Innovative Use of Force Field Analysis: Factors Influencing Technology-Enabled Change

Peter R. Toves
Walden University, MN

Linnaya Graf
Liberty University, VA

David A. Gould
Walden University, MN

Author's note

Dr. Peter R. Toves was the lead change agent in a project that transformed business practices for fourteen maintenance repair and overhaul organizations from paper to electronic manuals serving professionals using technology for aircraft maintenance. Email: petertoves@msn.com

Abstract

There remains a limited understanding of the factors that contribute to effectively managing technology-enabled change. Understanding the process of effective technology implementation is significant to many fields and government agencies, as organizations must do more tasks with less resources. To better understand technology-enabled change, this exploratory case study applied a unique conceptual framework consistent of the synthesis of a force field analysis and theories of change through technology insertion. Thirteen participants provided data through interviews, field observations, and a questionnaire. Findings revealed communication issues, a fundamental misconception in training, and a false assumption that most personnel easily acquire computer literacy.

*Keywords: Technology-enabled change, eTool, S*ocio-technical

Introduction

The pressure to modernize government agencies, public corporations, and nongovernmental organizations continues to grow with the knowledge that significant financial benefit occurs when moving from paper to digital systems. For example, under the President's Government Consolidation Proposal, agencies such as the Department of State, the National Aeronautics and Space Administration, the Social Security Administration, and the Food and Drug Administration will consolidate business practices and transform to paperless processes (Office of Management and Budget [OMB], 2013). This process will save taxpayer dollars for each agency ranging from $500M to $10B. While the cost savings for this endeavor is considerable, there are numerous hurdles that make this challenge difficult to implement for many agencies Furthermore, those affected by the technology enabled change may be

unprepared for or fail to accept change if the change is not accompanied by a more holistic goal, rather than a focus on the narrow technological endeavor (Martin & Huq, 2007).

This exploratory case study employed an innovative use of force field methodology, developed by Lewin (1951), to identify the social-technical factors and pathways contributing to and hindering the success of a transformational effort to move from paper to digital processing within an aircraft maintenance, repair and overhaul (MRO) organization. While, this study presents a specific snapshot of a singular organization it has important implications and significance as an example of comprehensive efforts to implement change in a governmental facility. Due to the nature of the targeted organization, this exploratory case study has important lessons learned for the field of management and technology transfer for future change. The lessons learned from this study provide an important evidenced-based best practices that can applied to future technology enabled change, as organizations continue to move departments into the 21st century.

For more than a decade, departments within the Department of Defense (DOD) have worked to transition Maintenance, Repair, and Overhaul (MRO) organizations to a digitized maintenance environment. However, slow-moving changeover has created fragmented implementation, complex processes, dual sustainment issues, wasted resources, and increased waste of tax dollars (A. Person, personal communication, April 2, 2013). ETools are computer devices used to view electronic technical manuals. ETools include laptops, desktops, hand-held devices, and associated storage cabinets (Toves, 2015).

The purpose of this exploratory case study was to identify the factors which influenced implementation of eTool/eTM technology in one MRO organization. An exploratory case study was chosen for this study, as it was an appropriate methodology for applying an innovative utility of application of force field analysis methodology to understanding the process of change. A force field analysis (Lewin, 1951) encapsulates the unique benefits of identifying factors, and then ranking those factors by importance and changeability. The key outcome for the study is the development of action steps for process improvement in efficiency and effect.

Boundaries of the Case

The research question driving the current case study was: What are the socio-technical factors that have inhibited the transition from a paper-based system to an electronic-based system in MRO organizations? Further, applying the framework of force field analysis and change management theory, what are appropriate action steps for future research or development that can improve the process of technology enabled change from a paper to digital process? The term socio-technical underscores the importance of integrating humans with technology in the workplace, identifying an interrelationship that exists among these systems (Ulhoi & Jorgensen, 2010). Socio-technical theory considers the interrelationship between organizational elements such as structure, tasks, people, and technology (Akbari & Land, 2011).

Parameters of the Case

For this exploratory case study, the unit of analysis was one DOD maintenance organization, purposefully selected based on pre-established criteria as the setting for current study. The pre-established criteria included access to the setting and participants, governmental approval, and ongoing occurrence of the process under study, namely the transference of a paper

based to digital platform. Further, participants were purposefully selected, within the organization, based on a connection or experience with the phenomena, as well as their position within the organization.

The current exploratory case study is bound to one specific DOD MRO. However, it is appropriate to assume that the information gained from the current case study has transferability to other DOD MRO organizations in similar circumstances, because the maintenance culture and parameters of such installations are very similar across geographies. Further, the significance of these findings are also potentially transferable to other organizations, outside the DOD, as the transition to a digitized process is not isolated to just one organization within the DOD (S. Teate, personal communication).

Background of Technology Acceptance

Digital and electronic services are replacing physical locations and paper processes with a shift towards digital operations that include ecommerce, eservices, e-tailing, and e-Biz. Despite this push towards a digital and modernized platform, in MRO organizations, the technical skill-sets vary, with a workforce comprised of military personnel, contractors, and civil servants that demonstrate various capabilities of operating in new, updated platforms (AF Personnel Center, 2013). Work groups differ significantly in age, experience, and technology competencies (AF Personnel Center, 2013). These differences create significant challenges in implementing tools that support workforce development of the nontechnical percentage of the professional workforce. To understand how future efforts might improve workforce development, the current exploratory case study focused on the social-technical factors which drive the successful transition from a paper to a digital paradigm.

