear understanding, trainees will be more likely to ignore the new solution or modify their original concept. This stage greatly relies on many of the external factors identified in the "preparation" stage, particularly those focused on trainer

characteristics. A level of trust between trainee and trainer is needed to achieve buy-in to the new concept (Hewson, 1992).

Ensuring adequate training resources and making time available for trainees will help prevent anxiety and frustration when transitioning to the new concept (Wiseman et al., 2014). If trainees are expected to keep up with all of their regular job duties in addition to training, managers risk change fatigue from employees (Mazur, McCreery, & Chen, 2012). For employees who have system processes ingrained with an extended tenure, old habits can be difficult to relinquish.

#### 5.3.5. Initial Assessment

Following the new concept introduction stage, the trainer conducts the first assessment to determine the level of understanding and acceptance of the new concept. It is not expected that trainees will fully accept the new concept, rather they should, at least, understand the new concept. While assessment plans will necessarily vary across change initiatives, Ültay et al. (2015) provide an example of an evaluation used in the assessment of conceptual change. Assessments could take the form of interviews as is described by Ültay et al. (2015), written short-answer questions, or Likert-scale based questions. Table 24 outlines a proposed approach to the Initial Assessment, which tests for the conditions of Dissatisfaction and Intelligibility. Proposed questions do not represent a complete Initial Assessment and are intentionally left broad to be applicable to many conceptual change scenarios.

Table 24. Initial assessment sample questions.

<b>Condition</b>	<b>Question</b>	<b>Form of Answer</b>
Dissatisfaction	After the discussion today, do you notice any differences in how you think about [previous approach]?	Short-answer
Dissatisfaction	Do your ideas about [previous approach] relate to [process in question] which was discussed today? How?	Short-answer
Intelligibility	Please describe the potential benefits of [new approach]. (Hewson & Thorley, 1989)	Short-answer
Intelligibility	In a few sentences, describe the main idea of [new approach]. (Hawson, 1992)	Short-answer
Intelligibility	Can you give an example of [new approach] being applied? (Hawson, 1992)	Short-answer

### 5.3.6. Stage 5: Validation

The “validation” stage is an opportunity to discuss how the new concept introduced in the “new concept introduction” stage solves the problem identified in the “generate meaningful conflict” stage. Ideally, trainees should discuss the solution together to come to a consensus on its usefulness and applicability. Trainees who find the new solution to be more effective than their previously held concepts will consider replacing their previously held concepts with the new concept. After learning a new concept, an effective approach to sustaining the learning is through teaching. By teaching the material to others, trainees will develop a deeper comprehension of the material (Fiorella & Mayer, 2013).

### 5.3.7. Stage 6: Transfer

The “transfer” stage relies on trainees recognizing the new concept in application (Mirdad et al., 2015). The new concept is now seen as being fruitful; that is, the concept is useful in personally-relatable scenarios. To fully accept a new concept that contradicts their preconception, trainees must recognize how the concept could be applied to more than just the scenario discussed in the training session. Tools like simulation could be useful in visualizing how new concepts can solve numerous problems. Furthermore, case studies of similar concepts being applied in other industries or organizations could provide further support for the new concept. The goal of this stage is to identify how new learnings can be applied in day-to-day actions while benefiting both the individual and organization. In order to reward using the new concept, an incentive could be given to employees who demonstrate the application of the concept. The trainer should highlight employees utilizing double-loop learning to give others an example to emulate.

### 5.3.8. Final Assessment

Finally, a concluding assessment will be completed to assess the level of conceptual change achieved in the training session. The assessment will be completed in the same manner as the initial assessment. Table 25 outlines a proposed approach to the final assessment, which tests for the conditions of Plausibility and Fruitfulness. As with the initial assessment, proposed questions do not represent a complete assessment.

Table 25. Final assessment sample questions.

<b>Condition</b>	<b>Question</b>	<b>Form of Answer</b>
Plausibility	Does [new approach] relate to [process in question]? How?	Short-answer
Plausibility	Does [new approach] address concerns you have with [process in question]?	Short-answer
Fruitfulness	How will [new approach] affect the organization?	Short-answer
Fruitfulness	How might [new approach] affect you and your work?	Short-answer
Fruitfulness	Does [new approach] solve any problems you have seen in the workplace, other than those discussed today? Describe those problems. (Hawson, 1992; Hewson & Thorley, 1989)	Short-answer

Achieving a gamma mindset shift, where trainees fully understand and accept the new concept, is ideal. However, we expect that achieving this level of change through one training session will be difficult. Rather, it is more likely that conceptual change will occur more as trainees have an opportunity to apply learnings from the training course in their day-to-day jobs. Following the training course, it is imperative that trainees at least reach the beta stage, where the new concept is fully understood and preconceptions begin to be modified. This is a strong baseline for further achieving a conceptual change transition.

#### **5.4. Case Study**

There are few applied or theoretical studies of conceptual change outside the education literature. The research team conducted a retrospective analysis of a change project at a technology company located in the Northwest United States. The research is focused on a

manufacturing group, henceforth called Group Y, within the technology company. Group Y employs 18 office personnel and 21 manufacturing personnel who assemble and test reference validation platforms. Reference validation platforms are electronic systems that are used by software engineers to test new hardware technologies developed by the technology company. Group Y is of interest because they test different new products each week. They are expected to progress through change more effectively than average work teams that might develop and maintain uniform work procedures for extended periods.

This case study describes a 145-mile relocation of Group Y. Group members were notified of the relocation eight months in advance. During this eight-month period, one of the primary product lines of Group Y was outsourced to another country, so Group Y also experienced a significant drop in product throughput. Group Y moved to an empty manufacturing space that was already owned by the technology company. Manufacturing floor space decreased by 60% to 32,500 square feet.

During the move, twelve office employees and ten manufacturing employees left the company. Two office employees left Group Y but stayed with the technology company in the original location. About 80 percent of the employees who left the company had been with Group Y for more than 10 years.

#### 5.4.1. Methodology

The researcher conducted four semi-structured interviews with members of Group Y who were involved in the relocation project. Invitations were sent to four Group Y members via email. Participants were identified based on their relative knowledge of and participation in the move. Relative knowledge was determined through pre-interview discussion with

manufacturing floor employees and managers. Two manufacturing floor (staff) employees and two managers were interviewed. Three of the four participants elected to complete their interview through email and one was completed by telephone. For the phone interview, the interviewer produced a call transcript on the same day as the interview. The interviewer initially asked broad questions about the move. The interviewer used follow-up questions and requests for examples to guide responses to specific points related to conceptualization.

The researcher used thematic analysis to identify the level of conceptual change achieved by each of the four individuals interviewed. The researcher first reviewed the interview responses and developed a list of characteristic themes for each individual. Following this initial review, themes were listed under one of the six conceptual change stages (preparation, preconception awareness, generate meaningful conflict, new concept introduction, validation, and transfer). Finally, the researcher read through the transcripts once more to identify any responses that were not already captured by one of the six conceptual change stages. The results were then analyzed to identify any variations between participants as well as to identify the level of fulfillment of each of the conceptual change model stages.

For this case study, conceptual change was not carried out through a training scenario as was described in the introduction of the conceptual change model. Instead, we consider management to fulfill the role of the trainer and staff to fulfill the role of the trainees.

#### 5.4.2. Results

The following results are divided into six sections, which present interview responses that represent the six stages of the Conceptual Change Model. Responses are identified as coming from individuals at the management or staff level, and disparity between these two sets of individuals' responses is discussed. In addition to interview responses, background information known by the researcher is also included for a broader picture of the situation during the notification, planning, and implementation of the move.

##### *5.4.2.1. Preparation*

Before initiating conceptual change, a trainer should prepare a suitable environment. In the case of Group Y, a suitable environment would include ensuring a strong relationship between management and staff, understanding the motivation of employees, and recognizing initial knowledge of employees, among others. Unfortunately, the amount of preparation for the Group Y relocation was nearly non-existent. The relocation was announced by the vice president level of the technology company to the employees of Group Y, so management did not have a chance to prepare their employees for such a large announcement.

Group Y employees and management were angered and frustrated following the announcement. The vice president notifying Group Y did not seem to express concern about the personal impact that the move would have on the employees of Group Y (Excerpt 1). Although this may have been an inadvertent comment, we theorize that initial

frustration with the presentation of a new idea could lead to failure for the rest of the project.

Excerpt 1. Management response.

---

*I: What were your thoughts/feelings about the move from [original location] to [new location]?*

*\*: “VP’s seem to be very insensitive when conveying the initial message”*

---

5.4.2.2. Preconception Awareness

The goal of preconception awareness in this case study is to ensure employees understood why Group Y was located in its original location. Ideally, this awareness would help employees recognize why Group Y needed to move locations. The four interview participants generally agreed that Group Y was located in its original location to build computers and be located close to other large technology companies (Excerpt 2 and Excerpt 3). Participants were also asked about the average Group Y employee because projective questions focused on “most people” can cause less social pressure and result in more honest answers (Bradburn, Sudman, & Wansink, 2004).

Excerpt 2. Staff response.

---

*I: What would you say were the [Group Y]-specific reasons for being located in [original location]?*

*\*: “constructed for manufacturing PCs”; “big technical companies are there”*

---

## Excerpt 3. Management response.

---

*I: What would you say were the [Group Y]-specific reasons for being located in [original location]?*

*\*: “building computers for OEM’s”; “close to [other technology company]”*

---

There was some disparity between staff and management in their views of how well the average Group Y employee understood why Group Y was located in its original location. One staff member expressed doubt that most Group Y employees understood the location of Group Y (Excerpt 4) while management expressed the opposite (Excerpt 5). This lack of agreement in responses could suggest that there was a lack of transparency with staff about Group Y and its operations. It should be noted that the manager quoted in Excerpt 4 was based out of a different state than the manufacturing operations before the move. The manager would travel multiple times a week to the manufacturing site. This lack of consistent presence may have played a role in the lack of knowledge sharing between staff and management.

## Excerpt 4. Staff response.

---

*I: Were most people aware of the [Group Y]-specific reasons for being located in [original location]?*

*\*: “I doubt most of the people were aware”*

---

## Excerpt 5. Management response.

---

*I: Were most people aware of the [Group Y]-specific reasons for being located in [original location]?*

*\*: “Most people knew the history of [Group Y]”*

---

#### 5.4.2.3. Generate Meaningful Conflict

Applied to this case study, generating meaningful conflict means that employees should have been able to recognize certain aspects of the original location that were not ideal. Based on both staff (Excerpt 6) and management (Excerpt 7) responses, meaningful conflict was never achieved. Without achieving meaningful conflict, conceptual change will be more difficult to achieve since employees will be unlikely to forgo their preconceptions for a new concept. In addition to cognitive conflict, personal and psychological factors play an important role in conceptual change (Appleton, 2013). In other words, in a major organizational change, such as the Group Y relocation, it is important to understand impacts on employees' lives and their job roles.

#### Excerpt 6. Staff response.

---

*I: If you were located in [original location], would you say you were happy in [original location]? Why?*

*\*: "I was happy in [original location] because it was close to home and family."*

---

#### Excerpt 7. Management response.

---

*I: If you were located in [original location], would you say you were happy in [original location]? Why?*

*\*: "I was very happy in [original location] and did not want to move. A lot had to do with family, cost of living..."*

---

#### 5.4.2.4. New Concept Introduction

The outcome of the new concept introduction stage is to ensure employees understand the reasoning behind a change. In the case of Group Y, both staff and management agreed that the majority of employees understood why the group was moving (Excerpt 8 and Excerpt

9). However, most employees were still unsatisfied with this because they were content with the original location (Excerpt 10). Employees appear to have never reached a level of dissatisfaction that left them searching for a new concept or solution. In a situation like a change of location, achieving dissatisfaction may be unrealistic. However, the authors propose that a more considerate approach to presenting the move to employees could have resulted in a greater openness to the change.

Excerpt 8. Staff response.

---

*I: Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?*

*\*: "I think people understood..."; "we were underutilized in [original location]"*

---

Excerpt 9. Management response.

---

*I: Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?*

*\*: "Most [Group Y] employees were aware and understood..."; "the site was underutilized"*

---

Excerpt 10. Staff response.

---

*I: Were you happy in [original location]? Why?*

*\*: "I was happy in [original location] because it was close to home, and family."*

---

#### 5.4.2.5. Validation

The validation stage seeks to move beyond just understanding the new concept but also recognizing how the new concept can solve some problems recognized earlier in the conceptual change process. The Group Y employees that were interviewed did not mention

any Group Y-specific benefits as a result of the move (Excerpt 11 and Excerpt 12). One manager and one staff member did respond positively, however. One manager mentioned that he believed most employees understood how the move would benefit the technology company as a whole (Excerpt 13). The staff member said that the move benefited her personal life as well (Excerpt 14), although other responses in her interview suggest she is not entirely satisfied with the new location's impact on her life (Excerpt 15).

Excerpt 11. Staff response.

---

*I: Did most people feel that the move would help eliminate some issues with [Group Y]? Why?*

*\*: "No. I think everyone felt like moving to [new location] was going to add issues."*

---

Excerpt 12. Management response.

---

*I: Did most people feel that the move would help eliminate some issues with [Group Y]? Why?*

*\*: "No. Most felt that it would create issues, knowing that space was limited in [new location]."*

---

Excerpt 13. Management response.

---

*I: Did most people feel that the move would help eliminate some issues with [the technology company] as a whole? Why?*

*\*: "Yes, most employees knew the reason for the move was to alleviate the burden of cost to an underutilized site."*

---

Excerpt 14. Staff response.

---

*I: "With some of the issues with being located in [original location], did people feel positive about the move that it was going to result in some benefit for [Group Y], personally, or [the technology company] as a whole?"*

*\*: "I think it is a positive move for myself and also for [the technology company] as a whole it was a better move."*

---

## Excerpt 15. Staff response.

---

*I: “What were your personal thoughts/feelings about the move?”*

*\*: “Well, it’s kind of cumbersome because I go home every weekend, so I live in kind of temporary housing here. So I live a temporary life...”*

---

## 5.4.2.6. Transfer

The transfer stage of conceptual change focuses on experiencing a concept in application. For Group Y, this occurred in the period following the move. Both staff and management appear to agree on the impact of the move on both Group Y employees’ personal lives (Excerpt 16 and Excerpt 17) as well as business processes (Excerpt 18 and Excerpt 19). The move was a challenge for employees because they had to find new housing and learn a new locale. Business processes also suffered following the move. Although the manager quoted in Excerpt 19 identifies more specific business process challenges, the staff employee quoted in Excerpt 18 expresses similar sentiments.

## Excerpt 16. Staff response.

---

*I: Were you able to see the impact the move had on your colleagues?*

*\*: “Yes. I think a lot of people struggled with the move.”*

---

## Excerpt 17. Management response.

---

*I: Were you able to see the impact the move had on your colleagues?*

*\*: “Yes, from personal impacts of having to sell homes, look for a new place to live...to where the best places to shop...”*

---

## Excerpt 18. Staff response.

---

*I: Were you able to see the impact the move had on [Group Y] business processes?  
How did it impact them?*

*\*: "I personally feel like everything got all sorts of messed up from the move. ...trying to keep three different sites up and running smoothly was difficult."*

---

## Excerpt 19. Management response.

---

*I: Were you able to see the impact the move had on [Group Y] business processes?  
How did it impact them?*

*\*: "[The move] forced us to change some of the business processes because we were no long collocated with our customers and that required more processes around connections and flows."*

---

In keeping with the Rasmussen Socio-technical Framework, when asked about the planning and implementation of the move, management and staff appeared to have different perspectives. Both managers felt that Group Y employees were involved with the move (Excerpt 20). One manager mentioned that employees were assigned to teams that had to report out in weekly progress reports about equipment moves, headcount moves, etc. Excerpt 21 contradicts this sentiment, in which one of the staff-level individuals said that only certain people were involved with the move. This suggests there may have been a lack of communication between management and staff during the move. Even if all staff was involved at some level, staff did not necessarily feel it was sufficient.