The term *socio-technical* denotes the importance of integrating humans with technology in the workplace such as identifying that an interrelationship exists among these systems (Ulhoi & Jorgensen, 2010). Socio-technical theory refers to the organization as comprising of two subsystems, a technical subsystem and a social subsystem (Mumford, 2006). The technical subsystem includes the tools, technology, and techniques used to innovate and economically improve output of the organization (Mumford, 2006). The social subsystem consists of employees, skill-sets, knowledge, values, attitudes, and group relationships rooted within the organization (Mumford, 2006). Thus, socio-technical system design ensures that technology and human issues are given equal weight whenever possible with emphasis on joint optimization (Chern, 1976; Mumford, 2006; Ulhoi & Jorgensen, 2010). For MRO organizations and its decade long transformation, it is conceivable there are socio-technical forces influencing effective implementation of technology thus, the motivation for this study. To enable transition to the digital paradigm, leaders should lead front line management towards building culture favorable to change (Popesecu, 2009).

Studies in change management have contributed to understanding people, technology, cultures, and how organizations manage change (Gotsill & Natchez, 2007; Laura-Georgeta, 2008; Martin & Huq, 2007). Several authors have suggested that implementation of IT is more effective when coupled with change management strategies and that change methodologies are key to technology acceptance (Gotsill & Natchez, 2007; Laura-Georgeta, 2008; Martin & Huq, 2007). Lewin's (1951) classical change model suggested that change is a three step sociological process. Lewin (1951) termed these steps: unfreeze, move, and refreeze. Lewin (1951) suggested that during major changes, any social barriers that inhibit acceptance to change should be

identified and addressed for change to be successful. This action would help to unfreeze affected attitudes from the past behaviors, move them towards change then refreeze the new behaviors to the new norm (as cited in Schein, 1995). In considering Lewin's change model and more than a decade of transition, it is conceivable that transition to a digital end-state is impeded by a breakdown in the process of moving through the necessary steps for positive change to the end state. In applying Lewin's (1951) force field methodology, the current case study included an exploration of the barriers that inhibit technology-enabled change.

Technology acceptance models provide core constructs and ideas to specific approaches that address behavior stages examined in Lewin's (1951) change model. For example, if an organization identified negative factors relative to perceived usefulness of technology, it is conceivable that a training program could decrease negative attitudes and increase positive perceptions of usefulness (Ji-Tsung & Markus, 2006)**.** It can be noted that user involvement, is the *moving* stage of Lewin's (1951) change model (previously mentioned). In this model, the moving stage is where users are more open-minded and change gains momentum towards the new norm. The key to success in the moving stage is effective strategies (Lewin, 1951). As organizational growth and technology efficiencies emerge, organizations must evolve to improve their effectiveness. Information technology can be a significant driver of organizational change "because of the technology involved and the difficulties of determining stakeholder readiness for adoption and understanding" (Long & Spurlock, 2008, p. 35). Leaders and managers must understand and appreciate the key positive and negative organizational factors that influence the effectiveness of technology-enabled change and its transition (Brenner, 2008; Levin & Gottlieb, 2009).

In today's technology centered environment, most planners tasked with modernizing organizational processes appear to concentrate on process requirements, contractual language, reasonable costs, enhanced productivity, and short time-lines (Martin & Huq, 2007). Although important, these areas focus more on managerial responsibilities and fall short of addressing the socio-technical aspects of people and technology, which need to assimilate as one inclusive system (Mumford, 2006). Too often, technology-enabled change neglects the human factor (Hornstein, 2008). This mind-set continues today and is evident by the ineffective and or fragmented technology systems deployed and or shelved by government, public and private corporations, nongovernmental, and DOD organizations (S. Teate, personal communication).

From an MRO perspective, aircraft maintenance organizations characteristically do not plan for or employ formal change management strategies for IT initiatives. This is evident based on the development of numerous implementation strategy documents (contract researcher for AFMX21 Maintenance Strategic Plan, 2011; Capabilities Development Document, 2006; Technical Manual CONOPS, 2012; Transformation Roadmap, 2002) that identified why and when to implement the transition but not explain how to achieve the goal.. Hence, change management strategies become a defaulted responsibility of the project managers (generally more concerned about the technical aspects of the initiative), or middle management (not experienced in managing change). In other words, change management strategies are developed ad-hoc, during crisis, or not at all.

Conceptual Model: Merger of Change Management Theory and FFA

Force field analysis (FFA) is a tool, often used, in management, designed to help identify factors or forces that influence, drive, or impedes change. FFA is a framework based on the

change theory developed by Lewin (1951) and used to define the dynamics of human behavior when change is introduced or when the status quo is disrupted. Specifically, the FFA was used to explore the factors that influenced an ineffective shift from a paper to a paperless paradigm in the MRO organizational process. According to Lewin (1951) and FFA principals, three key actions must take place for change to occur. Specifically, change agents must identify, determine, and develop. First, identify contributing and inhibiting factors or forces that influence behaviors. Second, determine which forces or factors can be controlled or positively manipulated to drive change. Third, develop recommendations or action plans for positive change (Toves, 2015). For the current exploratory case study, the force field analysis is used as the driving methodology to better understand the process of technology enabled change through identifying the factors that influence change, and identifying possible action steps to improve this process through driving and hindering factors.