## Excerpt 20. Management response.

---

*I: Would you say most people felt they were involved in the implementation of the move?*

*\*: "I think most people were involved or felt involved in the move."*

---

## Excerpt 21. Staff response.

---

*I: Would you say most people felt they were involved in the implementation of the move?*

*\*: "No. Managers only wanted certain people involved with anything to do with the move."*

---

## **5.5. Conclusion**

Based on the analysis through the lens of the Conceptual Change Model, the Group Y move could be considered a failure. Neither staff nor management was satisfied with the move and many employees left the company as a result. However, the move was technically successful, with on-time-delivery requirements being met and quality reaching satisfactory levels. This highlights a key aspect of organizational change. It is imperative that both the human and technical aspects of a project are satisfied. The study of Group Y identified numerous concerns from both management and staff, including identifying new schools for children, selling and purchasing homes, and continuing to maintain consistent Group Y business processes. Much of this could be attributed to the nature of the project, where vice president-level management made the decision to relocate Group Y with minimal input from Group Y managers or staff.

Key variations were also identified between staff and management viewpoints of the change, particularly around employee understanding and knowledge of the move. In any change project, it is important that management is as transparent with information as possible. In the case of Group Y, management seems to have believed this was achieved, although staff has a different view. This pinpoints a need for further research to understand how management can best gauge employees' understanding of a project and ensure

information is being shared appropriately. This could support conceptual change and improve the chances of overall project success.

It should be noted that conceptual change in an organizational change is different from conceptual change in education because, often, an individual's preconceptions are not necessarily incorrect. Instead, management may be trying to implement a new system which would require employees to forgo the use of a previously well-understood system. This may be where the conceptual change model requires modification. As argued by Kuhn (1996), a previous paradigm must often be modified to fit a new context. In the case of conceptual change in organizational change, dissatisfaction may be impossible to achieve if people are happy. Instead, more focus should be placed on the reasons why a change is being implemented, rather than why the previous system is incorrect.

This research is limited because interviews were conducted approximately a year after the completion of the move. Both staff and management may have forgotten certain aspects of the move that could have impacted the interview results. Furthermore, this research is limited in the number of participants selected for interviews. Further research could expand on the findings presented above by interviewing more Group Y employees as well as understanding the perspective of the vice president who first announced the move. To support the understanding and development of the Conceptual Change Model in application to organizational change, similar case studies could be completed. Particularly, it would be interesting to identify successful organizational change projects – both from the human and technical aspects – to analyze in a similar fashion.

## 6. CONCLUSIONS AND FUTURE WORK

### 6.1. Summary

The application of conceptual change to organizational change projects is relatively limited. Although a few authors have focused on micro-level change in organizational change projects (e.g. Judge et al., 1999; Mazur, McCreery, & Rothenberg, 2012), there is no apparent comprehensive framework for achieving conceptual change during organizational change. There remains an opportunity to build on the literature base focused on organizational change, by identifying how conceptual change could be further adapted.

Presently, most of the conceptual change literature focuses on fields like education and psychology. Modern methods that seek to achieve top-down organizational change appear to be insufficient based on the common understanding that 70% of organizational change projects are unsuccessful (Ashkenas, 2013; Burnes & Jackson, 2011). This thesis has presented a novel approach to adapting conceptual change methods proposed in the education literature to support a continuous improvement mindset and aiding in the successful implementation of change. Additionally, it clearly defined how individuals define success in a change project to better identify when a project has been successful.

This study includes: (a) a literature review of organizational change, conceptual change, and lean manufacturing; (b) an investigation of the impact of Kaizen event success factors in organizational change projects; (c) an analysis of varying definitions of success in change projects; (d) the identification of key variations in perception of change projects between individuals at staff, management, and company levels of an organization; (e) the identification of key variations in perception of change projects between industry

practitioners and academic professionals; (f) the identification of change project success factors; (g) the development of the Conceptual Change Model to be applied during organizational change projects; and (h) an initial case study to support the description of the Conceptual Change Model. The results will help managers implement successful changes by achieving buy-in and acceptance of new concepts. Additionally, the results will support researchers in further developing methods to implement change that will be more successful than traditional, top-down approaches.

## **6.2. Conclusions**

Challenges often arise during organizational change initiatives due to negative responses of personnel (Judge et al., 1999). This study provides a methodology to minimize these challenges by achieving greater understanding and acceptance of new concepts by employees. The first manuscript (Chapter 4) identified how successful organizational change projects are specified by individuals at different levels of an organization, as well as researchers. Results pinpoint some key variations in how success is defined by different groups. Individuals at the company level of an organization appear to focus more on clear metrics (e.g. *financial health*) and overall *goal satisfaction*, while individuals at the staff level focus more on process-level factors like *performance improvement* and *customer/employee well-being*. Individuals at the management level tend to mention both metrics and process-level factors but did not mention them at the frequency of either company or staff-level individuals.

Variations in definitions of change project success are also present between industry practitioners and academic professionals. Variations are primarily seen for the

definitions *minimal disruption*, *goal satisfaction*, and *performance improvement*. *Minimal disruption* and *performance improvement* were mentioned more often by industry practitioners, while *goal satisfaction* was mentioned more often by academic professionals. These variations in the definition of success suggest that there may be a disconnect between industry and academia. One of academia's primary purposes is to support the implementation of new findings in industry applications (Etzkowitz et al., 1998; Lacombe et al., 2013). It is important that academic professionals seek to fully understand industry concerns and viewpoints. This will help researchers identify future research avenues that will have a greater impact on industry.

In addition to defining change project success, the first manuscript sought to determine the impact of Kaizen event success factors on organizational change projects. The six factors studied were found to play an important role in the success of change projects. Furthermore, variations in viewpoints between individuals at different Rasmussen socio-technical levels and individuals in academia and industry provide insight into developing further research to benefit the success of change projects. Overall, findings from the first manuscript help build on the current organizational change literature by filling the gaps identified in Table 26.

Table 26. Fulfilment of gaps in the literature from Chapter 4 results.

<b>Literature Gap</b>	<b>New Findings</b>
Lack of understanding of how successful change projects are characterized	Common themes used to describe successful change projects are identified and discussed.
Lack of studies identifying variations in definitions of value across job roles	Definitions of value vary considerably depending on an individual's job role.
Lack of an overarching study that reviews the impact of all change project success factors mentioned in the literature.	Identification of six factors that impact change project success.

The second manuscript (Chapter 5) developed a model to aid managers in achieving conceptual change among employees. The model supports the belief that changes at the micro-level (or individual level) will impact the success of an organization-wide change. The model was developed based on a thorough literature review of the education and psychology literature studying conceptual change. The Conceptual Change Model was then further described through the example of an organization relocation of an industry partner. This helped identify stages of conceptual change that occurred during the change, as well as those that did not. Findings from the second manuscript help build on the organizational change literature by filling the gaps identified in Table 27.

Table 27. Fulfilment of gaps in the literature from Chapter 5 results.

<b>Literature Gap</b>	<b>New Findings</b>
Lack of a prescriptive model of conceptual change through the lens of organizational change	Development of a six-stage conceptual change model
Few case studies focused on conceptual change outside of the education and psychology literature	Analysis of a case study through the lens of the Conceptual Change Model

### 6.3. Implications for Engineering Managers

This research proposed a prescriptive model for managers to initiate conceptual change in their employees to support organizational change initiatives. Although the Conceptual Change Model presented in Chapter 5 proposes a novel approach in the change management literature to achieve micro-level change, there remains further opportunity to expand the prescriptive nature of the model. The following section outlines specific implementation methods that managers could utilize during each of the stages of the Conceptual Change Model.

Stage 1.       Preparation: The goal of the preparation stage is to identify potential factors that could impact the success of conceptual change. As a manager seeking to initiate conceptual change, this stage is ultimately utilized to manage expectations. For example, an employee who has been in the same position for 20 years is less likely to exhibit conceptual change in one training session in comparison to an employee who was recently hired. It is imperative that managers make the effort to recognize potential challenges that could hinder the success of conceptual change. Specific factors and characteristics of the trainees and training environment are presented in Figure 10 in Section 5.3.1.

Stage 2.       Preconception Awareness: The goal of the preconception awareness stage is to ensure trainees recognize their current views of the concept being discussed. Without identifying one's own views of the concept at hand, it will be difficult to continue with the next stages of conceptual change. The role of a manager in this stage is to ensure all individuals in the training session understand their current views of the

concept being discussed. Some individuals may be more likely to share their preconceptions than others, but it is imperative that all individuals express their views. The initial assessment presented in Table 24 in Section 5.3.5 is provided to determine if each individual is aware of his or her preconceptions.

Stage 3.       Generate Meaningful Conflict: The goal of the “generate meaningful conflict” stage is to identify the shortfalls in trainees’ preconceptions. Although trainees’ preconceptions may not be inherently incorrect, it is likely there are some aspects that could be improved. As a manager it is imperative to ensure trainees recognize the negative aspects of trainee preconceptions. This could be accomplished in a group discussion setting where current issues with the system are discussed. This will ideally lead to a list of shortcomings of the current system that could potentially be improved.

Stage 4.       New Concept Introduction: The goal of the new concept introduction stage is to introduce the underlying concepts of the new system being implemented. As a manager, attention should be focused on understanding the concept than on how it would be implemented. This is a key aspect of the Conceptual Change Model. The focus on understanding will help limit the potential of casting initial doubts before completely understanding how the new system works. This is the most important role of a manager in a conceptual change-training scenario. Discussion should be kept purely academic with little focus on how the new system will affect individual’s jobs or the current system.

Stage 5.       Validation: The goal of the validation stage is to recognize how the new concept remedies the problems identified with the current concept in the “generate

meaningful conflict” stage. In the validation stage, the manager should lead the discussion by referencing each of the issues previously identified with the current concept. Trainees should then identify how the new system solves those issues. If trainees are unable to recognize how the issues are resolved, the manager should make suggestions or ask questions that spur meaningful conflict. In this stage, the goal of “meaningful conflict” is to highlight relative benefits of the new system. However, the main role of the manager is to continue the discussion, so lecturing should be avoided. Before beginning the validation stage, a manager should be familiar with the value definition results presented in Chapter 4. It is particularly important to frame the new concept in light of trainees’ personal value definitions. For staff-level individuals, these definitions are often focused on personal satisfaction and job improvements. When identifying how the new concept remedies the issues identified with the previous system, a manager should focus on how the new system improves individual satisfaction and job performance. This focus on personal currencies will help achieve buy-in of employees.

Stage 6.        Transfer: The goal of the transfer stage is to identify how the new concept applies to trainees’ day-to-day lives. This stage represents an opportunity for a manager to receive feedback from employees. For example, trainees may be given a week to apply the new system. This trial period could be followed by a discussion session in which individuals express positive and negative aspects of the new system. The manager could then take this feedback and improve the system by directly involving the trainees who will use the system on a day-to-day basis. Employee involvement

during change projects has been shown to impact the success of change projects (Bhatti, 2005).

### **6.1. Future Research Opportunities**

The first manuscript is based on results from 67 survey responses. Future work will expand this sample size to further support the findings presented in Chapter 4. Similarly, the second manuscript case study is based on four interviews. In future case studies, the researchers suggest interviewing more individuals as well as individuals from more levels within the organization. This will provide a greater understanding of the case study and identify possible aspects and viewpoints of the organizational change that were not recognized in the present research.

The findings from the first manuscript are based on organizational change projects of a survey participant's choosing. Although this allows the researchers to gather larger data sets, it limits the conclusions that can be drawn from the study. Future research could identify specific change projects to study. Findings could then be used to identify variations in perception of success based on an individual's job level. Furthermore, the researchers could be more confident in the data since all descriptive data (e.g. industry classification) would not be self-identified.

Finally, further studies seeking to identify the impact of the Conceptual Change Model are needed. Follow-up studies will begin to collect more quantitative results to specify the level of conceptual change achieved during both successful and unsuccessful change projects. Moreover, application-based studies will be needed in the future, in which researchers follow a change project from beginning to end while the Conceptual Change

Model is implemented. These studies should be completed in a variety of industries and locales to determine the universality of the model.

## **6.2. Weaknesses and Improvement Opportunities**

This research is based on 67 survey responses (Chapter 4) and four interviews (Chapter 5). Future studies should seek to expand sample sizes for both studies to further support conclusions. Furthermore, sample sizes for each group studied (staff, management, company, industry practitioners, and academic professionals) should be increased to achieve sufficient statistical validity.

Survey results lack a considerable amount of background knowledge regarding the change project identified by the survey participants, as well as the participant's background. Additionally, survey participants are self-identified, which allows for some error to be introduced. Future work could study specific change projects as was done with the case study relocation project. Finally, combining the two study strategies (survey and interviews) could give greater depth to any analysis focused on conceptual change during an organizational change initiative.

**BIBLIOGRAPHY**

- Adbo, K., & Taber, K. S. (2014). Developing an understanding of chemistry: A case study of one Swedish student's rich conceptualisation for making sense of upper secondary school chemistry. *International Journal of Science Education*, 36(7), 1107–1136.
- Appleton, K. (2013). Elementary Science Teaching. In *Handbook of Research on Science Education*. Routledge.
- Arbab Kash, B., Spaulding, A., Johnson, C. E., & Gamm, L. (2014). Success factors for strategic change initiatives: A qualitative study of healthcare administrators' perspectives. *Journal of Healthcare Management*, 59(1), 65–81.
- Argyris, C. (1976). Single-loop and double-loop models in research on decision making. *Administrative Science Quarterly*, 21(3), 363–375.
- Argyris, C., & Schon, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.
- Ashkenas, R. (2013, April). Change Management Needs to Change. *Harvard Business Review*. Retrieved from <https://hbr.org/2013/04/change-management-needs-to-cha>
- Badurdeen, F., & Gregory, B. (2012, February). The Softer Side of Lean. *Industrial Engineer*, 44(2), 49–53.
- Baker, P. (2002, October). Why is Lean so Far Off? *Works Management*, 55(10), 26–29.
- Barker, J. A. (2015, February). A Look Back: Futurist Joel Barker on the Challenge of Change. *Industry Week*. Retrieved from <http://www.industryweek.com/leadership/look-back-futurist-joel-barker-challenge-change>
- Bateman, N., Hines, P., & Lucey, J. (2004). Achieving pace and sustainability in a major lean transition. *Management Services*, 48(9), 8–12.
- Beer, M., & Nohria, N. (2000, June). Cracking the code of change. *Harvard Business Review*, 15–22.
- Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International Journal of Project Management*, 14(3), 141–151.
- Beruvides, M., & Omachonu, V. (2001). A Systematic-Statistical Approach for Managing Research Information: The State-of-the-Art-Matrix Analysis. In *Industrial Engineering Research Conference Proceedings*. Dallas, Texas.

- Bhasin, S. (2008). Lean and Performance Measurement. *Journal of Manufacturing Technology Management*, 19(5), 670–684.
- Bhasin, S. (2012). An appropriate change strategy for lean success. *Management Decision*, 50(3), 439–458.
- Bhatti, T. R. (2005). Critical success factors for the implementation of enterprise resource planning. In *The Second International Conference on Innovation in Information Technology* (pp. 26–28). Dubai, UAE.
- Blanchard, D. (2007, September). Census of U.S. manufacturers -- lean green and low cost. *Industry Week*.
- Bobko, P., Roth, P. L., & Buster, M. A. (2007). The usefulness of unit weights in creating composite scores: A literature review, application to content validity, and meta-analysis. *Organizational Research Methods*, 10(4), 689–709.
- Bradburn, N., Sudman, S., & Wansink, B. (2004). *Asking questions: The definitive guide to questionnaire design - For market research, political polls, and social and health questionnaires*. San Francisco: Jossey-Bass.
- Burnes, B. (1996). No Such Thing as ... a “One Best Way” to Manage Organizational Change. *Management Decision*, 34(10), 11–18.
- Burnes, B. (2009). *Managing Change: A Strategic Approach to Organizational Dynamics* (5th ed.). Harlow, England: Pearson Education.
- Burnes, B. (2011). Why does change fail, and what can we do about it? *Journal of Change Management*, 11(4), 445–450.
- Burnes, B., & Jackson, P. (2011). Success and failure in organizational change: An exploration of the role of values. *Journal of Change Management*, 11(2), 133–162.
- Carbonell, P., Rodríguez-Escudero, A. I., & Pujari, D. (2009). Customer involvement in new service development: An examination of antecedents and outcomes. *Journal of Product Innovation Management*, 26(5), 536–550.
- Carrejo, D. J., & Reinhartz, J. (2014). Facilitating Conceptual Change Through Modeling in the Middle School Science Classroom. *Middle School Journal*, 46(2), 10–19.
- Chi, C. G., & Gursoy, D. (2009). Employee satisfaction, customer satisfaction, and financial performance: An empirical examination. *International Journal of Hospitality Management*, 28(2), 245–253.
- Chidester, T. R., & Grigsby, W. C. (1984). A Meta-Analysis of the Goal Setting-Performance Literature. *Academy of Management Proceedings*, 1984(1), 202–206.