Methods

For this exploratory study, internal users and managers from one aircraft MRO organization participants shared their perceptions of the organization's digital transition state of affairs, as well as their experiences during the transition. Observations provided a real-life understanding of the work environment, daily work practices, and potential issues associated with the use of the technology (Yin, 2009). Individual interviews were conducted to conceptualize the perceived value of the technology (Davis, 1989). In an effort to understand the most influential factors of technology acceptance, a follow-up questionnaire was used for participants to rate the most important and most implementable factors.

Study Rigor

Sample Description. A purposeful sampling approach was used to capture viewpoints from specific participants in selected organizational positions. The sample population for this research included two maintenance organizations, Flying Training Wing X (FTW X) and staff members from the headquarters X (HQ X). There were 20 participants solicited for the main study and three participants for the pilot study. Further, three members of the HQ X staff were solicited to pilot test the interview questions/guide and questionnaire. Participants of the main study were selected based on their specific positions within the FTW X organization. These positions included, one group commander or equivalent, two technical order distribution officers (TODO/program managers), and 17 maintainers (technology users). The total anticipated number of participants for the main study was estimated to be 20. The number solicited within each position differed because there are only a specific number of personnel assigned to these key positions in the MRO organization. Although 20 volunteers were originally identified for the main study, only 13 individuals participated. This was because after 13 interview events, participants were no longer providing any new information of value (Saumure & Given, 2008); thus, data saturation occurred after reaching 13 participants.

Data Collection

Interviews. Semistructured interviews were conducted, recorded, transcribed, coded, and analyzed. During the concluding review of the coded data, 23 key factors were identified, structured under eight major themes, and confirmed as valid. An independent reviewer

crosschecked the coding to ensure soundness of interpretation of terms and protect against data entry errors. Organizational policy and higher headquarters documentation was also reviewed to understand and determine whether interpretations or communication gaps existed within the workforce. Documentation review was key to identifying issues not readily apparent from other data sources.

A follow-up questionnaire was distributed to participants to provide ratings for key factors captured during the interview sessions. This instrument developed the foundation of the force field analysis framework that enabled final analysis of the findings and the constructs for building the action plan. A pilot study was conducted to ensure the instruments and methods were trustworthy, free of bias, appropriate for the current population, and understandable at the proposed reading level.

Observations. Observations helped to gain insight into unusual aspects of the environment, understand direct participant experience, and gain insights to motives or behaviors (Yin, 2009). Observations were conducted within two aircraft hangars. This location was ideal because it allowed a complete look at the maintenance facility, working environment, and conditions, eTool equipment, and the workforce in action. Personnel observations were conducted on four of the 13 maintenance participants interviewed. This was because there was no value in conducting technology use observations on all participants especially, for those who appeared confident with the equipment. Additional observation points included evaluating how the technology architecture was set-up and whether access to the data was user friendly. The following was observed during observations in the maintenance hangar:

First, there were three different models of eTool equipment in use. According to the users, some were more user-friendly than others. Consequently, users had to learn or understand the different types of machines because they would not necessarily sign the same one out daily. Thus, computer-use competencies or abilities came into question.

Second, eTool monitors were maintenance mechanics assigned to assist the IT section with the eTools allocated to their respective sections. However, the monitors received no formal IT training and were required to work both the eTools and their primary aircraft maintenance duties simultaneously. Follow-up questioning revealed that at times, the combined duties became overwhelming causing one of the two responsibilities to be reprioritized. This created a domino effect at different levels of the MRO operation. For example, when the monitors worked eTools issues, their primary duties had to be accomplished by someone else or left for another time. On the other hand, when the eTool duties were left for another time, the workload for the IT repair section increased. The increase in workload increased the repair cycle time because the monitors were forced to batch the equipment until they were able to transport them to the IT section for repair. Consequently, an increase repair and turnaround time typically forced shortages in equipment and possibly a slowdown in MRO maintenance production. The inefficiency in this system and potential consequences of the shortfall was also noteworthy.

Third, during informal follow-up questioning, some participants were asked whether they were aware of procedures and eTool user responsibilities outlined in their organizational policies and documentation. All replies were negative; most all users replied that responsibilities came from rumors or other colleagues. This final issue regarding a gap in understanding procedures and policies was another critical factor identified during observation.

Documentation. Archived documents were examined for potential conflicts between internal policy and procedures, the interpretation of guidelines between staff members and workers, and potential training shortfalls. The documentation revealed interesting insights. First,

most of the explicit responsibilities outlined in the organization's maintenance operating instruction (MOI 21-16) were specific to equipment monitors and not much detail explained information for users. Yet, users have physical and safekeeping responsibility of equipment throughout the entire workday. The review also suggested that there were specific monitor responsibilities inherent or applicable to users as well. For example, for decentralized eTool checkout areas, users must also be mindful to "Ensure eTool is plugged into its own unique power supply and drawer" (MOI 21-16, 3.2.4. 2014). However, follow-up questioning revealed that users were unaware of the MOI 21-16 and the general information that provided guidance to avoid equipment damage that could cause increased IT workload and or equipment shortfalls. This information suggested two potential issues. First, communication about procedures and guidance are not effectively reaching the workforce. Second, as the MOI guidance is not specific enough to users, thus, there is not sufficient policy requiring user's to adhere to important procedures. The need to understand and communicate organizational policy, procedures, and guidelines is important as one part of the system can affect other parts of the system (Bertalanffy, 1972).