- Choothian, W. (2014, November 24). *A study of the application of lean practices to new product development processes* (Dissertation). Oregon State University, Corvallis, OR.
- Chrusciel, D., & Field, D. W. (2006). Success Factors in Dealing With Significant Change in an Organization. *Business Process Management Journal*, 12(4), 503–516.
- Combe, M. (2014, July). Change readiness: Focusing change management where it counts. Project Management Institute. Retrieved from <http://www.pmi.org/learning/~media/PDF/Knowledge%20Center/Focusing-Change-Management-Where-it-Counts.ashx>
- Cope, D. G. (2014). Computer-Assisted Qualitative Data Analysis Software. *Oncology Nursing Forum*, 41(3), 322–323.
- Crawford, M. L. (2001). *Teaching Contextually: Research, Rationale, and Techniques for Improving Student Motivation and Achievement in Mathematics and Science*. Waco, TX: Center for Occupational Research and Development.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297–334.
- Crute, V., Ward, Y., Brown, S., & Graves, A. (2003). Implementing lean in aerospace—challenging the assumptions and understanding the challenges. *Technovation*, 23(12), 917–928.
- Dahlsten, F. (2004). Hollywood wives revisited: A study of customer involvement in the XC90 project at Volvo cars. *European Journal of Innovation Management*, 7(2), 141–149.
- Dallavalle, C. (1991). Managing During Organizational Change. *Journal of Management in Engineering*, 7(4), 357–364.
- Dawson, C. (2014). Towards a conceptual profile: rethinking conceptual mediation in the light of recent cognitive and neuroscientific findings. *Research in Science Education*, 44(3), 389–414.
- de Araujo, C. C. S. (2015). IT project manager competencies and IT project success: A qualitative study. *Organisational Project Management*, 2(1), 1–14.
- de Winter, J. C. F. (2013). Using the student's T-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation*, 18(10).
- DeVellis, R. F. (1991). *Scale development: Theory and application*. Newbury Park, CA: Sage Publishing.

- Dickmeyer, L. (2015, May). Manufacturing executives top fear: Communication with plant floor workers. *Manufacturing Engineering*. Retrieved from <http://www.sme.org/MEMagazine/Article.aspx?id=8589934592&taxid=1415>
- Duit, R., & Treagust, D. (2003). Conceptual change: A powerful framework for improving science teaching and learning. *International Journal of Science Education*, 25(6), 671–688.
- Effective. (2016). *Merriam-Webster*. Retrieved from Merriam-Webster.com
- Enders, C. K. (2004). The impact of missing data on sample reliability estimates: Implications for reliability reporting practices. *Educational and Psychological Measurement*, 64(3), 419–436.
- Erez, M., & Gati, E. (2004). A Dynamic, Multi-Level Model of Culture: From the Micro Level of the Individual to the Macro Level of a Global Culture. *Applied Psychology*, 53(4), 583–598.
- Etzkowitz, H., Webster, A., & Healey, P. (1998). *Capitalizing knowledge: New intersections of industry and academia*. SUNY Press.
- Farris, J. A. (2006, December 18). *An empirical investigation of kaizen event effectiveness: Outcomes and critical success factors* (Dissertation). Virginia Polytechnic Institute and State University, Blacksburg, Virginia.
- Farris, J. A., Van Aken, E. M., Doolen, T. L., & Worley, J. (2008). Learning from less successful kaizen events: A case study. *Engineering Management Journal*, 20(3), 10–20.
- Fernandez, S., & Rainey, H. G. (2006). Managing Successful Organizational Change in the Public Sector. *Public Administration Review*, 66(2), 168–176.
- Fiorella, L., & Mayer, R. E. (2013). The relative benefits of learning by teaching and teaching expectancy. *Contemporary Educational Psychology*, 38(4), 281–288.
- Ford, M. W. (2001). Car Launch: The Human Side Of Managing Change. *Journal of Engineering and Technology Management*, 18(1), 93–96.
- Fujisue, K. (1998). Promotion of academia-industry cooperation in Japan: Establishing the “law of promoting technology transfer from university to industry” in Japan. *Technovation*, 18(6–7), 371–381.
- García, J., Rivera, D., & Iniesta, A. (2013). Critical success factors for kaizen implementation in manufacturing industries in Mexico. *International Journal of Advanced Manufacturing Technology*, 68(1–4), 537–545.
- Garland, R. (1991). The mid-point on a rating scale: Is it desirable? *Marketing Bulletin*, 2(1), 66–70.

- Geoghegan, L., & Dulewicz, V. (2008). Do project managers' leadership competencies contribute to project success? *Project Management Journal*, 39(4), 58–67.
- Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism*, 10(2), 486–489.
- Gill, R. (2002). Change Management—or Change Leadership? *Journal of Change Management*, 3(4), 307–318.
- Glover, W. J., Farris, J. A., Van Aken, E. M., & Doolen, T. L. (2011). Critical success factors for the sustainability of kaizen event human resource outcomes: An empirical study. *International Journal of Production Economics*, 132(2), 197–213.
- Goldstein, I. (1980). Training in work organizations. *Annual Review of Psychology*, 31, 229–272.
- Goldstein, N., Cialdini, R., & Griskevicius, V. (2008). A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels. *Journal of Consumer Research*, 35(3), 472–482.
- Greenwood, J. (1998). The role of reflection in single and double loop learning. *Journal of Advanced Nursing*, 27(5), 1048–1053.
- Hammer, M., & Champy, J. (1993). *Reengineering the corporation: A manifesto for business revolution*. Harper Business.
- Harker, M. (1996). Managing the Company Turnaround Process: A Case Study of the Australian Heavy Engineering Industry. *Journal of Engineering and Technology Management*, 13, 245–261.
- Harris, G., Stone, K. B., Mayeshiba, T., Componation, P. J., & Farrington, P. A. (2014). Transitioning from Teaching Lean Tools To Teaching Lean Transformation. *Journal of Enterprise Transformation*, 4(3), 191–204.
- Harvard Business Review Analytic Services. (2013). *The impact of employee engagement on performance*.
- Hayes, J. (2014). *The Theory and Practice of Change Management*. Palgrave Macmillan.
- Hendrickx, H. H. M. (2015). Business Architect: A Critical Role in Enterprise Transformation. *Journal of Enterprise Transformation*, 5(1), 1–29.
- Hennessey, M. G. (1993). Students' Ideas About Their Conceptualization: Their Elicitation Through Instruction. Presented at the Annual Meeting of the National Association for Research in Science Teaching, Atlanta, GA. Retrieved from <http://eric.ed.gov/?id=ED361209>

- Herkert, J. (2005). Ways of thinking about and teaching ethical problem solving: Microethics and macroethics in engineering. *Science and Engineering Ethics, 11*(3), 373–385.
- Hewson, P. W. (1992). Conceptual Change in Science Teaching and Teacher Education (pp. 1–15). Presented at the Research and Curriculum Development in Science Teaching, Madrid, Spain: National Center for Educational Research, Documentation, and Assessment.
- Hille, J., & Eseonu, C. (2015a). State-of-the-Art Review of Lean Product Development Practices and Their Impact on Project Success. In *Proceedings of the American Society for Engineering Management 2015 International Conference*. Indianapolis, IN.
- Hille, J., & Eseonu, C. (2015b). State-of-the-art review of training and its applicability to lean. Presented at the Industrial and Systems Engineering Research Conference, Nashville, TN.
- Holahan, P. J., Aronson, Z. H., Jurkat, M. P., & Schoorman, F. D. (2004). Implementing Computer Technology: A Multiorganizational Test of Klein and Sorra’s Model. *Journal of Engineering and Technology Management, 21*(1–2), 31–50.
- Holman, R., Glas, C. A., Lindeboom, R., Zwinderman Aeilko H, & de Haan, R. J. (2004). Practical methods for dealing with “not applicable” item responses in the AMC linear disability score project. *Health and Quality of Life Outcomes, 29*(2).
- Huovila, P., & Seren, K.-J. (1998). Customer-oriented design methods for construction projects. *Journal of Engineering Design, 9*(3), 225–238.
- Jackson, H. L. S. K. (2005, October). The Hard Side of Change Management. Retrieved June 9, 2015, from <https://hbr.org/2005/10/the-hard-side-of-change-management>
- Jadva, V., Freeman, T., Tranfield, E., & Golombok, S. (2015). “Friendly allies in raising a child”: A survey of men and women seeking elective co-parenting arrangements via an online connection website. *Human Reproduction, 30*(8), 1896–1906.
- Jarrar, Y. F., Al-Mudimigh, A., & Zairi, M. (2000). ERP implementation critical success factors-the role and impact of business process management. In *Proceedings of the 2000 IEEE International Conference on Management of Innovation and Technology* (pp. 122–127). Singapore.
- Jiao, H., Alon, I., Koo, C. K., & Cui, Y. (2013). When Should Organizational Change be Implemented? The Moderating Effect of Environmental Dynamism Between Dynamic Capabilities and New Venture Performance. *Journal of Engineering and Technology Management, 30*(2), 188–205.

- 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(2), 361–386.
- Judge, T. A., Thoresen, C. J., Pucik, V., & Welbourne, T. M. (1999). Managerial Coping With Organizational Change: A Dispositional Perspective. *Journal of Applied Psychology*, 84(1), 107–122.
- Kahneman, D., & Lovallo, D. (1993). Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management Science*, 39(1), 17–31.
- Kanter, R. M., Stein, B. A., & Jick, T. D. (2003). *Challenge of Organizational Change: How Companies Experience It And Leaders Guide It*. New York, NY: Simon and Schuster.
- Kirkpatrick, D. (1975). *Evaluating training programs* (1st ed.). Alexandria, VA: ASTD.
- Kirkpatrick, D. (1996, January). Great ideas revisited. *Training & Development*, 50(1), 54–59.
- Komodromos, M., & Halkias, D. (2015). *Organizational justice during strategic change: The employee's perspective*. Burlington, VT: Gower Publishing Company.
- Kotnour, T., Barton, S., Jennings, J., & Bridges, R. (1998). Understanding and leading large-scale change at the Kennedy Space Center. *Engineering Management Journal*, 10(2), 17.
- Kotnour, T., & Matkovitch, J. (1999). Establishing a Change Infrastructure Through Teams. *Engineering Management Journal*, 11(3), 25.
- Kotter, J. P. (1996). *Leading Change*. Harvard Business Press.
- Koys, D. J. (2001). The Effects of Employee Satisfaction, Organizational Citizenship Behavior, and Turnover on Organizational Effectiveness: A Unit-Level, Longitudinal Study. *Personnel Psychology*, 54(1), 101–114.
- Kuhn, T. S. (1996). Normal Science as Puzzle-solving. In *The Structure of Scientific Revolutions* (3rd ed., pp. 35–42). Chicago: The University of Chicago Press.
- Lacombe, D., Burock, S., & Meunier, F. (2013). Academia-industry partnerships: Are we ready for new models of partnership?: The point of view of the EORTC, an academic clinical cancer research organisation. *European Journal of Cancer*, 49(1), 1–7.
- Laframboise, D., Nelson, R. L., & Schmaltz, J. (2002). Managing resistance to change in workplace accommodation projects. *Journal of Facilities Management*, 1(4), 306–321.

- Lawrence, P. R. (1969, January). How to Deal With Resistance to Change. Retrieved October 1, 2015, from <https://hbr.org/1969/01/how-to-deal-with-resistance-to-change>
- Levasseur, R. E. (2010). People skills: Ensuring project success—A change management perspective. *Interfaces*, 40(2), 159–162.
- Lewin, K. (1947). Frontiers in group dynamics: concept, method and reality in social science; social equilibria and social change. *Human Relations*, 1(1), 5–41.
- Limón, M. (2001). On the cognitive conflict as an instructional strategy for conceptual change: A critical appraisal. *Learning and Instruction*, 11(4–5), 357–380.
- Lines, R. (2004). Influence of participation in strategic change: resistance, organizational commitment and change goal achievement. *Journal of Change Management*, 4(3), 193–215.
- Lippert, S. K., & Davis, M. (2006). A conceptual model integrating trust into planned change activities to enhance technology adoption behavior. *Journal of Information Science*, 32(5), 434–448.
- Long, S., & Spurlock, D. G. (2008). Motivation and stakeholder acceptance in technology-driven change management: Implications for the engineering manager. *Engineering Management Journal*, 20(2), 30–36.
- Luecke, R. (2003). *Managing Change and Transition*. Harvard Business Press.
- Lundkvist, A., & Yakhlef, A. (2004). Customer involvement in new service development: A conversational approach. *Managing Service Quality: An International Journal*, 14(2/3), 249–257.
- Machado Guimarães, C., & Crespo De Carvalho, J. (2014). Assessing Lean Deployment in Healthcare—A Critical Review and Framework. *Journal of Enterprise Transformation*, 4(1), 3–27.
- Mann, H. B., & Whitney, D. R. (1947). On a Test of Whether one of Two Random Variables is Stochastically Larger than the Other. *The Annals of Mathematical Statistics*, 18(1), 50–60.
- Martin, J., & Siehl, C. (1983). Organizational culture and counterculture: An uneasy symbiosis. *Organizational Dynamics*, 12(2), 52–64.
- Matesic, G. D. (2009). Every Step You Change: A Process of Change and Ongoing Management. *Journal of Library Administration*, 49(1/2), 35–49.
- Maurer, R. (2014a). How senior leader's behaviors affect change projects' success. *Journal for Quality & Participation*, 37(2), 1–4.

- Maurer, R. (2014b). The Influence of Senior Leaders in Successful Change. *Journal for Quality & Participation*, 37(2), 4–9.
- Mazur, L. M., McCreery, J. K., & Chen, S.-J. (2012). Quality Improvement in Hospitals: Identifying and Understanding Behaviors. *Journal of Healthcare Engineering*, 3(4), 621–648.
- Mazur, L. M., McCreery, J. K., & Rothenberg, L. (2012). Facilitating lean learning and behaviors in hospitals during the early stages of lean implementation. *Engineering Management Journal*, 24(1), 11–22.
- Mazur, L. M., Rothenberg, L., & McCreery, J. K. (2011). Measuring and understanding change recipients' buy-in during lean program implementation efforts. In *2011 Industrial Engineering Research Conference*. Reno, NV.
- McKnight, P. E., & Najab, J. (2010). Mann-Whitney U Test. In *The Corsini Encyclopedia of Psychology*. John Wiley & Sons, Inc.
- Mendenhall, A. N., Iachini, A., & Anderson-Butcher, D. (2013). Exploring stakeholder perceptions of facilitators and barriers to implementation of an expanded school improvement model. *Children & Schools*, 35(4), 225–234.
- Mirdad, W., Hille, J., & Melamed, J. (2015). Application of Resilient Systems Thinking to Sustain a Lean Organizational Culture. In *Proceedings of the American Society for Engineering Management 2015 International Annual Conference*.
- Mitchell, G. (2013). Selecting the best theory to implement planned change. *Nursing Management - UK*, 20(1), 32–37.
- Montfort, D. B., Brown, S., & Whritenour, V. (2013). Secondary Students' Conceptual Understanding of Engineering as a Field. *Journal of Pre-College Engineering Education Research*, 3(2), 1–12.
- Moran, J. W., & Brightman, B. K. (2001). Leading Organizational Change. *Career Development International*, 6(2), 111–119.
- Murray, A. (2009, April). What is the difference between management and leadership? *The Wall Street Journal*. Retrieved from <http://guides.wsj.com/management/developing-a-leadership-style/what-is-the-difference-between-management-and-leadership/>
- Nachar, N. (2008). The Mann-Whitney U: A test for assessing whether two independent samples come from the same distribution. *Tutorials in Quantitative Methods for Psychology*, 4(1), 13–20.
- Nagesh, D. S., & Thomas, S. (2015). Success factors of public funded R&D projects. *Current Science*, 108(3), 357–363.

- Nah, F. F., Lau, J. L., & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*, 7(3), 285–296.
- NAICS Association. (2016). NAICS Identification Tools. Retrieved April 5, 2016, from <http://www.naics.com/search/>
- Nasrallah, W. F., & Qawasmeh, S. J. (2009). Comparing multi-dimensional contingency fit to financial performance of organizations. *European Journal of Operational Research*, 194(3), 911–921.
- Newton, C., Teo, S. T. T., Pick, D., Yeung, M., & Salamonson, Y. (2013). Flexibility in change practices and job outcomes for nurses: exploring the role of subjective fit. *Journal of Advanced Nursing*, 69(12), 2800–2811.
- Nicolini, D. (2002). In search of “project chemistry.” *Construction Management & Economics*, 20(2), 167–177.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York, NY: McGraw-Hill.
- Nussbaum, J., & Novick, S. (1982). Alternative frameworks, conceptual conflict and accommodation: Toward a principled teaching strategy. *Instructional Science*, 11(3), 183–200.
- Oppenheim, B. W. (2004). Lean Product Development Flow. *Systems Engineering*, 7(4).
- Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, 19(3), 354–365.
- Panayides, P. (2013). Coefficient alpha: Interpret with caution. *Europe's Journal of Psychology*, 9(4), 687–696.
- Panayides, P., & Walker, M. J. (2013). Evaluating the psychometric properties of the foreign language classroom anxiety scale for Cypriot Senior High School EFL students: The Rasch measurement approach. *Europe's Journal of Psychology*, 9(3), 493–516.
- Pettigrew, A. M., Woodman, R. W., & Cameron, K. S. (2001). Studying Organizational Change and Development: Challenges for Future Research. *Academy of Management Journal*, 44(4), 697–713.
- Piaget, J. (1975). *L'e'quilibration des structures cognitives. Proble`me central du de'veloppement [The development of thought: equilibration of cognitive structures]*. Paris: PUF (Eng. trans. New York: Viking Press).
- Pinto, J. K., & Slevin, D. P. (1987). Balancing strategy and tactics in project implementation. *Sloan Management Review*, 33–41.

- Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education*, 66(2), 211–227.
- Rasmussen, J. (1997). Risk management in a dynamic society: A modelling problem. *Safety Science*, 27(2/3), 183–213.
- Razali, N. M., & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, 2(1), 21–33.
- Recht, R., & Wilderom, C. (1998). Kaizen and Culture: On the Transferability of Japanese Suggestion Systems. *International Business Review*, 7(1), 7–22.
- Rieley, J., & Clarkson, I. (2001). The Impact of Change on Performance. *Journal of Change Management*, 2(2), 160–172.
- Saad Sarhan, A. F. (2013). Barriers to Implementing Lean Construction in the UK Construction Industry. *The Built & Human Environment Review*, Volume 6, pages 1-17.
- SanAgustin, A. J. (2014). Case studies in managing change. *Information Management Journal*, 48(4), 42–44.
- Sanders, E. (2003). From User-Centered to Participatory Design Approaches. In *Design and the Social Sciences: Making Connections*. CRC Press.
- Schein, E. H. (1984). Coming to a new awareness of organizational culture. *Sloan Management Review*, 25(2).
- Schell, W. J., & Kuntz, S. W. (2013). Driving change from the middle: An exploration of the complementary roles and leadership behaviors of clinical nurse leaders and engineers in healthcare process improvement. *Engineering Management Journal*, 25(4), 33–43.
- Segovia, R. H., Jennex, M. E., & Beatty, J. (2009). Paralingual web design and trust in e-government. *International Journal of Electronic Government Research*, 5(1), 36.
- Self, D. R., & Schraeder, M. (2009). Enhancing the success of organizational change: Matching readiness strategies with sources of resistance. *Leadership & Organization Development Journal*, 30(2), 167–182.
- Shah, M. H., & Siddiqui, F. A. (2006). Organisational critical success factors in adoption of e-banking at the Woolwich bank. *International Journal of Information Management*, 26(6), 442–456.
- Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality. *Biometrika*, 52(3/4), 591–611.

- Shenge, N. (2014). Training evaluation: Process, benefits, and issues. *IFE Psychologia: An International Journal*, 22(1), 50–58.
- Sinatra, G. M., & Pintrich, P. R. (2003). The role of intentions in conceptual change learning. In G. M. Sinatra & P. R. Pintrich (Eds.), *Intentional Conceptual Change* (pp. 1–18). L. Erlbaum.
- Sinsky, C. A., Willard-Grace, R., Schutzbank, A. M., Sinsky, T. A., Margolius, D., & Bodenheimer, T. (2013). In Search of joy in practice: A report of 23 high-functioning primary care practices. *Annals of Family Medicine*, 11(3), 272–278.
- Smidt, A., Balandin, S., Sigafos, J., & Reed, V. (2009). The Kirkpatrick model: A useful tool for evaluating training outcomes. *Journal of Intellectual & Developmental Disability*, 34(3), 266–274.
- Stelzer, D., & Mellis, W. (1999). Success factors of organizational change in software process improvement. *Software Process Improvement and Practice*, 4(4).
- Strebel, P. (1996, June). Why do employees resist change? *Harvard Business Review*.
- Strike, K. A., & Posner, G. J. (1992). A Revisionist Theory of Conceptual Change. In *Philosophy of Science, Cognitive Psychology, and Educational Theory and Practice* (pp. 147–176). SUNY Press.
- Sumner, M. (1999). Critical success factors in enterprise wide information management systems projects. In *Proceedings of the 1999 ACM SIGCPR Conference on Computer Personnel Research* (pp. 297–303). New York, NY, USA: ACM.
- Todnem, R. (2005). Organisational Change Management: A Critical Review. *Journal of Change Management*, 5(4), 369–380.
- Trauer, T., & Mackinnon, A. (2001). Why are we weighting? The role of importance ratings in quality of life measurement. *Quality of Life Research*, 10(7), 579–585.
- Trevio, L. K., den Nieuwenboer, N. A., & Kish-Gephart, J. J. (2014). (Un)Ethical Behavior in Organizations. *Annual Review of Psychology*, 65, 635–660.
- Tuner, J. R., & Müller, R. (2005). The project manager's leadership style as a factor on projects: A literature review. *Project Management Journal*, 36(2), 49–61.
- Ültay, N., Durukan, Ü. G., & Ültay, E. (2015). Evaluation of the Effectiveness of Conceptual Change Texts in the REACT Strategy. *Chemistry Education Research and Practice*, 16(1), 22–38.
- U.S. Bureau of Labor Statistics. (2015). United States labor force statistics seasonally adjusted (in thousands). Retrieved from <http://www.dlt.ri.gov/lmi/laus/us/usadj.htm>

- Wanberg, C. R., & Banas, J. T. (2000). Predictors and outcomes of openness to changes in a reorganizing workplace. *Journal of Applied Psychology*, 85(1), 132–142.
- Watkins, M. (2013, May 15). What Is Organizational Culture? And Why Should We Care? Retrieved October 1, 2015, from <https://hbr.org/2013/05/what-is-organizational-culture>
- Weems, G. H., & Onwuegbuzie, A. J. (2001). The impact of midpoint responses and reverse coding on survey data. *Measurement and Evaluation in Counseling and Development*, 34(3).
- White, D. J. (2009, December 1). *The effect of youth participatory evaluation and youth community action training on positive youth development* (Dissertation). Oregon State University, Corvallis, OR.
- White, S. (2007). Critical Success Factors For E-Learning and Institutional Change—Some Organisational Perspectives on Campus-Wide E-Learning. *British Journal of Educational Technology*, 38(5), 840–850.
- Wiersema, M. F., & Bantel, K. A. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal*, 35(1), 91–121.
- Winklhofer, H. (2002). Information systems project management during organizational change. *Engineering Management Journal*, 14(2), 33–37.
- Wiseman, L. (2011, May 31). *Evaluating the Effectiveness and Efficiency of Continuous Improvement Training*. Oregon State University, Corvallis, OR.
- Wiseman, L., Eseonu, C., & Doolen, T. (2014). Development of a framework for evaluating continuous improvement training within the context of enterprise transformation. *Journal of Enterprise Transformation*, 4(3), 251–271.
- W.K. Kellogg Foundation. (2004). *Logic Model Development Guide* (p. 72). Battle Creek, MI: W.K. Kellogg Foundation.
- Womack, J. P., & Jones, D. T. (1996). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Simon and Schuster.
- Womack, J. P., Jones, D. T., & Roos, D. (1990). *The Machine That Changed the World*. New York, NY: Rawson Associates.
- Wong, K. Y. (2005). Critical success factors for implementing knowledge management in small and medium enterprises. *Industrial Management & Data Systems*, 105(3), 261–279.
- Worley, J. M., & Doolen, T. L. (2006). The role of communication and management support in a lean manufacturing implementation. *Management Decision*, 44(2), 228–245.

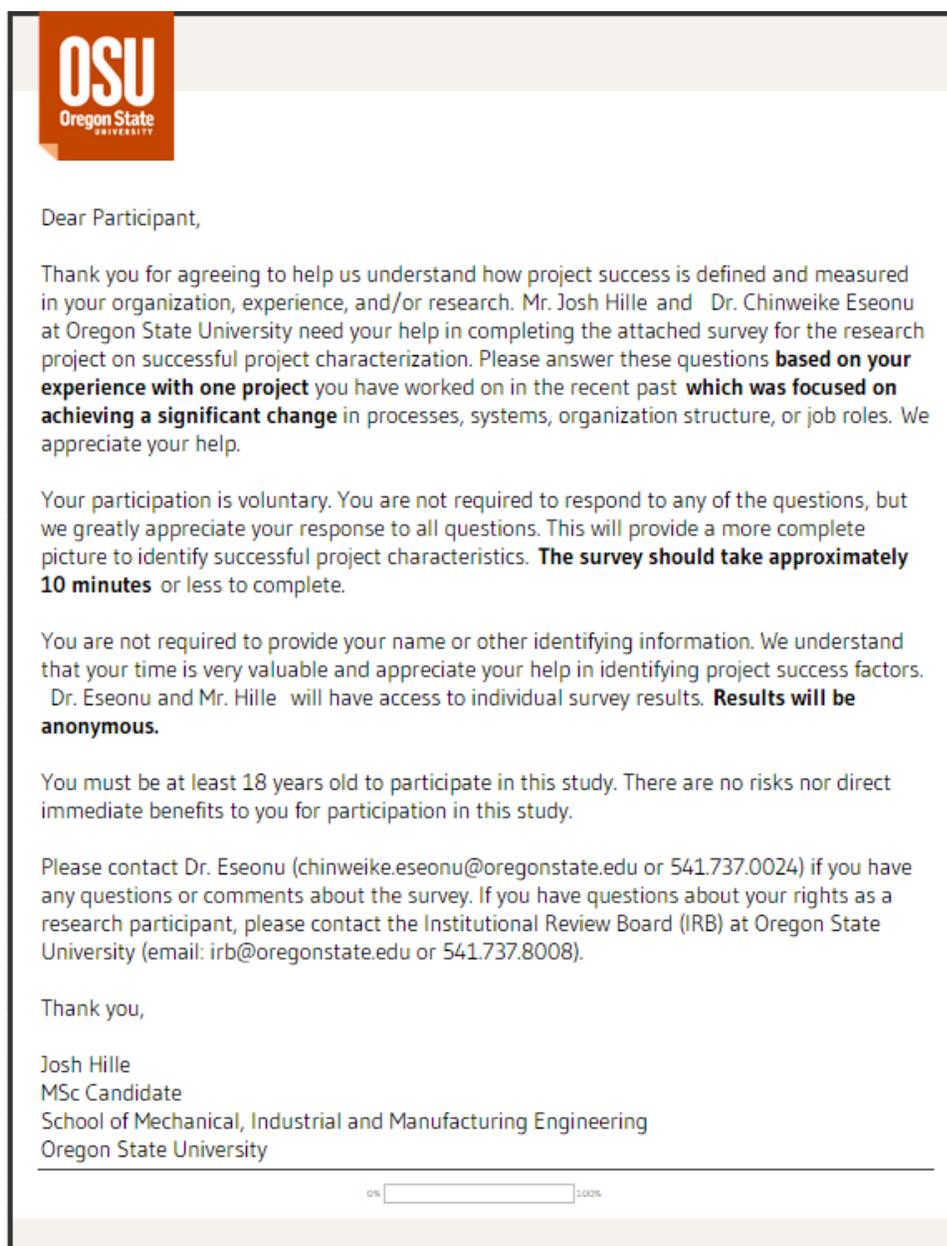
- Yu, M.-C. (2009). Employees' perception of organizational change: The mediating effects of stress management strategies. *Public Personnel Management, 38*(1), 17–32.
- Yu, Z., Serban, N., & Rouse, W. (2013). The Demographics of Change: Enterprise Characteristics and Behaviors that Influence Transformation. *Journal of Enterprise Transformation, 3*(4), 285–306.
- Zarbo, R. J. (2012). Creating and Sustaining a Lean Culture of Continuous Process Improvement. *American Journal of Clinical Pathology, 138*(3), 321–326.
- Zeira, Y., & Avedisian, J. (1989). Organizational planning change: Assessing the chances for success, *17*(4), 31–45.
- Zhang, Z., & Yuan, K.-H. (2015). Robust coefficients alpha and omega and confidence intervals with outlying observations and missing data: Methods and software. *Educational and Psychological Measurement, 1–25*.

**APPENDICES**

### **Appendix A: Survey 1**

The following figures (Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, and Figure 14) present the survey which was sent to both academic professionals and industry practitioners who were involved with a change project in the past two years. Results from the collected data are presented in Section 4.4.

## Appendix A: Survey 1 (Continued)



**OSU**  
Oregon State  
UNIVERSITY

Dear Participant,

Thank you for agreeing to help us understand how project success is defined and measured in your organization, experience, and/or research. Mr. Josh Hille and Dr. Chinweike Eseonu at Oregon State University need your help in completing the attached survey for the research project on successful project characterization. Please answer these questions **based on your experience with one project** you have worked on in the recent past **which was focused on achieving a significant change** in processes, systems, organization structure, or job roles. We appreciate your help.

Your participation is voluntary. You are not required to respond to any of the questions, but we greatly appreciate your response to all questions. This will provide a more complete picture to identify successful project characteristics. **The survey should take approximately 10 minutes** or less to complete.

You are not required to provide your name or other identifying information. We understand that your time is very valuable and appreciate your help in identifying project success factors. Dr. Eseonu and Mr. Hille will have access to individual survey results. **Results will be anonymous.**

You must be at least 18 years old to participate in this study. There are no risks nor direct immediate benefits to you for participation in this study.

Please contact Dr. Eseonu ([chinweike.eseonu@oregonstate.edu](mailto:chinweike.eseonu@oregonstate.edu) or 541.737.0024) if you have any questions or comments about the survey. If you have questions about your rights as a research participant, please contact the Institutional Review Board (IRB) at Oregon State University (email: [irb@oregonstate.edu](mailto:irb@oregonstate.edu) or 541.737.8008).

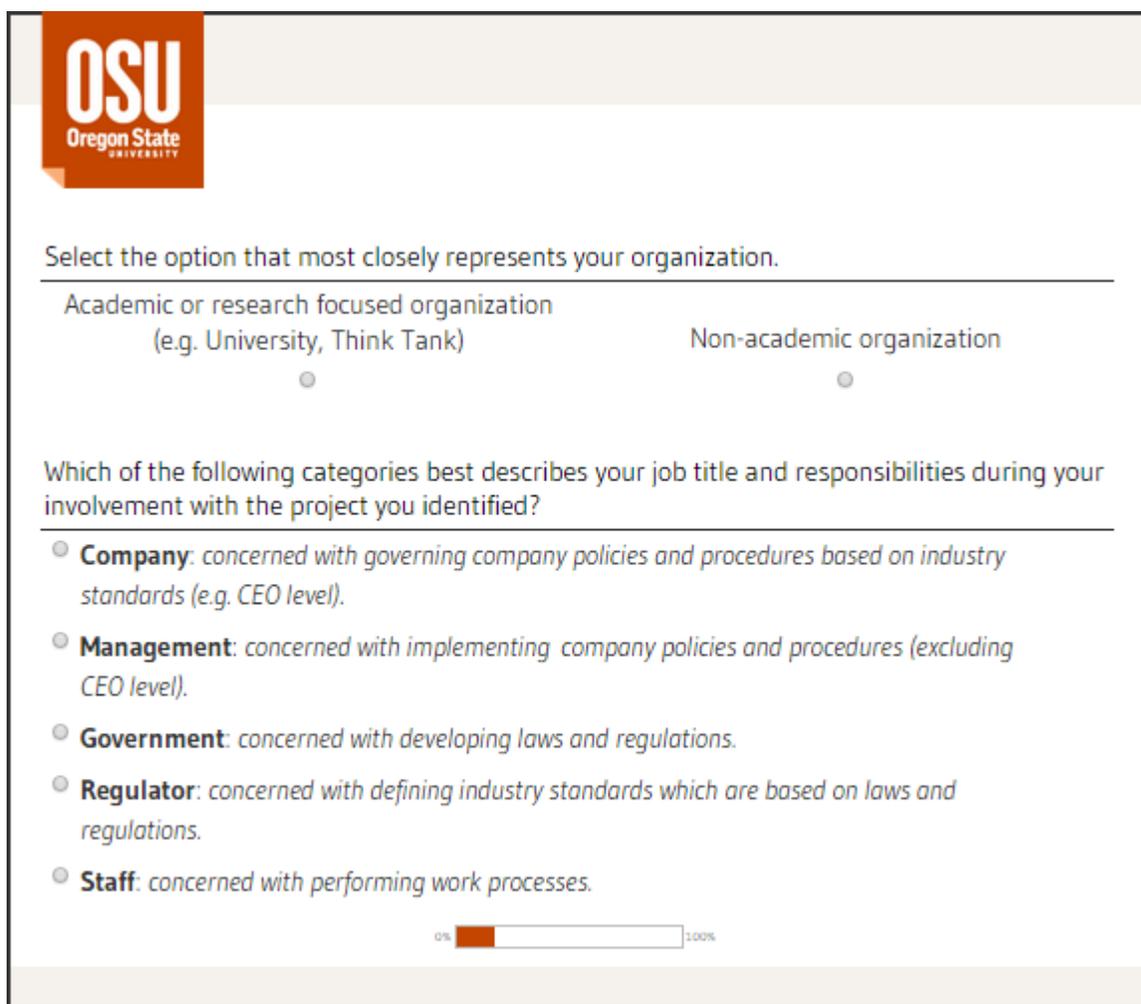
Thank you,

Josh Hille  
MSc Candidate  
School of Mechanical, Industrial and Manufacturing Engineering  
Oregon State University

---

0%  100%

Figure 8. Survey cover page.