Questionnaire. As part of the FFA framework, a questionnaire was distributed to participants after data was collected, aggregated, and factors were identified. The FFA questionnaire was designed with 23 questions based on the key factors identified and captured during data collection. The identified factors were perceived by the participants as barriers that negatively influenced technology implementation and adoption. The questionnaire included a rating scheme where participants were required to rate the factors by both level of importance and by its perceived level of implementation. The rating scheme was instrumental to the questionnaire process because it clarified that factors perceived as implementable should be considered for the development of strategies, outcomes, and recommendations.

The FFA questionnaire facilitated a methodical approach to understanding three important pieces of this research. First, it helped to identify important factors to technology-enabled change as perceived by the internal users. Second, results provided an opportunity to further validate the study by triangulating and comparing the data from the other data sources. Third, the method assisted in identifying factors that are potentially implementable that may enable the development of a future action plans and strategy to improve overall technology implementation. The questionnaire facilitated the FAA framework's strategy by compartmentalizing the important data and enabling increased rigor to the identification process. Predictive analytics software (PASW) software was used to capture and organize statistical data developed from the FAA questionnaires.

Data Analysis

To begin the data analysis process, factors were first identified by calculating frequency of report during interviews and further sorted into emerging patterns and themes using hand coding (Patton, 2002). After two iterations, forty key factors were identified during this process. After the second iteration of hand coding was completed, these 44 identified factors were further scrutinized and consolidated to 23 key factors based on similarity of terms. This process helped to facilitate the application of a more manageable force field analysis questionnaire (see Toves, 2015). Following, the FFA paradigm these 23 factors were used to further develop key action steps for future best practices in the area of technology enabled change.

Data Queries. NVivo10 was used to organize the data and provide confirmatory analysis. As mentioned previously, 23 established child nodes were identified. After developing the hierarchy of nodes for themes and factors, several queries were run to further explore data collected during the 13 interviews. The first query run was a coding query. The purpose of this coded query was to test the ideas and relationships between the aggregated codes as confirmation of the hierarchy developed during hand coding. The secondary query run was a matrix-coding query; this compared the data collected across the developed nodes. A final query sought a word list for text query of top reported words. In this query several critical words stand out that should be noted with a recording of their number of uses in parentheses.

- Know/Experience (N=605)
- Support (N=571)
- Training (N=496)
- Use/Functionality (N=340)
- Management (N=217)
- Processes (N=144)
- Technology (N=143)
- Maintainer/Maintenance (N= 142)
- Force (N=132)
- System (N=129)

Results

Demographics

The demographics for this study were typical of that of any DOD civil service maintenance organization. Volunteers included 12 men and 1 woman, eight were over age 50 and the remaining ages ranged between 20-50 years old. Twelve of the 13 participants attended some college or attained college degrees and only one participant completed high school only.

Rigor

Several steps were taken to ensure collected data was scrutinized for credibility, conformability, transferability, and dependability. This included member checking, cross checking, triangulation, as well as exploring transferability, dependability and confirmability. To ensure objectivity, independent reviewer crosschecked the process by confirming results and challenging any assumptions as part of the triangulated data sources analysis. The use of an independent reviewer to cross check the coding processes, assisted in establishing rigor and confirmed that the data was consistent with my interpretation.

Currently, nearly all MRO organizations within the DOD, state-side and abroad with flying missions are transitioning to a digitized aircraft maintenance concept. The current study was a 1-month snap-shot of a single organization experiencing this transition. However, the potential for transfer in this unique study is conceivable because the sample used for this study is representative of most MRO organizations with flying missions. Unlike many other institutions, U.S. MRO organizations within the DOD are designed, operated, and managed using a similar culture and organizational structure. A significant attribute of the structure is the similarity across various points. The assumption is based on similarities in attributes such as organizational

maintenance, structure, leadership hierarchy, maintenance philosophies of management, maintenance duty positions (Command X, 2009), standardized eTool technology, software application used with eTools (Command X, 2012), AF guidelines and directives, and standardized system architectures (Command X 2011, 2009). While research indicates this singular snap shot is not transferable (Creswell, 2007), in this particular case it can be argued that there is a stronger likelihood that the sample is transferable to other organizations because of the similarities and standardized nature of the DOD agencies, as noted.

Findings

The FFA model required the researcher to: (a) identify factors that influenced behaviors, rate factors based on their level of importance, (b) determine which factors could be positively manipulated to drive change, and (c) develop recommendations or action plans for positive change (Lewin, 1951). However, during statistical analysis, other considerations emerged from the factors rated based on level of importance. This was because all 23 identified factors ranged on the high end of the Likert scale, 2-3, moderately important and very important. Consequently, this near one-sided agreement made these results impractical to plot or discuss individually. Therefore, the most important factors among the 23 were identified using Pareto's 80/20 rule.