**Appendix A: Survey 1 (Continued)**

**OSU**  
Oregon State  
UNIVERSITY

Select the option that most closely represents your organization.

---

Academic or research focused organization  
(e.g. University, Think Tank)

Non-academic organization

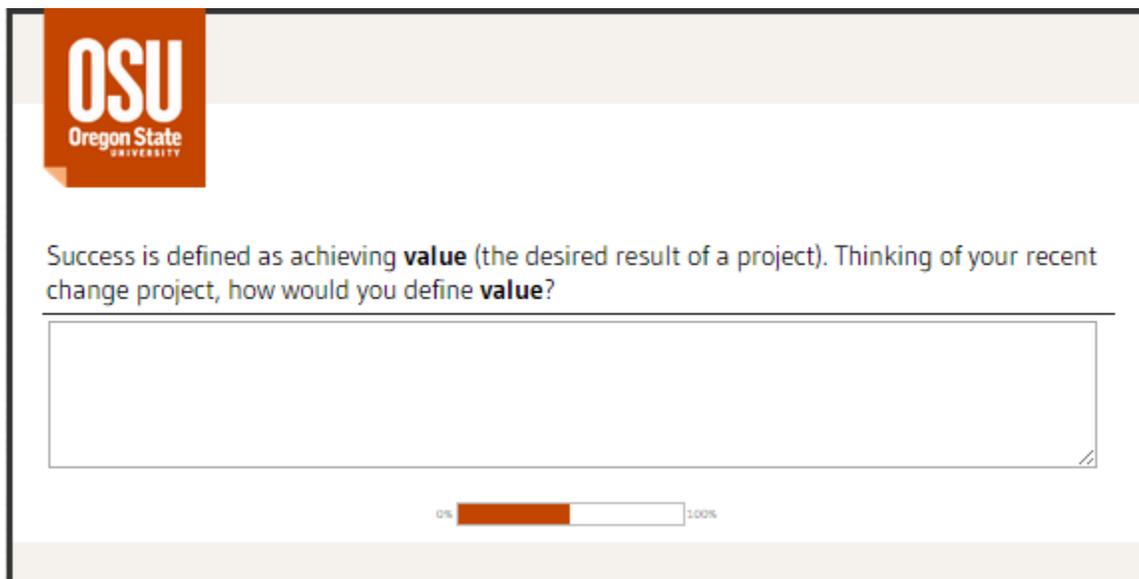
Which of the following categories best describes your job title and responsibilities during your involvement with the project you identified?

---

- Company:** *concerned with governing company policies and procedures based on industry standards (e.g. CEO level).*
- Management:** *concerned with implementing company policies and procedures (excluding CEO level).*
- Government:** *concerned with developing laws and regulations.*
- Regulator:** *concerned with defining industry standards which are based on laws and regulations.*
- Staff:** *concerned with performing work processes.*

0%  100%

Figure 9. Survey section one.

**Appendix A: Survey 1 (Continued)**

OSU  
Oregon State  
UNIVERSITY

Success is defined as achieving **value** (the desired result of a project). Thinking of your recent change project, how would you define **value**?

0% 100%

The image shows a survey question interface. At the top left is the OSU logo. The question text is centered. Below the question is a large empty text box for the answer. At the bottom center is a progress bar showing 0% completion.

Figure 10. Survey section 2.

### Appendix A: Survey 1 (Continued)



Select the response that BEST describes your opinion of the change project you identified.

The following question references the **project team**, which is defined as *the group of individuals who actively worked on or were involved with any aspect of the project.*

---

	Strongly Disagree	Disagree	Tend to Disagree	Tend to Agree	Agree	Strongly Agree	Not Applicable
The right methods were applied in achieving the change.	<input type="radio"/>						
The project team valued the diversity of the team members.	<input type="radio"/>						
The project team was primarily focused on implementing the project and did not spend too much time on analysis.	<input type="radio"/>						
The project was right and proper for the organization.	<input type="radio"/>						
Overall, this change project was a success.	<input type="radio"/>						
The project team was primarily focused on analysis and did not spend too much time on implementation.	<input type="radio"/>						

Figure 11. Survey section 3-1.

**Appendix A: Survey 1 (Continued)**

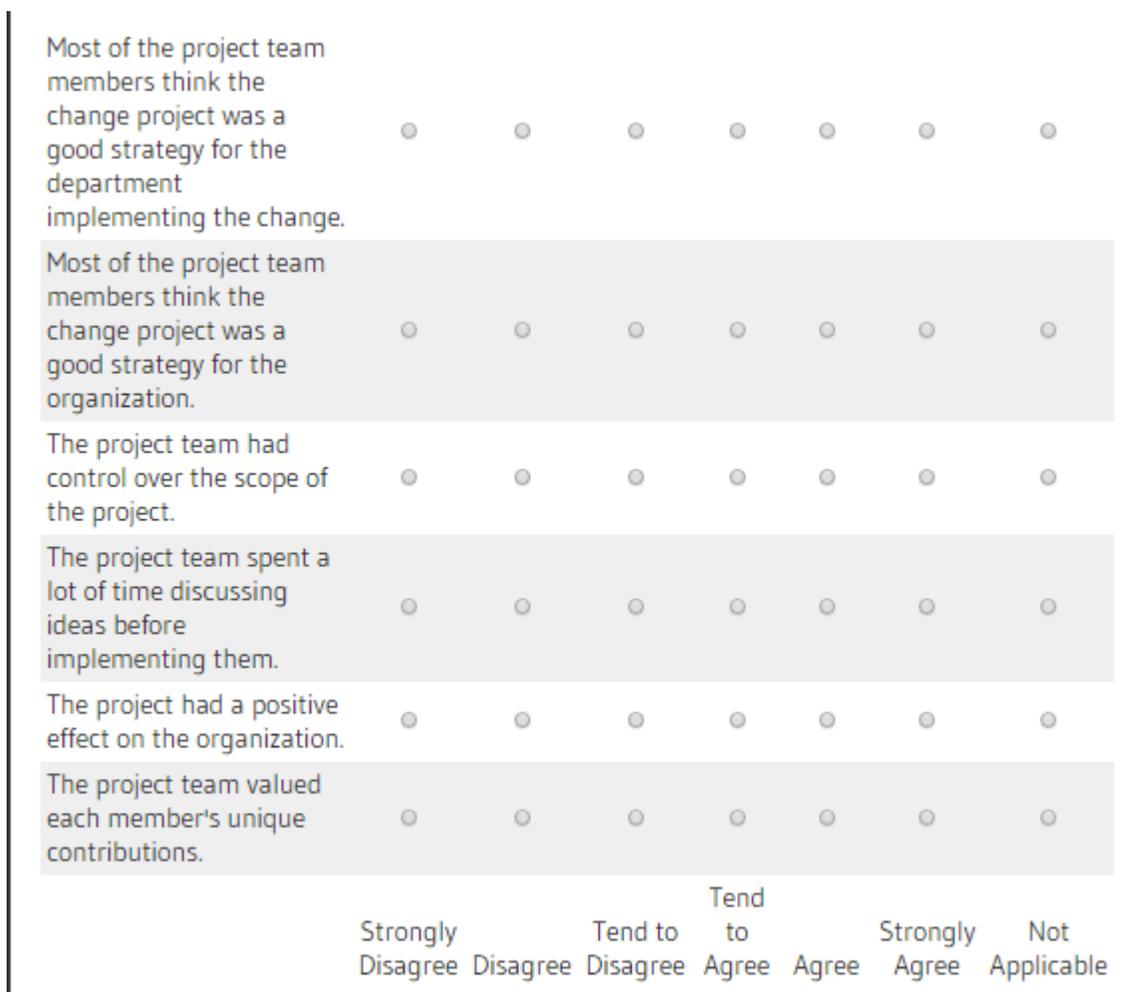


Figure 12. Survey section 3-2.

**Appendix A: Survey 1 (Continued)**

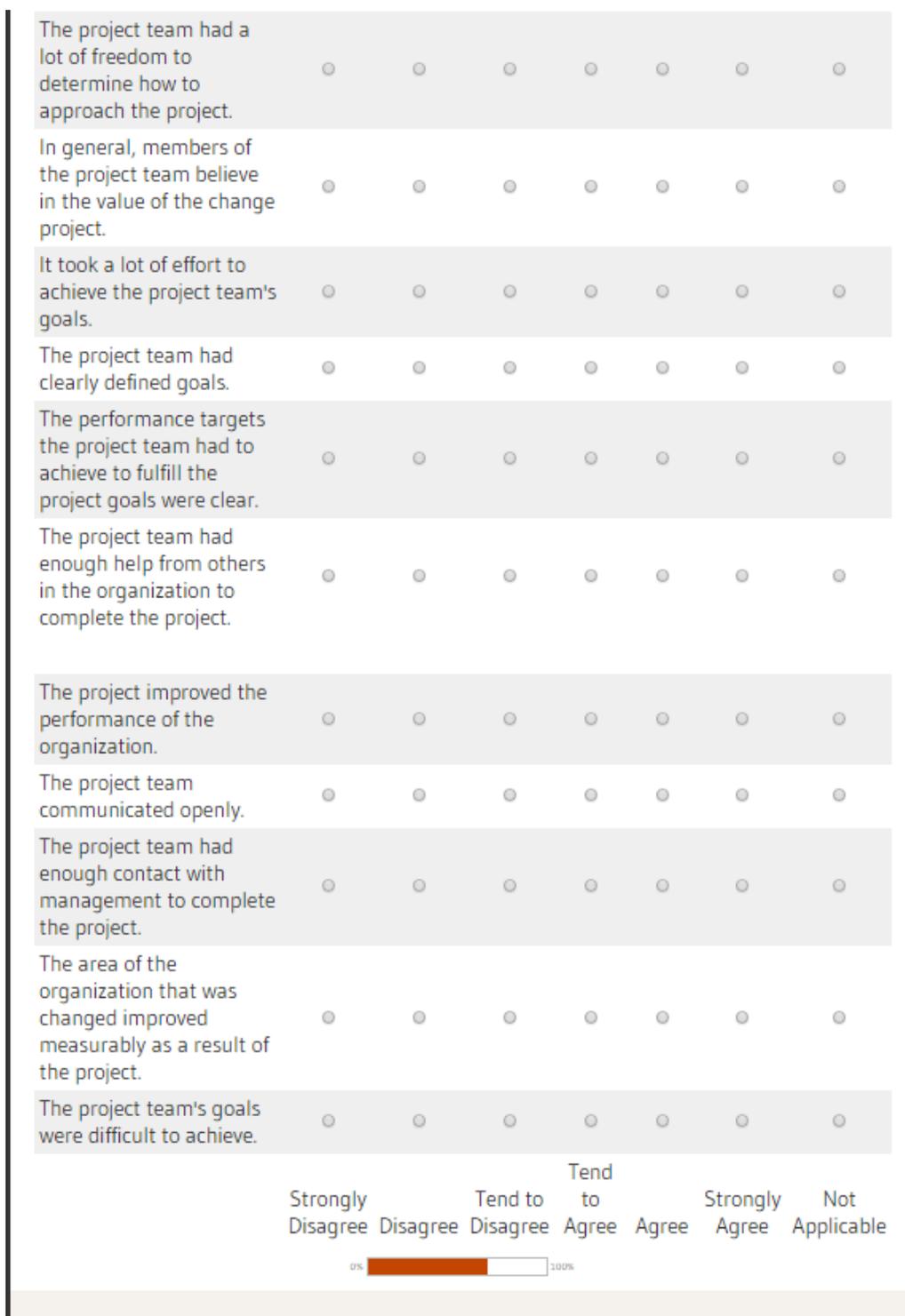


Figure 13. Survey section 3-3.

## Appendix A: Survey 1 (Continued)



Please select the industry sector that most closely represents the organization that underwent the change you identified. Hover and hold your cursor over any of the sectors to view a definition.

---

- Public Administration
- Manufacturing
- Mining, Quarrying, and Oil and Gas Extraction
- Utilities
- Management of Companies and Enterprises
- Transportation and Warehousing
- Educational Services
- Real Estate and Rental and Leasing
- Accommodation and Food Services
- Wholesale Trade
- Professional, Scientific, and Technical Services
- Finance and Insurance
- Arts, Entertainment, and Recreation
- Retail Trade
- Construction
- Agriculture, Forestry, Fishing and Hunting
- Information
- Administrative and Support and Waste Management and Remediation Services
- Other Services (except Public Administration)
- Health Care and Social Assistance

0%  100%

Figure 14. Survey section 4.

### Appendix B: Interview Transcripts

The following tables (Table 26, Table 27, Table 28, and Table 29) present the interview from the transcripts analyzed in Section 5.4. Table 26, Table 27, and Table 28 include transcripts from email interviews and Table 29 includes a transcript created by the interviewer based on a recorded phone call.

Table 26. Manager email interview transcript.

I:	<b><i>Could you tell me a bit about the move from [original location] to [new location] (reasons, timeline, affected parties, etc.)?</i></b>
*:	<p><i>Reason:</i> [Technology company] site in [original location] was underutilized the decision was made by corporate to sell the 100 acre facility, (including 3 buildings). Many factors went into the decision; however the main reason was the change in taxes from headcount based to sq. ft. base.</p> <p><i>Time Line:</i> “[Technology company] told its 690 employees at its [original location] site on Monday, (Oct 15, 2013) that it plans to sell the property and lease back enough space to keep its 310-person server development and validation team working at the [original location]. The high-tech company said it will lay off 32 of its [original location] workers and transfer about 350 others to other [technology company] facilities. Many of those likely will move to [new location], which is [technology company]’s largest site and where it employs some 17,000 workers”. (There were a lot of confusion and erroneous dates on when employees had to be at future locations, miss-communication on who would have a job and get to stay at [technology company]). [Group Y] end Date in [original location] was Oct 2014 for the move to [new location].</p> <p><i>Affected Parties:</i> Everyone at the [original location] [technology company] facilities were affected in one way or the other, the employees staying at the site had to move buildings put in new facilities in the areas they were moving, the rest of the employees were either laid off or went to different sites.</p>
I:	<b><i>What were your thoughts/feelings about the move from [original location] to [new location]?</i></b>
*:	Upset, conflicting information, conflicting timelines, conflicting information coming from HR, worried about my employees future, turned into anger over the way the move was communicated, VP’s seem to be very insensitive when conveying the initial message, ([Group Y] VP made the statement (jokingly) the reason her employees were staying in [original location] is because they were important).

## Appendix B: Interview Transcripts (Continued)

Table 26 (Continued). Manager email interview transcript.