Pareto's 80/20 rule states that 80% of the issues may be addressed by 20% of the causes (Reh, n.d). Thus, for this study, the six highest rated or most important factors were selected for discussion. The six factors that participants or employees perceived as most important were the following: Employee feedback to leadership (Employee Fdbk Ldshp), Employee feedback to middle management (Employee Fdbk Md Mgmt), Leadership support, Communications, Trust, and Dual processes. The following results explains the findings of this process.

Employee feedback to leadership. One hundred percent of all participants considered employee feedback to leadership as the most important factor of the 23 captured. Sixty-nine percent of the participants believed that this factor would be very easy or somewhat easy to implement and 31% believed it would be somewhat difficult. Although this factor was identified as most important, participants were evenly divided on its ability to be implemented.

Table 1

Number of Frequency Reponses to: Employee to Leadership Factor.

Level of Difficulty	Frequency	Percent	Valid Percent
Somewhat Difficult	4	30.8	31%
Somewhat Easy	4	30.8	31%
Very Easy	5	38.5	38%
Total	13	100.0	100%

Employee feedback to leadership. This factor relates to the need for an established and reliable feedback process where employees and upper level leaders can exchange information, ideas, and concerns about maintenance issues, organizational changes, and challenges that effect business practices. Employees expressed anxieties about their ability to have a voice about the needs in the maintenance area. One participant who was concerned with changes being made in a vacuum stated, "People who are making decisions with money don't know what it's like to work

on a flight line." Another participant was concerned about how senior leadership implemented technology-enabled change and stated that, "I think there's a lot of assumptions in regards to what everybody should know, when in reality, it's not that way." Thus, participants felt communication with feedback to senior leaders was essential for positive change to take place.

Table 2

Number of Frequency Reponses to: Employee to: Employee Feedback to Middle Management.

Level of Difficulty	Frequency	Percent	Valid Percent
Very Difficult	1	7.7	8%
Somewhat Difficult	2	15.4	17%
Somewhat Easy	6	46.2	50%
Very Easy	3	23.1	25%
Total	12	92.3	100%
Missing System	1	7.7	
Total	13	100.0	

Employee feedback to middle management. Ninety-seven percent of all participants surveyed considered employee feedback to middle management as the second most important factor. Seventy-five percent of participants believed that this factor would be very easy or somewhat easy to implement. Twenty-five percent of the participants believed that this factor would be somewhat and very difficult to implement.

The Employee feedback to middle management factor represented a perceived disjointed relationship between management and frontline employees. This factor was related to the need for an established process where employees could provide comment or feedback about work concerns, actions, and the effects of changes. Thus, with the current verbal method, the sense of urgency or importance to address concerns differs in scope between managers and employees. One frustrated participant stated, "Who knows better what I need than myself, because I'm the one doing the job." Another participant stated after bringing up several concerns, that all they got from management was "Lip service to a problem like... yeah were addressing that, or that's being considered, or we don't have money to do that right now." Employees believed that an established feedback process where voices could be heard, issues tracked, and addressed would be integral to improving organizational efficiency and positively moving technology-enabled change.

Leadership support. Ninety-five percent of all participants surveyed considered leadership support and the subsequent 3 factors, communication, trust, and dual processes equally as important. For this key factor, employees expressed considerable frustrations in working with technology to perform aircraft maintenance. One participant stated that, "A more hands on approach from middle and upper management. They need to be more involved at the ground level and have a genuine interest in how the user is dealing with this from day to day, like, if you didn't have the skills…you [could've been] were in trouble."

Table 3

Number of Frequency Reponses to: Employee to: Leadership Support.

Level of Difficulty	Frequency	Percent	Valid Percent
Very Difficult	1	7.7	8%
Somewhat Difficult	3	23.1	23%
Somewhat Easy	4	30.8	31%
Very Easy	5	38.5	38%
Total	13	100.0	100%

Table 4

Number of Frequency Reponses to: Communications Factor.

Level of Difficulty	Frequency	Percent	Valid Percent
Somewhat Difficult	4	30.8	31%
Somewhat Easy	6	46.2	46%
Very Easy	3	23.1	23%
Total	13	100.0	100%

Communication. Sixty-nine percent of the participants surveyed believed that the communication factor was very to somewhat easy to implement. The communication factor refers to the need for consistent reliable communication from top to bottom and across the maintenance organization. During the interviews, participants expressed concern and confusion about learning about changes in maintenance practices via rumors, chatter, during breaks, and on the fly. One participant stated, …"because the Air Force has so many different levels, the message tends to get watered down… and sometimes, if you didn't have a lot of the middle guys…it's easier to get these changes implemented. In other words, too many layers of managers are confusing the context of the messages." Another participant, concerned with direct leadership level communication stated, "I think, some stuff goes up and down, other stuff doesn't. It will reach my immediate boss, but I think sometimes it just dies right there." Another participant stated, "That's…a big complaint, I bring it up…then I don't hear anything back. So, 3 or 4 months go by, I'll bring it up again to somebody else and… that's the first time I heard about that…typical."

Trust. For the trust factor, 54% of participants felt that this factor could be somewhat easy and very easy to implement. The remaining half or 46% believed it would be somewhat difficult and no one said it would be very difficult. For the trust factor, participants expressed numerous perspectives related to both system trust and their own computer literacy skills.

Participants felt that trust was important because it related to two significant issues. First, some participants didn't trust in their own technical abilities in operating the eTool technology and in navigating the software to find the applicable technical data. Second, users were not confident in the new electronic/digitized system itself because of their lack of understanding

versus the many years of experience in using paper technical manuals. This appeared to be a personnel anxiety issue that kept some resisting the change to electronic technical manuals. These personal barriers were more significant for the "seasoned" personnel. One participant stated, "You will always find it the hardest thing…that any human being has to do is change." Another participant stated, "Some of the more mature guys are not computer savvy, they won't use it... they're going off their knowledge." Another participant commented that for "Some of the older folks that I know…there was a fear…of not being able to find what they needed to find, and even spending a lot of time …I still see it now."

Table 5

Number of Frequency Reponses to: the Trust Factor

Level of Difficulty	Frequency	Percent	Valid Percent
Somewhat Difficult	6	46.2	46%
Somewhat Easy	6	46.2	46%
Very Easy	1	7.7	8%
Total	13	100.0	100%

Table 6

Number of Frequency Reponses to: the Dual Processes Factor.

Level of Difficulty	Frequency	Percent	Valid Percent
Somewhat Difficult	5	38.5	38.5%
Somewhat Easy	5	38.5	38.5%
Very Easy	3	23.1	23%
Total	13	100.0	100%

Dual processes. For the dual process factor, a combined 62% of participants felt that this factor was somewhat and very easy to implement or amend. Thirty-eight and ½ percent felt it was somewhat difficult and no one believed it would be very difficult. Under this factor's description, dual process was an undesirable practice that required the organization using two data formats of the same information with different rules associated.

Interpretation of Findings

Implementation strategy

The findings in this study confirmed a key oversight in the development of technology enabled change. A paradigm shift from paper to digitized maintenance practices with no clear implementation strategy triggered confusion, resistance, and uncertainty issues from both management and employee levels throughout organization in the current DOD MRO organization. Some maintainers learned how to adapt to the new maintenance philosophy through trial and error, others had some computer skills to get by, and some have yet to use

eTools. For example, users indicated that navigating through the information was tedious and time consuming using both the hardware and software. One user stated, "It took us too long to find [out] the information." We really weren't trained on the possibilities of how to use it and we were just taking too much of our own time…that's the reason why it took us so long and why we all had that negativity."

In the literature, effective technology-enabled change was conceptualized by the use of dedicated and trusted change agents assigned from within the organization (Hornstein, 2008). This not only allows management to focus on day-to-day business, but also ensures consistent information exchange focused on shaping attitudes, beliefs, and values in support for the change initiative. Westover (2010) postulated that change agents not only work towards transitioning behaviors but also concentrate in promoting and fostering the new behaviors for growth and stability. When referring back to the literature, this concept reflects the *refreezing* stage of Lewin's (1951, 1958) classical three-stage change model. Another way in which the unit could have ensured effective change was in establishing an organizational readiness posture. The following sections identify key factors which must be considered when developing best practices for technology-enabled change from a paper to digital platform.

Organizational readiness

Organizational readiness for change is a multilevel construct and a precursor to successful implementation (Weiner, 2009). Readiness refers to the organization's shared belief that by committing to change there would be positive benefits or outcomes. This commitment is often based on resources, task demands, and other organizational situations (Weiner, 2009). Thus, for this investigation, potential competing priorities may have taken precedence over developing a readiness posture to shift organization into the new digitized maintenance concept. Users were not aware, trained, or involved in decisions or discussions in the changing environment. Participants alluded to factors such as, forced transition, hardware challenges, lip service, and most frequently mentioned, training. Kanter (2012) suggested that change is generally resisted when imposed upon people suddenly with little time to prepare.

In drawing from the literature, Lewin's (1951, 1958) three-stage change model can ideally be prescribed to create organizational readiness. Thus, readiness can be achieved by implementing communicative strategies focused on unfreezing mindsets fixed on the status quo. These strategies should communicate the importance of change, emphasize the differences between the current and desired states, underscore dissatisfaction with the status quo, and or motivate a sense of urgency. Other unfreeze strategies can be connected to on-time training, adequate resources and support, performance incentives, and awards. By unfreezing past norms, employees will be open-minded to new ideas that help to enable change and facilitate a key aspect of organizational readiness.

Top barriers in the current exploratory case study were a result of two highlighted communication shortfalls. First, an inconsistent communication processes were directives/changes were learned via rumors or other unofficial channels. Second, the absence of a feedback process where management can address and answer workforce concerns.

Communication

Vasile (2009) stated, "The major role of information is to reduce uncertainty due to an imperfect knowledge of a reality" (p. 185). Consistent and reliable communication from top management and across the frontline workforce was perceived as disjointed. This factor was exposed from the interviews, questionnaires, and during the post observations interviews. Thus, unreliable information may have contributed to the long-term implementation process. This is because employee uncertainty could have created instability problems that lead to low morale, low commitment, and ultimately resistance to change (Vasile, 2009).

Participants conveyed a need to voice concerns relative to organizational changes and policies affecting work practices. Participants believed that their involvement could have prevented many technology acceptance issues. Thus, a lack of voice or involvement about important issues could have driven a low sense of urgency for the workforce to transition to digitized systems.