I:	<i>What were most people's thoughts/feelings about the move from [original location] to [new location]?</i>
*:	Was dependent on each individual situation. Was able to keep most conflicting information away from the employees, about the move until it was sorted out. People were worried about the new location, breaking up a team that had been together for many years. Nervous about the future, some; whom were at retirement age was glad to get the extra incentives to retire.
I:	<b>The next two questions deal with the period BEFORE you knew of the move. Try to recall that period (BEFORE you knew of the move to [new location]) in your response to these questions.</b>
I:	<i>What would you say were the [Group Y]-specific reasons for being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i>
*:	[Group Y] was moved to [original location] in 1998 from [new location], there was a need for more manufacturing and warehouse space and at that time there were 1900 employees in [Group Y] and computer production levels were ~40K computers a quarter, during this time [technology company] was building computers for OEM's. I was aware of the decision as part of the Systems Manufacturing Management team, (MRC).
I:	<i>Were most people aware of the [Group Y]-specific reasons for being located in [original location]? (Explain the reason for your answer)</i>
*:	Most people were not aware of the [Group Y] specific reason for being located in [original location]. The reason; there were many who were not part of the decision to move in 1998. [Group Y] ran a 24/7 shift schedule and during the opening of the site in [original location] most of the employees were new hires from the local area. The reason for being in [original location] when the decision was made had changed over the years. For example, [external technology company number one] influenced [technology company]'s decision to stop manufacturing computers for OEM's and being viewed as being in competition with [external technology company number one]; this was during the Giga Hertz race with [external technology company number two]. At that time [Group Y] switched from providing computers to OEM's such as [external technology company number three] to providing reference design systems for engineers and software developers.

## Appendix B: Interview Transcripts (Continued)

Table 26 (Continued). Manager email interview transcript.

I:	<b><i>What would you say were the [technology company]-specific reasons for [Group Y] being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i></b>
*	[Technology company] pacific reasons for moving Systems Manufacturing, ([Group Y]) from Oregon to [original location]: The proximity to [external technology company number four] was the main deciding factor as well as the need for more manufacturing and warehouse space. During this time [technology company] was building computers for OEM's, [technology company CEO] and [external technology company CEO] would have meetings in [original location], [technology company] was trying to influence [external technology company number four] to move faster on Software development to support advances in [technology company] hardware/architecture. I was aware of the decision as part of the Systems Manufacturing management team, (MRC).
I:	<b><i>Could you talk a bit about any positive or negative issues ([Group Y] or [technology company]-specific) related to being located in [original location]?</i></b>
*:	Positive: The positive about being in [original location] for [Group Y] was the amount of space the organization had and the flexibility to support new business. The proximity to our customers in [original location] allowed for trust and flexibility in product support in that the customer could just walk down to manufacturing to make changes or check on their product. Systems being built for [external technology company number four] could be put on a shuttle to [external technology company number four] down the road to ensure they had platforms when they needed to meet software development schedule. Small local team made it feel like a family environment.  Negative: Being on a small site made it hard for advancement that you would have at a large site such as [new location] or [other location], lateral job movements for advancement or career development were very limited and restrictive.
I:	<b><i>If you were located in [original location], would you say you were happy in [original location]? Why?</i></b>
*:	This has a lot to do with individual situations, where we were at in our career. I was very happy in [original location] and did not want to move a lot had to do with family, cost of living, proximity to an Army base and hospital. Being close to the Army base it was easy to find high quality employees. Family environment everyone knew each other and had a long history together at the [technology company] site was part of the site since opening.

## Appendix B: Interview Transcripts (Continued)

Table 26 (Continued). Manager email interview transcript.

I:	<i>The next two questions deal with the period AFTER you knew about the move, but BEFORE the move actually happened. Try to recall this period (AFTER you knew about the move, but BEFORE the move actually happened) in your response to these questions.</i>
I:	<i>Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?</i>
*:	Most [technology company] employees were aware and understood why the group was moving, this was discussed in many communications meeting years before this move was announced. The [technology company] campus was up for sale for several years; Reason for the group moving was the site was underutilized and with tax changes it was time for [technology company] sell the site at any cost given the future costs to the [technology company] corporation.
I:	<i>Who/what entity initiated the move? (Explain your response – e.g. I was aware of this because...)</i>
*:	This was discussed and initiated from [technology company] Corp Services at the VP level. First announcement was doing away with the Air shuttle services cutting us off from other [technology company] sites. Second [Group Y] VP's called a site meeting informing the employees that the site was going to be sold and everyone would be impacted in one way or the other, and that their immediate GM would have discussions with each employee explaining the impact. I was aware of this being part of the process as a site manager.
I:	<i>Did most people feel that the move would help eliminate some issues with the [Group Y] group? Why? (Please explain your response)</i>
*:	No most felt that it would create issues, knowing that space was limited in [new location]? Most knew that the reason for the move was to solve an [technology company] corporate issue. Group knew that new processes would need to be created to work in the new environment.
I:	<i>Did most people feel that the move would help eliminate some issues with [technology company] as a whole? Why?</i>
*:	Yes, most employees knew the reason for the move was to alleviate the burden of cost to an underutilized site.

### Appendix B: Interview Transcripts (Continued)

Table 26 (Continued). Manager email interview transcript.

I:	<b><i>The following question relates to the period AFTER the move happened.</i></b>
I:	<b><i>Would you say most people felt they were involved in the implementation of the move? (Explain your response using examples where possible)</i></b>
*:	Yes most people felt they were involved in the move. Through MAP days the team put milestones on MS project MAP for areas of responsibility. Milestones had to happen each week to be successful with the move and be operational in [new location] and flawless execution that was invisible to customer product support. Most employees were on Teams that had to report out in weekly progress reports, equipment moves, Headcount moves, where product was going to be built meetings for lights out in [original location] so each employee was involved in the planning.
I:	<b><i>Do you feel you were involved in the planning of the move?</i></b>
*:	As [Group Y] manager I was involved in every aspect of the move to include Corporate Services, HR, employee communications and tracking weekly project milestones.
I:	<b><i>Were you able to see the impact that the move had on your colleagues? How did it impact them?</i></b>
*:	Yes, from personal impacts of having to sell homes, look for a new place to live, from finding out where to go for medical and dental to where the best places to shop, where my kids go to school getting them enrolled and involved in the community. At the same time the employees had to keep the business running often at times overwhelming the key was to provide them help/information when needed.
I:	<b><i>Were you able to see the impact the move had on [Group Y] business processes? How did it impact them?</i></b>
*:	Yes, there were a lot of changes to the business processes, tools that ran the [Group Y] business, process changes that had to take place because owners were no longer in the group or processes needed to change for business reasons or in some cases laws in [new location] were different than [original location]. The impact to [Group Y] was the struggle to meet customer commitments, quality excursions, data driven decision processes that no longer had an owner. Took several months; to update/put in place necessary and pertinent processes to meet [Group Y] and customer needs.

## Appendix B: Interview Transcripts (Continued)

Table 27. Manager email interview transcript.

I:	<b><i>Could you tell me a bit about the move from [original location] to [new location] (reasons, timeline, affected parties, etc.)?</i></b>
*:	Reason for move was closure of the [technology company] Site in [original location]. There were not enough occupants in the building to keep it open. This affected several business groups which all had to determine separately how they were going to manage the change. The plan was to sell the building and we were told the building could sell in as early as 6 months. The agreement was any buyer would need to give [technology company] a 2 months' notice if sold after the initial 6 months. This made it even more difficult to make plans as there was no real end date. For [Group Y] we knew our operation would take 6 months or longer to move so we were forced to make biz decisions quickly, which included looking for move options and outsourcing the biz externally or internally.
I:	<b><i>What were your thoughts/feelings about the move from [original location] to [new location]?</i></b>
*:	I had mixed feelings about moving the business to [new location]. I was somewhat excited as I already lived in [new location] and thought it would be nice to have the business here. It was also sad since I knew that not all employees would make the move and it had major impact to several people.
I:	<b><i>What were most people's thoughts/feelings about the move from [original location] to [new location]?</i></b>
*:	I think most people were angry at 1 <sup>st</sup> because they didn't understand or agree with the decision to close the [original location] site. Several were glad that we were moving the business instead of just closing it.
I:	<b><i>The next two questions deal with the period BEFORE you knew of the move. Try to recall that period (BEFORE you knew of the move to [new location]) in your response to these questions.</i></b>
I:	<b><i>What would you say were the [Group Y]-specific reasons for being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i></b>
*:	[Group Y] was originally in [original location] to build desktop computers during the PC boom, but that business dropped significantly a few years later. [Group Y] reduced HC drastically and found new business to keep viable. That included 2 major businesses; building systems for [Group Y] which was located in [original location] to be close to [external technology company number four], and to support designing and building test tooling for internal use.

## Appendix B: Interview Transcripts (Continued)

Table 27 (Continued). Manager email interview transcript.

I:	<i>Were most people aware of the [Group Y]-specific reasons for being located in [original location]? (Explain the reason for your answer)</i>
*:	Most people knew the history of [Group Y] as most were hired when the system factory opened.
I:	<i>What would you say were the [technology company]-specific reasons for [Group Y] being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i>
*	Same as [previous response].
I:	<i>Could you talk a bit about any positive or negative issues ([Group Y] or [technology company]-specific) related to being located in [original location]?</i>
*:	Positive thing about being in [original location] was located at same site as [Group Y]. Additionally the site had plenty of space to support the business.
I:	<i>If you were located in [original location], would you say you were happy in [original location]? Why?</i>
*:	I was not a resident.
I:	<i>The next two questions deal with the period AFTER you knew about the move, but BEFORE the move actually happened. Try to recall this period (AFTER you knew about the move, but BEFORE the move actually happened) in your response to these questions.</i>
I:	<i>Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?</i>
*:	I think most people understood the reason, but several disagreed with the decision. The reason for the move was that [technology company] was selling that building for financial reasons (cost too much to maintain and was way underutilized – I think about 30%). We had 2 choices to either move the business or close it.

## Appendix B: Interview Transcripts (Continued)

Table 27 (Continued). Manager email interview transcript.

I:	<b><i>Who/what entity initiated the move? (Explain your response – e.g. I was aware of this because...)</i></b>
*:	[Group Y] Initiated the move based on the decision [technology company] made with the [original location] site.
I:	<b><i>Did most people feel that the move would help eliminate some issues with the [Group Y] group? Why? (Please explain your response)</i></b>
*:	Most people did not feel the move had anything to do with any issues in [Group Y]. This was a site decision that happened to impact [Group Y].
I:	<b><i>Did most people feel that the move would help eliminate some issues with [technology company] as a whole? Why?</i></b>
*:	I think most people understood that the site closure was a financial decision by [technology company] and had nothing to do with making improvements to any of the groups in [original location], including [Group Y].
I:	<b><i>The following question relates to the period AFTER the move happened.</i></b>
I:	<b><i>Would you say most people felt they were involved in the implementation of the move? (Explain your response using examples where possible)</i></b>
*:	I think most people were involved or felt involved in the move.
I:	<b><i>Do you feel you were involved in the planning of the move?</i></b>
*:	I was heavily involved in the move and managed most of it as Program Manager.
I:	<b><i>Were you able to see the impact that the move had on your colleagues? How did it impact them?</i></b>
*:	There were several categories of impact to people as some moved, some left [technology company] and a couple found other jobs with [technology company] in the same area. Basically though everyone felt like the “family” was breaking up. [Group Y] had a very strong team / group dynamics and this was impacting that.

## Appendix B: Interview Transcripts (Continued)

Table 27 (Continued). Manager email interview transcript.

I:	<b><i>Were you able to see the impact the move had on [Group Y] business processes? How did it impact them?</i></b>
*:	[Group Y] business was impacted because the business was split, where the [product line] moved to [other location] and the [product line] moved to [new location]. For the portion that moved to [Group Y] it forced us to change some of the biz processes because we were no longer collocated with our customers and that required more processes around connections and flows.

Table 28. Staff-level individual email interview transcript.

I:	<b><i>Could you tell me a bit about the move from [original location] to [new location] (reasons, timeline, affected parties, etc.)?</i></b>
*:	Reasons: From what I heard, the move from [original location] to [new location] was decided by a Vice President of the company because he felt that the [original location] campus was a waste of [technology company] dollars. [Group Y] leadership saw that our group was still valuable and made the decision to relocate to [new location].  Timeline: We were informed of the decision to close the [original location] campus on October 14, 2013. November 1, 2013 we all received relocation packages with information
I:	<b><i>What were your thoughts/feelings about the move from [original location] to [new location]?</i></b>
*:	I felt a lot of sadness and depression. It was rough seeing a lot of my coworkers making the decision to not relocate due to family. And they also ended up losing their jobs. I was sad to leave my new house and family, and my friends. Moving to a new place where you don't know anyone is intimidating. Leaving everything behind to go start somewhere new, all alone was rough.
I:	<b><i>What were most people's thoughts/feelings about the move from [original location] to [new location]?</i></b>
*:	I think a lot of people were angry, sad, and depressed. A lot of the older people who were close to retirement felt cheated. Those who couldn't relocate were sad they were going to lose their jobs they had been working for 15+ years and were scared about reentering the job market.

## Appendix B: Interview Transcripts (Continued)

Table 28 (Continued). Staff-level individual email interview transcript.

I:	<i>The next two questions deal with the period BEFORE you knew of the move. Try to recall that period (BEFORE you knew of the move to [new location]) in your response to these questions.</i>
I:	<i>What would you say were the [Group Y]-specific reasons for being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i>
*:	To the best of my knowledge the reasons for [Group Y] being located in [original location] were associated with space, equipment and trained personnel availability and close proximity to [external technology company number four] headquarters. In addition the [technology company] campus was still under certain business and occupation tax exemptions from [original location], [original location county] and [original location state]. Also, associated business units also using space, equipment and personnel resources were basically cost sharing the cost of operations at the [original location] campus.
I:	<i>Were most people aware of the [Group Y]-specific reasons for being located in [original location]? (Explain the reason for your answer)</i>
*:	I doubt most of the people were aware since most of the other [technology company] personnel were not based in [original location] in 1996 to 2009 and therefore unaware of some of the reasons why [technology company] choose the [original location] site for a campus in the first place. Facility space was probably the most important factor. [Group Y] underwent many name changes over the years and the name migrated from a profitable Research and development operation to a near solely non-profit R&D and capital equipment manufacturing operation the cost of [original location] exceeded future strategic and financial expectations.
I:	<i>What would you say were the [technology company]-specific reasons for [Group Y] being located in [original location]? (Explain your response – e.g. I was aware of Reason A because...)</i>
*	The [technology company] specific reasons for being located in [original location] were space availability, tax exemptions, trained personnel and equipment, proximity to [external technology company number four] headquarters and to maintain business bridge to outsourcing and transferring work to lower cost locales. In general, it was a financial business decision to optimize profits from existing resources until alternative resources could be established.
I:	<i>Could you talk a bit about any positive or negative issues ([Group Y] or [technology company]-specific) related to being located in [original location]?</i>
*:	To me it seemed like [original location] was a perfect spot to be.

## Appendix B: Interview Transcripts (Continued)

Table 28 (Continued). Staff-level individual email interview transcript.

I:	<i>If you were located in [original location], would you say you were happy in [original location]? Why?</i>
*:	I was happy in [original location] because it was close to home, and family.
I:	<i>The next two questions deal with the period AFTER you knew about the move, but BEFORE the move actually happened. Try to recall this period (AFTER you knew about the move, but BEFORE the move actually happened) in your response to these questions.</i>
I:	<i>Even if they disagreed with the move, would you say that most people understood why the group was moving from [original location] to [new location]? Why was the group moving?</i>
*:	I think people understood that our managers saw we were a valuable group and understood their decision to relocate us to [new location].
I:	<i>Who/what entity initiated the move? (Explain your response – e.g. I was aware of this because...)</i>
*:	I think [Group Y manager] was able to save us and find us a new home in [new location]. ☺ I'm not entirely sure if it was solely his decision. But I'd like to think he played a big role in making sure we didn't all lose our jobs.
I:	<i>Did most people feel that the move would help eliminate some issues with the [Group Y] group? Why? (Please explain your response)</i>
*:	No. I think everyone felt like moving to [new location] was going to add issues. Because we were going to lose headcount of trained personnel, and workspace that would limit our output to our customers.
I:	<i>Did most people feel that the move would help eliminate some issues with [technology company] as a whole? Why?</i>
*:	No. I really think a lot of people saw the move as a bad decision.
I:	<b>The following question relates to the period AFTER the move happened.</b>
I:	<i>Would you say most people felt they were involved in the implementation of the move? (Explain your response using examples where possible)</i>
*:	No. Managers only wanted certain people involved with anything to do with the move.