Implications and Conclusions

The sluggishness of more than a decade of transition to a digital end-state has created fragmented implementation and complex processes across MRO organizations with an aircraft maintenance objective (D. Airman, personal communication, April 2, 2013). Thus, leaders and technology planners must seek effective approaches to assimilate both technology and people processes equally so that the final end-state can be achieved. The force field analysis framework required the researcher to: (a) identify factors, (b) rate factors, (c) determine those that can be positively manipulated, and (d) develop recommendations or action. Thus, the results from the aggregated data were used to develop the following action plan that can potentially decrease or eliminate current negative factors generated from this study. In addition, lessons learned from this study may assist in improving future technology-enabled change initiatives.

Establish eTool training

Throughout 100% of the interviews and approximately 70% of the questionnaires, participants reported eTool training as a key factor of technology acceptance and effectiveness in the workplace. One participant suggested, "A standardized training program based on particular e-tool characteristics and program content." Another suggested, "Establish a basic level of understanding using ETools prior to operational use in a maintenance environment." A third participant proposed "A training video… for laptop and tablet orientation and use; it could even go as far as describing Maintenance Operating Instructions and related information about the proper use and handling of the e-tool equipment." All suggestions were noteworthy because participants reported that there were several eTool models in use and each had different features and limitations to understand. This issue made maintenance especially untimely and extra complicated for employees with limited computer literacy skills.

Action. In considering the variety of data analyzed and reviewed, a specific set of action sets is presented related to the parameters of the FFA. Specifically, the following are appropriate action steps that should be considered by future organizations engaged in this type of transition.

- Establish an eTool hardware and software training program
- Provide initial eTool training during organization in-processing

- Provide consistent familiarization training after new eTool model purchases in addition, participants also described a need for:
- ETool responsibility, safe keep, care, and accountability training.

This approach would train users on how to care and maintain the equipment in their custody and the consequences of abuse.

Establish feedback process

According to the data, 100% of the participant's felt that feedback between employees, middle, and senior management levels was very important and essential to organizational efficiency. Users felt that changes in maintenance practices were made in a vacuum and that issues that arose during and post implementation could have been reduced or eliminated if communication within the chain was consistent and more reliable.

Action. Following the previous model, these are the recommended action steps for establishing a feedback process. Specifically, establish a SharePoint site (already available to DOD) where maintenance personnel have access, perhaps a dashboard that automatically initiates on desktop PCs and as an icon for the eTools. Suggested forums: (a) management announcements, (b) personnel comments, (c) management feedback to comments (tracked), (d) organizational reports, and (e) awards program section. As a routine, the forum must be socialized during the in processing of all new personnel.

Recommendations for future research

This study provided needed exploratory groundwork to understanding a way to improve the implementation of technology-enabled change in maintenance organizations. A FFA framework as part of an exploratory case study provided a sound process that facilitated the identification of factors (e.g., reasons, causes, perceptions, and attitudes) that influenced the employees thinking as a result of change initiative. The results of this study provided a snapshot of a single organization and were representative of one segment of the maintenance population. Thus, future studies should include a duplication of this method with a larger population of this segment and later a mixture of all three of segments in the maintenance entire population. The current study contributed to the feasibility of a larger, more generalized questionnaire by providing identified factors as a baseline for developing future measures. Additional quantitative data, such as personnel demographics, size of organization and education and experience levels could also help in understanding the bigger picture**.**

First, the results of this study should be replicated with a larger population of the same civilian segment as in this research. This will help to establish whether results of this study are transferable to DOD civilians in maintenance organizations. Next, the study should be conducted on sites where there are a mixed population of DOD maintenance personnel to include, civilians and military employees. This would help determine whether the issues or factors among employees with mixed working cultures differ in comparison. Thus, it may be conceivable that a diverse maintenance population adapt to change better or worse than that of a single segment, if so, why. Such a study could contribute to best practices in understanding organizational alignment and the variables associated with technology-enabled change in diverse and non-diverse maintenance organizations.

The results of this study included aggregated data from interviews, observations, and documentation. A force field analysis design exploited important factors that influenced the perceptions of employees affected by the change. Participants rated factors by importance and their ability to implement, then provided actions based on their experiences. Thus, this study may be used as a guideline to better analyze, identify, and reduce the barriers that affect people and change. Moreover, it may instill an improved understanding that technology-enabled change and managing change should be planed concurrently because poor transition could cost more than the change may be worth. DOD leaders, planners, and managers continue work on the assumption that change will be transparent, people are resilient, and that transition will take place one way or another.

Conclusion

The results of this study were successful in identifying the barriers to technology-enabled change; however, a secondary critical takeaway from this study is that force field analysis is a powerful tool which should be applied on the front-end of technology-enabled change. In carefully analyzing the circumstances for this case study, it is important to remember that technology acceptance and implementation issues persisted for more than a decade. Thua, understanding how to avoid this type of delay in technology acceptance goes beyond understanding the specific barriers, to improving the actual planning process of organizational change management and implementation. Recommendations for future planning during implementation is an unintended, but an important finding from the study.

Specifically, beyond understanding the basic results of the barriers that exist to technology-enabled change, what was learned during the current study is that applying proper planning and the use of the force field analysis methodology, on the front-end of technology change, has the potential to mitigate many of the barriers that could exist for any unique instance of change implementation. In conclusion, technology implementers/planners should anticipate and attempt to mitigate potential barriers to technology-enabled change prior to implementation. The use of the FFA framework pre-technology insertion, has important potential for any organization who wishes to lessen people problems, strengthen technology acceptance, and avoid issues that increase the cost of change.

References

Akbari, H., & Land, F. (2011). Socio-technical theory. Retrieved from http://istheory.byu.edu/wiki/Socio-technical_theory

Bertalanffy, L. V. (1972). The history and status of general systems theory. *Academy of Management Journal*, 15(4), 407-426. doi:10.2307/255139

Brenner, M. (2008). It's all about people: Change management's greatest lever. *Business Strategy Series*, 9(3), 132-137. doi:10.1108/17515630810873366

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-340. doi:10.2307/249008

Gotsill, G., & Natchez M. (2007). From resistance to acceptance: How to implement change management. T + D, 6(11), 24-27. Retrieved from http://www.astd.org/Publications/Magazines/TD

Hornstein, H. (2008). Using a change management approach to implement IT programs. *Ivey Business Journal Online*, *72*(1), 1. Retrieved from http://www.iveybusinessjournal.com/

Ji-Tsung, B. W., & Marakas, G.M. (2006). The impact of operational user participation on perceived system implementation success: An empirical investigation. *Journal of Computer Information Systems*, *47*, 127-140. Retrieved from http://www.iacis.org/jcis/

Kanter, R. M. (2012). Ten Reasons People Resist Change. Retrieved from https://hbr.org/2012/09/ten-reasons-people-resist-chang.html

Levin, I., & Gottlieb, J. (2009). Realigning organizational culture for optimal performance: Six principals & eight practices. *Organizational Development Journal*, *27*(4), 31-46. Retrieved from http://www.highbeam.com/publications/organization-development-journal-p61828

Lewin, K. (1951). *Field theory in social science. Selected Theoretical Papers, edited by D. Cartwright.* New York, NY: Harper's Publication.

Lewin, K. (1958). The group reason and social change. In Maccoby, E. (Ed.) *Readings in Social Psychology* Holt, Rinehart, & Winston, London, pp. 201-216.

Long, S., & Spurlock, D. G. (2008). Motivation and stakeholder acceptance in technology driven change management: Implications for engineering manager. *Engineering Management Journal*, 20(2), 30-36. Retrieved from http://www.highbeam.com/publications/engineering-management-journal-p62072

Martin, T. N., & Huq, Z. (2007). Realigning top management's strategic change actions for ERP implementation: How specializing on just cultural and environmental contextual factors could improve success. *Journal of Change Management, 7*(2), 121-142. doi:10.1080/14697010701531749

Mumford, E. (2006). The story of socio-technical design: Reflections on its successes, failures and potential. Info Systems, 16(4), 317-342. doi:101111/j1365-2575.2006. 00221.x

Office of Management and Budget (2013) Cuts, consolidations, and savings (2013). Budget of the U.S. government (OMB publication). Retrieved from https://www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/ccs.pdf

Patton, M., Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Popescu, D. (2009). The influence of organizational culture upon organizational changes. *Metalurgia International, 14*(11), 99. Retrieved from http://www.metalurgia.ro

Reh, F. J. (n.d.). Pareto's principle the 80-20 rule. Retrieved from http://management.about.com/cs/generalmanagement/a/Pareto081202.htm

Saumure, K., & Given, L. M. (2008). The SAGE Encyclopedia of Qualitative Research Methods. doi:10.4135/9781412963909.

Schein, E. H, (1995). Kurt Lewin's change theory in the field and in the classroom. Notes towards a model of managed learning. *Systems Practice, 9*(1), 27-48. Retrieved from http://www.solonline.org/res/wp/10006.html

Toves, P., R. (2015). *Evaluating Success Factors in Implementing E-Maintenance in Maintenance, Repair, and Overhaul (MRO) Organizations* (Doctoral dissertation). Retrieved from ProQuest, Walden University from http://auth.waldenulibrary.org/ezpws.exe?url=http://search.proquest.com/pqdtlocal1005747?%20accounted=14872

Ulhoi, J. P., & Jorgensen, F. (2010). Linking humanity with performability through social-technical systems theory. *International Journal of Performability Engineering*, *6*(1), 89-99. Retrieved from http://www.scimagojr.com/

USAF, (2013) AF personnel demographics. AF Personnel Center. Retrieved from http://www.afpc.af.mil/library/airforcepersonneldemographics.asp

Vasile, D. C. (2009). Communicational approach in the organizational change management. Annals of the University of Oradea *Economic Science Series*, 18(4), 185-190. Retrieved from http://steconomice.uoradea.ro/anale/volume/2009/v4-management-and-marketing/29.pdf

Weiner, B.J. (2009). A theory of organizational readiness for change. *Implementation Science, 4* (1), 67-76.

Westover J.H. (2010). Managing organizational change: Change agent strategies and techniques to successfully managing the dynamics of stability and change in organizations. *International Journal of Management and Innovation, 2* (1), 45-50.

Yin, R. K. (2009, 2013). *Case study design research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.