## Appendix B: Interview Transcripts (Continued)

Table 28 (Continued). Staff-level individual email interview transcript.

I:	<b><i>Do you feel you were involved in the planning of the move?</i></b>
*:	Yes. I was involved with planning the headcount for the move to [new location].
I:	<b><i>Were you able to see the impact that the move had on your colleagues? How did it impact them?</i></b>
*:	Yes. I think a lot of people struggled with the move. There were a lot of stressed out, sad, depressed people. And it was rough to see everyone going through the same kind of struggles from the move.
I:	<b><i>Were you able to see the impact the move had on [Group Y] business processes? How did it impact them?</i></b>
*:	I personally feel like everything got all sorts of messed up from the move. We were transferring products from [original location], to [new location] and also [other location] and trying to keep 3 different sites up and running smoothly was difficult.

Table 29. Staff-level individual phone call interview transcript.

I:	<b><i>For the first question, could you tell me a bit about the move. Just facts about the move: what you know about it, reason why, timeline, who was affected by it, maybe who initiated it?</i></b>
*:	Ok. So, we got a new CEO that year – 2013. And he came in and he looked at all the optimal –the revenue – we were under-utilized in [original location] – size wise. Not many people and not many things were going. Our [Group Y] group itself, we were always busy and had enough work. [Group Y] always did new product introduction type of work. So they decided to move a majority of the work to [other location]. Under the [Group Y] group which is [Vice President]’s staff and [Vice President], which is the [Group Y] – VP. So they are the ones who sold the building, and that took about a year to move out of there. And they gave us the option of coming to work here, inside [new location], you know, [new location] site, or separating from there. And I think five of us came down here out of about 27 [full time employees] on the manufacturing floor. 100 more from the supporting groups.

## Appendix B: Interview Transcripts (Continued)

Table 29 (Continued). Staff-level individual phone call interview transcript.

I:	<b><i>What were your personal thoughts/feelings about the move?</i></b>
*:	Well, it's kind of cumbersome because I go home every weekend, so I live in kind of temporary housing here. So I live a temporary life until, you know, I'm going to rack up a few years before I'm going to move on. Other than that, it's a great job and great work, and I like my job.
I:	<b><i>So the work side is fine, but personally it is tough?</i></b>
*:	Yes.
I:	<b><i>Would you say most people have similar views?</i></b>
*:	I believe so.
I:	<b><i>Are there [Group Y]-specific reasons for being located in [original location] or is it more of a [technology company] as a whole reason?</i></b>
*:	Originally, [original location] was constructed for manufacturing PCs and when PCs went belly-up in mid-March. Originally we had 6,000 people. We hired a mass of people and then throughout every year it went down. Eventually, we were doing literally everything. Test units, phones, to health monitors. But we still went down. I think at one time we also had a logistics group in that building, which was huge because they were moving from everywhere. And they closed down and moved to [other state] too.
I:	<b><i>I know since you've been there a long time, you might be more aware of those things, but would you say most people were aware of those business reasons for being located in [original location]? Was that readily known?</i></b>
*	Probably not. Not the one in [original location].

## Appendix B: Interview Transcripts (Continued)

Table 29 (Continued). Staff-level individual phone call interview transcript.

I:	<b><i>Why would you say that?</i></b>
*:	We were research and development and I think we were put there because [external technology company number five] is there, [external technology company number four] is there, [external technology company number six] is there. Big technical companies are there. So they thought we were getting involved with all that. I think each of these companies, at one time, was building huge sites close to the [external technology company number five] area there for the boards factories. They never made it. They never even started anything. They built sites, but they never did anything. We had all kinds of companies coming in and then I don't think [original location state] was that tax friendly either. And then I think we used up our own tax credits from the [original location state].
I:	<b><i>Could you discuss some positive and negative issues related to being located in [original location]?</i></b>
*:	Well it was great for me, personally. It was huge, but I knew we had a lot of room, a lot of new tools, and I don't know if I mentioned it or not, but at the beginning it was research and development, so we didn't have to contribute to any of the revenue. We were revenue users but not revenue generators, or group was. So we didn't have to worry about any of that. We were just making it to make it. Slowly that design kind of went away.
I:	<b><i>Is that not similar now though?</i></b>
*:	No. We are doing work for other people and then we get paid for our bidding. So we actually have to be qualified and also manage our time and money and our contracts. Service level agreement with business units. We didn't have to do that before.
I:	<b><i>After you heard about the move, but before the move actually happened, would you say most people understood why the move was happening?</i></b>
*:	Oh yeah! We weren't the only tech-company who doing all this. As a matter of fact, the same year I think, [external technology company number four] got a new CEO and they cut out 8,000 people from the [original location state]. Right in the [original location] area. That's the first thing most CEOs do. It's an easy way of adjusting the balance and money to get positive reviews from analysts. That's their way of doing it.
I:	<b><i>Yeah, management was pretty open about that?</i></b>
*:	Yeah. So I think it's good, yeah.

### Appendix B: Interview Transcripts (Continued)

Table 29 (Continued). Staff-level individual phone call interview transcript.

I:	<i>So who was the first group or person to initiate the move? I assume it didn't come directly from the CEO, but was it outside [Group Y] that initiated the move?</i>
*:	O yeah, sure. I think it was the VP, [Vice President], I believe. Anyway, she was the one who, she's the VP of [Group Y], and then under that is [Vice President]. And [Vice President] is kind of in charge of [other location] and [other location] and all that .And she was just stealing out all of our work that way. They're the ones who started it.
I:	<i>With some of the issues with being located in [original location], did people feel positive about the move that it was going to result in some benefit for [Group Y], personally, or [technology company] as a whole?</i>
*:	I think it is a positive move for myself and also for [technology company] as a whole it was a better move. I think it was a smart move. There is a lot of work here [new location]. Lots of people here. Lots of opportunity here that we didn't have in [original location].
I:	<i>Ok. Because you were somewhat removed from the rest of [technology company] being located in [original location]?</i>
*:	Sure. Sure.
I:	<i>Ok. So did you feel involved with the actual implementation of the move? Were people who weren't managers involved in planning and implementing – or asked their opinions? What was that process?</i>
*:	The majority of my job was actually removing equipment from the [original location] site. That was what I was doing. And selling and moving huge equipment that was worth about \$500,000 of everything. From actual machines, to tables, to everything. So that is what I did. And then me and [staff-level individual] were the first ones who got here [new location] to this site and it still had construction going in here. It wasn't ready. But few things we realized wasn't going to work because, you know, we the ones who going to be working and realized they located the wrong thing in the wrong places. Not enough room. You know, this and that. We are slowly changing since that.
I:	<i>Maybe you weren't really involved in the planning but the implementation and setting up you were definitely involved?</i>
*:	Yes.

### Appendix B: Interview Transcripts (Continued)

Table 29 (Continued). Staff-level individual phone call interview transcript.

I:	<i>We lost quite a few people. Quite a few people left because of the move. For the few people who stayed on, how did it impact them, do you think, personally and at work?</i>
*:	Well, the majority of them retired. They didn't work anymore. Probably 1/5 of them probably looking for a job or got a job. Another 1/5 probably is not working and looking for a job. And another some people not be able to find a job. I heard some people who went to [external technology company number five] and other places. The only ones who went to [external technology company number four], but then it was a long drive for most of them and [large city near original location] area. They weren't that happy, but at least they had a job.

## Appendix C: Manuscript 1 IRB Documents

### RESEARCH PROTOCOL

June 30, 2015

1. Title: Case study to characterize successful change management projects

#### PERSONNEL

2. Principal Investigator: Chinweike Eseonu
3. Student Researcher(s): Joshua Hille
4. Co-investigator(s): N/A
5. Study Staff: N/A
6. Investigator Qualifications

Dr. Eseonu is an Assistant Professor in the School of Mechanical, Industrial, and Manufacturing Engineering. Dr. Eseonu conducts research on socio-technical process optimization, with a focus on factors that lead to sustained acceptance of an idea or innovation (which includes methods, technologies, etc).

Mr. Hille is a Masters student in the School of Mechanical, Industrial, and Manufacturing Engineering. Mr. Hille completed his undergraduate degree in Mechanical Engineering at Oregon State University. He is interested in the application of lean methodologies to support product development success.

7. Training and Oversight

The PI has verified that all study researchers have completed the required IRB training in the ethical use of human participants in research. The PI has reviewed all IRB related documents before submission and will continue to review any future documents that require IRB approval.

All initial data collection will be carried out using Qualtrics software. The researchers will assign non-descriptive identifiers to each source to maintain anonymity and confidentiality of the participants.

If the PI and student researchers are both absent (such as vacations or sabbaticals), data collection will cease until a PI is again available.

8. Conflict of Interest

To the knowledge of the study team, no members of the study team, or any of their family members, have a financial or business interest in the source(s) of funding, materials, or equipment related to this research study.

#### FUNDING

9. Sources of Support for this project (unfunded, pending, or awarded)

Unfunded

#### DESCRIPTION OF RESEARCH

## Appendix C: Manuscript 1 IRB Documents (Continued)

### 10. Description of Research

The OSU researchers are interested in understanding how successful change management projects are characterized. The OSU researchers will be conducting survey-based research to identify significant factors. A pilot study will be completed initially to ensure survey consistency. Journal articles, conference proceedings, and theses summarizing significant findings are anticipated. The journal articles, conference proceedings, or theses will not identify any participants, including any companies involved.

### 11. Background Justification

The change management literature is comprised of many theories describing techniques to achieve a success change project (Burnes, 2009; Hayes, 2014; Mitchell, 2013; Todnem, 2005). Furthermore, much of this research is focused on implementation (Adel M. Aladwani, 2001; McMurray, Chaboyer, Wallis, & Fetherston, 2010; Yi Zou & Sang-Hoon Lee, 2009), which supports the needs of industry managers. However, there is still a lack of understanding of how a successful change management project is characterized (Maurer, 2014). The literature is inundated with descriptions of successful change management projects, but little characterization of this success is made. To definitively state that a change management project is successful, a common characterization must be developed.

### 12. Multi-center Study

N/A – this study involves OSU researchers only.

### 13. External Research or Recruitment Site(s)

- a) Name or description of each research site: N/A
- b) Name and role of appropriate authority from each site providing a letter of support or permission (when applicable): N/A
- c) Name of each recruitment site: N/A
- d) If recruitment method involves more than an advertisement (newspaper classified, flier, listserv email), name and role of appropriate authority from each site providing a letter of support: N/A
- e) Attach or include the final content of the ad or correspondence to be used for recruitment

### 14. Subject Population

- A description of participant characteristics: The participant population consists of employees of US companies. The participants could have varying education levels and responsibilities.
- Total target enrollment number: 5000
- Description of any vulnerable population(s): We do not envision participants under the age of 18. It is possible an employee may be:
  - Pregnant
  - An OSU student
  - Of American Indian ethnicity

## Appendix C: Manuscript 1 IRB Documents (Continued)

- Of Alaska Native ethnicity

None of the populations are specifically targeted in this study, but may be participants. It is anticipated that all respondents/potential participants will be able to respond in English.

- Inclusion and exclusion criteria: Students of OSU and individuals who have participated in a new product development project will be included
- Recruitment: An email will be sent out to potential candidates with a link to the Qualtrics survey.

### 15. Consent Process

It is anticipated that each potential participant will be given a consent and invitation email that contains relevant contact information for both the PI and the IRB, and the possible risks of participating.

The research team would like to request a waiver of signed documentation of informed consent. Participation in the survey will imply consent.

It is anticipated that all participants will have capacity to consent.

### 16. Assent Process

N/A

### 17. Eligibility Screening

An eligibility screening process is not anticipated as being necessary.

### 18. Methods and Procedures

An invitation email will be sent to potential participants, which will include a link to an online Qualtrics survey.

### 19. Compensation

No compensation will be given to participants.

### 20. Costs

No participation costs are associated with this research.

### 21. Drugs or Biologics

N/A – no drugs or biologics are utilized in this study.

### 22. Dietary Supplements or Food

N/A – this study does not involve dietary supplements or food.

### 23. Medical Devices

N/A – this study does not involve any medical devices.

### Appendix C: Manuscript 1 IRB Documents (Continued)

24. Radiation

N/A – this study does not involve radiation.

25. Biological Samples

N/A – this study does not involve biological samples.

26. Anonymity or Confidentiality

Survey responses will be anonymous, or confidential if participant provides identifying information. No IP addresses will be captured. Data anonymization will be turned on in the Qualtrics tool. All study information will be stored for 3 years post-study termination by the PI. The information will be stored on an encrypted computer in the PI's lab. Dr. Eseonu and Mr. Hille will be the only individuals who have access to raw data.

27. Risks

There are no known risks to participants in this study.

28. Benefits

The research will not directly benefit any participants. The research may be published, however, in accessible journals, conferences proceedings and/or theses.

29. Assessment of the risks and benefits.

Benefits in #28 outweigh risks in #27.

### Appendix C: Manuscript 1 IRB Documents (Continued)

#### EXPLANATION OF RESEARCH

<b>Project Title:</b>	Case study to characterize successful change management projects
<b>Principal Investigator:</b>	Chinweike Eseonu, PhD
<b>Student Researcher:</b>	N/A
<b>Co-Investigator(s):</b>	Joshua Hille
<b>Sponsor:</b>	N/A
<b>Version Date:</b>	June 19, 2015

---

**Purpose:** You are being asked to take part in a research study. The purpose of this research study is to understand how successful projects, which are focused on achieving a significant change in processes, systems, organization structure, or job roles, are characterized. We will ask both an open-ended question and a question focused on success factors including, but not limited to, goal clarity, appropriateness, management support, and project team disposition. We will use the data collected from the research study as the basis for a Master's Thesis and journal publication.

**Activities:** The study activities include completing a 16 question survey provided through Qualtrics.

**Time:** Your participation in this study is expected to last approximately 10 minutes.

**Risks:** We do not foresee that you will be at any risk for participating in the study.

**Benefit:** We do not know if you will benefit from being in this study. It is possible, however, that we may identify characterizations that could impact the success of future projects.

**Payment:** You will not be paid for participating in this research study.

**Confidentiality:**

Any information you provide will be kept confidential to the extent permitted by law. The information you provide will be pooled with information collected from other research participants and then analyzed for common themes. The researchers will produce articles based on these common themes. Your name will never be used in the report. The researchers will keep participation confidential, but it is possible, though unlikely, that other team members could learn that you participated in this study.

**Voluntary:** Participation in this study is voluntary. You are allowed to answer or not answer as you feel comfortable.

**Study contacts:** If you have any questions about this research project, please contact: Chinweike Eseonu at (541) 737-024 or by email at [chinweike.eseonu@oregonstate.edu](mailto:chinweike.eseonu@oregonstate.edu). If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at [IRB@oregonstate.edu](mailto:IRB@oregonstate.edu)

## Appendix C: Manuscript 1 IRB Documents (Continued)

Dear Participant,

The Oregon State University Process Improvement Group is seeking participants who are at least 18 years old and have been involved in a project which was focused on achieving a significant change in processes, systems, organization structure, or job roles. Your email was identified because the principal investigator is aware that you may have been involved with this type of project. The purpose of this study is to understand how successful change projects are characterized.

Participation in this study involves a time commitment of approximately 10 minutes. The survey can be accessed online at the following link: [Link to Qualtrics survey].

For more information about this study, please contact the principal investigator, Dr. Chinweike Eseonu, by phone at 541-737-0024 or email at chinweike.eseonu@oregonstate.edu.

Thank you,

Dr. Chinweike Eseonu  
Principal Investigator

Study Title: Case study to characterize successful change management projects

Success factors based on work by Farris, Van Aken, Doolen, and Worley, "Learning From Less Successful Kaizen Events: A Case Study", 2008; and Mazur, Rothenberg, and McCreery, "Measuring and Understanding Change Recipients' Buy-in During Lean Program Implementation Efforts", 2011

No.	Question	Factors	Scale
1	Please select the category that best describes your role during your involvement with the project you identified.	N/A	Academia; Industry
2	Which of the following categories best describes your job title and responsibilities during your involvement with the project you identified?	N/A	Government; Regulator; Company; Management; Staff
3	Success is defined as achieving the value or desired result of an attempt. Given the project you identified, how would you define value?	N/A	N/A
4	Please rate the extent to which the following factors impacted the success of the project you identified, where 5 is the most impactful and 1 is the least impactful.	Goal Clarity	5, 4, 3, 2, 1
		Goal Difficulty	5, 4, 3, 2, 1
		Appropriateness	5, 4, 3, 2, 1
		Project Team Attitude	5, 4, 3, 2, 1
		Impact on Organization	5, 4, 3, 2, 1
		Project Team Skills	5, 4, 3, 2, 1
		Project Team Autonomy	5, 4, 3, 2, 1
		Management Support	5, 4, 3, 2, 1
		Action Orientation	5, 4, 3, 2, 1
		Internal Processes	5, 4, 3, 2, 1
		Perceived Success	5, 4, 3, 2, 1
		Project Team Disposition	5, 4, 3, 2, 1
	Discrepancy	5, 4, 3, 2, 1	

## Appendix D: Manuscript 2 IRB Documents

### RESEARCH PROTOCOL

October 14, 2015

1. Title: Identification of change management project success factors

#### PERSONNEL

2. Principal Investigator: Chinweike Eseonu
3. Student Researcher(s): Joshua Hille
4. Co-investigator(s): N/A
5. Study Staff: N/A
6. Investigator Qualifications

Dr. Eseonu is an Assistant Professor in the School of Mechanical, Industrial, and Manufacturing Engineering. Dr. Eseonu conducts research on socio-technical process optimization, with a focus of factors that lead to sustained acceptance of an idea or innovation (which includes methods, technologies, etc).

Mr. Hille is a Masters student in the School of Mechanical, Industrial, and Manufacturing Engineering. Mr. Hille completed his undergraduate degree in Mechanical Engineering at Oregon State University. He is interested in the application of lean methodologies to support product development success.

7. Training and Oversight

The PI has verified that all study researchers have completed the required IRB training in the ethical use of human participants in research. The PI has reviewed all IRB related documents before submission and will continue to review any future documents that require IRB approval.

All initial survey data collection will be carried out using Qualtrics software. The researchers will assign non-descriptive identifiers to each source to maintain anonymity and confidentiality of the survey participants.

An Excel spreadsheet will be used to track the number of participants. At the end of each day of data collection, the spreadsheet will be updated.

Interviews will be recorded with the participants consent. During the interviews, the first question listed on the test instrument will be asked. As the participant responds, the researcher will note if each of the 12 other questions have been answered. If all questions are not answered after the first question, specific follow-up questions will be asked.

If the PI and student researchers are both absent (such as vacations or sabbaticals), data collection will cease until a PI is again available.

8. Conflict of Interest

Funding of student masters degree provided by Intel. Includes 6 - 9 months of internship. Not a grant.

## Appendix D: Manuscript 2 IRB Documents (Continued)

### FUNDING

9. Sources of Support for this project (unfunded, pending, or awarded)

Funded: A gift from [REDACTED] to the OSU Foundation is funding the student researcher's fellowship

### DESCRIPTION OF RESEARCH

10. Description of Research

The OSU researchers are interested in identifying change management project success factors. The OSU researchers will be conducting survey and interview-based research to identify significant factors. For the survey, a pilot study will be completed initially to ensure consistency. Journal articles, conference proceedings, and theses summarizing significant findings are anticipated. The journal articles, conference proceedings, or theses will not identify any participants, including any companies involved.

11. Background Justification

The change management literature is comprised of many theories describing techniques to achieve a successful change project (Burnes, 2009; Hayes, 2014; Mitchell, 2013; Todnem, 2005). Furthermore, much of this research is focused on implementation (Adel M. Aladwani, 2001; McMurray, Chaboyer, Wallis, & Fetherston, 2010; Yi Zou & Sang-Hoon Lee, 2009), which supports the needs of industry managers. However, there is still a lack of prescriptive methods for implementing change. A clear, prescriptive method to successfully implement change management projects is needed.

12. Multi-center Study

N/A – this study involves OSU researchers only.

13. External Research or Recruitment Site(s)

- a) Name or description of each research site: N/A
- b) Name and role of appropriate authority from each site providing a letter of support or permission (when applicable): N/A
- c) Name of each recruitment site: N/A
- d) If recruitment method involves more than an advertisement (newspaper classified, flier, listserv email), name and role of appropriate authority from each site providing a letter of support: N/A
- e) Attach or include the final content of the ad or correspondence to be used for recruitment  
See attachment

14. Subject Population

- A description of participant characteristics: The participant population consists of employees of US companies. The participants could have varying education levels and responsibilities.
- Total target enrollment number: 1000

## Appendix D: Manuscript 2 IRB Documents (Continued)

- Description of any vulnerable population(s): We do not envision participants under the age of 18. It is possible an employee may be:
  - Pregnant
  - An OSU student
  - Of American Indian ethnicity
  - Of Alaska Native ethnicity

None of these populations are specifically targeted in this study, but may be participants. It is anticipated, by reason of employment in these US based companies, that all respondents/potential participants will be able to respond in English.

- Inclusion and exclusion criteria: Individuals who have participated in a new product development project will be included
- Recruitment: An email will be sent out to potential candidates with a link to the Qualtrics survey. Interview participants will be asked in-person or through email if they are interested in participating in the research. The consent form will be provided to interview participants.
  - Participants will be identified
    - Through personal and professional networks at [REDACTED]
    - Through membership in professional groups on LinkedIn
    - Through reviews of research publications on publicly available research websites and databases
    - Additional means including, but not limited to, discussions at conferences, participation in Change projects in senior design courses, etc.

### 15. Consent Process

Potential survey participants will be given a consent and invitation email that contains relevant contact information for both the PI and the IRB, and the possible risks of participating.

Potential interview participants will be given a consent and invitation email that contains relevant contact information for both the PI and the IRB, and the possible risks of participating.

The research team would like to request a waiver of signed documentation of informed consent. Participation in the survey after reading the consent statement will imply consent.

It is anticipated that all participants will have capacity to consent.

### 16. Assent Process

N/A

### 17. Eligibility Screening

An eligibility screening process is not anticipated as being necessary.

## Appendix D: Manuscript 2 IRB Documents (Continued)

### 18. Methods and Procedures

An invitation email will be sent to potential participants, which will include a link to an online Qualtrics survey. Interview participants will be individually contacted, either in person or through email.

#### SURVEY:

The team will close the survey once the number of participants is reached

The team will use statistical analysis to identify cause effect relationships in the survey data

The team will publish results in Mr. Hille's thesis and in research journals

#### INTERVIEW:

Interviews will be conducted with [REDACTED] employees. The team does not, at this time, plan to interview non [REDACTED] participants.

The team will identify potential participants based on recommendations from Mr. Hille's manager at [REDACTED] (50% of participants) and Mr. Hille's identification (50% of participants).

The team will contact the participants by email, which will include an overview of the topic to be discussed in the meeting along with the consent document.

Interviews will be completed through telephone, video conferencing (i.e. Skype, Google Hangouts, etc.) or email, depending on the participants' preference. Interviews will be audio recorded.

Participants will be warned to omit their names from the discussion while audio recording is ongoing.

Mr. Hille will assign numeric identifiers to participants and state said identifier before the interview begins.

Mr. Hille will maintain an excel document that links identifier to participants, in case there is a need to follow up or provide clarification.

Responses will be transcribed post interview

Analysis will be conducted using qualitative data analysis methods outlined by Miles (<http://www.amazon.com/Qualitative-Data-Analysis-Methods-Sourcebook/dp/1452257876>).

#### RECRUITMENT FOR INTERVIEW

Dear Sir/Madam,

I am writing to ask for your participation in a brief interview to support [REDACTED] previous summer 2015 intern (Josh Hille) in his project completion. Josh is working on a study titled "Identification of change management project success factors" as part of his work at [REDACTED] and Oregon State University. His work is funded through a fellowship with [REDACTED]. The goal of this work is to help us understand why some projects fail, and vice versa. There are very few experts/examples specific to this industry, so the information you provide is very important and will help us better manage change management projects.

## Appendix D: Manuscript 2 IRB Documents (Continued)

The interview will take about 30 minutes. As Josh is no longer an intern with [REDACTED], we would appreciate completing the interview through either phone, video conference, or email, based on your preference. Josh will contact you directly to set up a convenient time. You can contact him at [hillej@onid.orst.edu](mailto:hillej@onid.orst.edu), or 503-407-4788 to set up your interview, or if you have any questions.

As part of this research I am to inform you of the following:

There are no foreseeable major risks associated with your participation in this interview. The questions address the change management process and draw on your experience as an expert in this field. You will be sent an overview of the interview questions 24 – 48 hours before your interview. This will allow you better prepare for our discussion. Results from the study including statistics and final reports that include direct quotes from subject interviews will be provided to [REDACTED]. Full interview manuscripts will not be provided.

If you have any questions about this research project, please contact: Dr. Chinweike Eseonu [Chinweike.eseonu@oregonstate.edu](mailto:Chinweike.eseonu@oregonstate.edu). If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB), at (541) 737-8008 or by email at [IRB@oregonstate.edu](mailto:IRB@oregonstate.edu)

Thank you,  
Joshua Hille

### 19. Compensation

No compensation will be given to participants.

### 20. Costs

No foreseen participation costs (beyond time spent completing the survey) are associated with this research.

### 21. Drugs or Biologics

N/A – no drugs or biologics are utilized in this study.

### 22. Dietary Supplements or Food

N/A – this study does not involve dietary supplements or food.

### 23. Medical Devices

N/A – this study does not involve any medical devices.

### 24. Radiation

N/A – this study does not involve radiation.

### 25. Biological Samples

N/A – this study does not involve biological samples.

### 26. Anonymity or Confidentiality

### **Appendix D: Manuscript 2 IRB Documents (Continued)**

Survey responses will be anonymous, or confidential if participant provides identifying information. All study information will be stored for 3 years post-study termination by the PI. Data will be stored on an encrypted computer in the PI's office, or in the OSU Library database. Results from the study including statistics and final reports that include direct quotes from subject interviews will be provided to [REDACTED]. Full interview manuscripts will not be provided.

27. Risks

No foreseeable risk is anticipated.

28. Benefits

The research will not directly benefit any participants. The research may be published, however, in accessible journals, conferences proceedings and/or theses.

29. Assessment of the risks and benefits.

Benefits in #28 outweigh risks in #27.

## Appendix D: Manuscript 2 IRB Documents (Continued)

	EXPLANATION OF RESEARCH
<b>Project Title:</b>	Identification of change management project success factors
<b>Principal Investigator:</b>	Chinweike Eseonu, PhD
<b>Student Researcher:</b>	N/A
<b>Co-Investigator(s):</b>	Joshua Hille
<b>Sponsor:</b>	N/A
<b>Version Date:</b>	October 11, 2015

---

**Purpose:** You are being asked to take part in a research study. The purpose of this research study is identify success factors of projects which are focused on achieving a significant change in processes, systems, organization structure, or job roles. We will ask questions focused on a previous change project you were involved with. These questions will identify the level of involvement and project understanding of people involved with the change. We will use the data collected from the research study as the basis for a Master's Thesis and journal publication.

**Activities:** The study activities include completing a 17 question survey provided through Qualtrics and/or participating in an interview, lasting about 30 minutes

**Time:** Your participation in the survey is expected to last approximately 10 minutes. Your participation in the interview is expected to last approximately 30 minutes.

**Risks:** We do not foresee that you will be at any risk for participating in the study.

**Benefit:** We do not know if you will benefit from being in this study. It is possible, however, that we may identify characterizations that could impact the success of future projects.

**Payment:** You will not be paid for participating in this research study.

**Confidentiality:** Any information you provide will be kept confidential to the extent permitted by law. The information you provide will be pooled with information collected from other research participants and then analyzed for common themes. The researchers will produce articles based on these common themes. Your name will never be used in the report. The researchers will keep participation confidential, but it is possible, though unlikely, that other team members could learn that you participated in this study.

**Voluntary:** Participation in this study is voluntary. You are allowed to answer or not answer as you feel comfortable.

**Conflicting Interest Disclosure:** A conflict of interest occurs when a researcher or the University has a financial or other business interest that could affect the research. In some situations, the results of a study might lead to a financial gain or other benefit for the investigator(s) and/or the University. Mr. Joshua Hille's OSU fellowship is funded by [REDACTED] and includes an internship with [REDACTED]; [REDACTED] will serve as a recruitment site for potential participants of this research study.

## Appendix D: Manuscript 2 IRB Documents (Continued)

Results from the study including statistics and final reports that include direct quotes from subject interviews will be provided to [REDACTED]. Full interview manuscripts will not be provided.

**Study contacts:** If you have any questions about this research project, please contact: Chinweike Eseonu at (541) 737-024 or by email at [chinweike.eseonu@oregonstate.edu](mailto:chinweike.eseonu@oregonstate.edu). If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at [IRB@oregonstate.edu](mailto:IRB@oregonstate.edu)

Dear Participant,

Mr. Hille and Dr. Eseonu at Oregon State University are asking for your help in a research study to understand what factors affect success of change management projects. You are one of a few people across the country who have been invited to participate because of your experience with projects of this nature.

To participate, fill out the 10 minute survey, using the following link: [Link to Qualtrics survey].

For more information about this study, please contact the principal investigator, Dr. Chinweike Eseonu, by phone at 541-737-0024 or email at [chinweike.eseonu@oregonstate.edu](mailto:chinweike.eseonu@oregonstate.edu). If you have questions about your rights as a research participant, please contact the Institutional Review Board (IRB) at Oregon State University ([irb@oregonstate.edu](mailto:irb@oregonstate.edu) or 541.737.8008).

Thank you,

Dr. Chinweike Eseonu  
Principal Investigator

Study Title: Identification of change management project success factors

## Appendix D: Manuscript 2 IRB Documents (Continued)

### Survey Questions

Heading	No.	Statement	Scale	
Select the degree to which you agree with the following statements. The following statements are based on your knowledge before you knew about the change.	1	Most people understood the basic functions and characteristics of the system to be modified.	Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree, I do not remember	
	2	Most people recognized a problem with the basic functions and characteristics of the system to be modified.		
	3	Most people were satisfied with the previous functionality of the system before the change occurred.		
Select the degree to which you agree with the following statements. The following statements are based on your knowledge after you knew about the change, but before the change was implemented.	4	Most people understood the reasons and impact of the change.		
	5	Most people understood the potential outcomes of the change.		
	6	Most people understood how the change would occur (timeline, activities, tasks, etc.).		
	7	Most people recognized that the change would impact their day-to-day job.		
Select the degree to which you agree with the following statements. The following questions are based on your current knowledge of the change project.	8	Most people recognized that the change would address the problems they identified with the basic functions of the system.		
	9	Most people were involved in the implementation of the change project.		
	10	Most people were involved in the planning of the change project.		
Rate the impact of the project on the following.	11	Most people saw first-hand the impact of the change project.		
	12	Perceived meaningfulness of most people's job		Very negative impact, Negative impact, No impact, Positive impact, Very positive impact, I do not remember
	13	Most people's job-related stress		
	14	Success of the organization		
	15	Most people's job satisfaction		
	16	Most people's opportunities for promotion		
	17	Most people's level of inclusion in decision making		

### Interview Questions

1. What did you think of the move from [REDACTED] to [REDACTED]?

Please answer the following questions based on your knowledge before you knew about the move.

2. Preconception awareness
  - 2.1. Did you understand the [REDACTED]-specific business reasons for being located in [REDACTED]? What were those reasons?
  - 2.2. Did you understand the [REDACTED]-as-a-whole business reasons for being located in [REDACTED]? What were those reasons?
3. Generate meaningful conflict
  - 3.1. Did you notice any issues with being located in [REDACTED]? For example, were there [REDACTED]-specific or [REDACTED]-as-a-whole business issues resulting from being located in [REDACTED]?
  - 3.2. Were you happy being located in [REDACTED]?

Please answer the following questions based on your knowledge after you knew about the move, but before the move actually happened.

4. New concept introduction
  - 4.1. Even if you disagreed with the move, did you understand why the group was moving from [REDACTED] to [REDACTED]? Why was the group moving?
  - 4.2. Do you know who was initiating the move?
5. Validation
  - 5.1. Did you recognize that the move would help eliminate some issues with the [REDACTED] group?
  - 5.2. Did you recognize that the move would help eliminate some issues with [REDACTED] as a whole?

Please answer the following questions based on your knowledge after the move happened.

6. Transfer
  - 6.1. Do you feel like you were involved in the implementation of the move?
  - 6.2. Do you feel like you were involved in the planning of the move?
  - 6.3. Were you able to see the impact that the move had on your colleagues? How did it impact them?
  - 6.4. Were you able to see the impact the move had on [REDACTED] business processes? How did it impact them?

