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A Case Study of Participant Responses to Organizational Change Involving Technology in the National Security Domain: How Informal Processes Iterate Structure and Outcomes

Brian E. Martinez
Old Dominion University, bandemartinez@icloud.com

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**CASE STUDY OF PARTICIPANT RESPONSES TO ORGANIZATIONAL CHANGE
INVOLVING TECHNOLOGY IN THE NATIONAL SECURITY DOMAIN: HOW
INFORMAL PROCESSES ITERATE STRUCTURE AND OUTCOMES**

by

Brian E. Martinez
B.S. August 1988, Southern Illinois University
M.A. May 1995, Webster University

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Approved by:

Meagan Jordan (Director)

Wie Yusuf (Member)

Saikou Diallo (Member)

ABSTRACT

A CASE STUDY OF PARTICIPANT RESPONSES TO ORGANIZATIONAL CHANGE INVOLVING TECHNOLOGY IN THE NATIONAL SECURITY DOMAIN: HOW INFORMAL PROCESSES ITERATE STRUCTURE AND OUTCOMES

Brian E. Martinez
Old Dominion University, 2019
Director: Dr. Meagan M. Jordan

Nuanced differences between organizations and the pace of change within the national security domain have routinely produced equivocal results involving information and communication technology (ICT) development. These results are characterized by unpredictable costs, unrealistic delivery schedules, and dubious ICT performance in-use. This research is a case study exploration of organizational change involving technology (also referred to as ICT) in the national security domain of the public sector.

This research used machine learning and manual content analysis to compare the results of three experiments on interview transcripts. The first experiment investigated linkages between empirical and interpretive elements of organizational change. Empirical elements are defined as the a priori formal structure of organizational processes and outcomes. Interpretive elements are defined as informal process actions taken by organizational actors to coordinate organizational change involving ICT. The second experiment investigated linkages between formal a priori organizational context and outcomes, and informal process actions defined as individual (i.e., performative) and group (i.e., ostensive) practices. The third experiment parsed the interview transcripts into three episodes of organizational change. Manual content analysis was used to code formal a priori organizational structures and outcomes, and informal processes.

Case study results are conceived in four categories of process actions that link a priori organizational processes and outcomes. The process action categories are conceived as, iterating, adjudicating, coordinating, and processes in-use. These categories offer explanations for how organizational change and stability involving ICT is impacted by informal coordinating process actions of organizational actors. The case study findings implicate a type of organizational change involving ICT as an evolving and dynamic endeavor. The findings contrast with formulaic phases and stages prescriptions for organizational change that dominate the extant literature.

Organizational context in the national security domain is characterized by porous networked arrangements of multi-sector, dynamic and complex public jurisdictions. Enactment of public administration programs and policies is dependent upon ICT as tools of governance. Informal coordinating processes that link the fulfillment of organizational change involving technology to a priori structured processes and outcomes need to be better understood in theory and practice to ensure effective execution of aspirational policies and programs.

This dissertation is dedicated to my life partner whose steadfast energy defines who we are throughout planned and unexpected episodes of change.

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CHAPTER ONE INTRODUCTION

Problem Statement and Definition

Results of organizational change involving Information and Communication Technologies (ICTs) are frequently eclipsed by enigmatic structures and processes and unanticipated participant actions and outcomes. Organizational studies by public administration scholars overemphasize structure and outcomes as entities to measure stability and change. This approach misses the opportunity to understand organizational change in ongoing linkages between formal and informal process-driven dynamics. In the national security domain, participation in organizational missions and functions is defined in policy and procedures. However, analysis of linkages between informal dynamic participant actions, formal structures, seen as processes and outcomes found in organizational change involving ICTs is an under-explored area of public administration and organizational science. A dearth of theoretical understanding about linkages between change and stability involving ICTs contributes to confused and ambiguous results in practice including unpredictable costs, unrealistic delivery schedules, and dubious ICT performance in-use. (Disclaimer: The views presented are those of the author and do not necessarily represent the views of the Department of Defense or its components.)

Purpose

The purpose of this case study is to better understand the impacts of participant responses to organizational change and outcomes involving ICTs in the national security domain. This research will therefore formulate explanations for linkages between the actions of organizational agents, and a priori formal structures defined as processes and outcomes for organizational change involving ICTs in the case study organization. The case study probes dynamic responses to formal organizational change mandates by agents who are accountable to a priori

organizational structures and processes. This study of organizational change involving ICTs investigates the roles of technology developers and technology users involved in coordinating processes that are necessary to develop and implement new or enhanced software, hardware and administrative modifications to fulfill requirements advanced by management and stakeholders. In this vein, this case study defines linkages between a priori mandates, their formal processes and defined outcomes, and informal coordinating processes by focusing a research lens on organizational change that is dependent upon ICT development. Improved understanding is needed about the variety of organizational change contexts involving ICT. This study explicates circumstances that combine aspects of organizing and technological change to understand the impacts of interpretive elements defined as informal and unscripted decision making by organizational actors during ICT development and implementation.

This case study research will analyze interpretive elements of organizational change involving ICT to identify performative and ostensive factors in interview transcripts that account for three episodes of change involving technology in the case study organization. Performative activities refer to repeated interpretations of organizational rules and procedures that constitute mutually recognizable actions that people take in organizations (e.g., a performative activity is the way someone chooses to do something) (Feldman & Pentland, 2003). Performative practices manifest in the activities of organizational actors as they interpret and enact rules and procedures in the exercise of agential capacity (Feldman, 2000). Ostensive practices are repeated patterns of performances by organizational actors (Feldman & Pentland, 2003). Ostensive patterns of practice are defined as the way repeated actor performances constitute organizational outcomes (e.g., the way something is commonly done) (Feldman & Pentland, 2003). This case study investigates performative and ostensive elements of organizational change involving technology

to obtain empirical evidence on mediations between processes, structures and outcomes that contribute understanding about stability and change to the discipline of public administration.

Research Question

This case study research examines organizational change involving ICTs in the national security domain to ask specifically:

How do informal interpretive process actions (defined as performative and ostensive elements) iterate structures (defined as a priori processes and outcomes) during participant responses to organizational change involving ICT in the national security domain?

The next section provides context for this case study. Results from the practitioner literature provide background to better understand the case study organization's mission, technologies, and formal a priori processes and outcomes. This information is foundational to formulating and interpreting findings from analysis that are presented in subsequent steps of this case study research.

Case Study Context

This section provides details and definitions for the context of change involving technology in the case study organization. First, practitioner findings explicate the need to extend the study or organizational change to include both the of study formal change processes and the interpretive practices that actors use to implement change involving technology in the national security domain. Next, a basic understanding of the organizational context includes a description of the organization's mission and technology. Third, an outcome involving ICT provides an example of complexities inherent in organizational change. Last, structures and documented

processes used by the case study organization to manage change involving technology are described.

Organizational Change as Formal and Informal Interpretive Processes

Practitioners found that IT managers from private and local, state and federal organizations reported that among over 8,000 technology development projects 31% of projects will be cancelled before they ever get completed, 53% of projects will cost 189% of their original estimates, only 16% of software projects are completed on- time and on-budget; with larger organizations completing 9% of projects on-time and on-budget (*Standish Chaos Summary Report*, 2015). At completion, many Information and Communication Technology (ICT) projects (i.e., software and hardware) either lack features that were initially specified in project requirements, or contain features that were not initially required (*Standish Chaos Summary Report*, 2015). Next, examples of troubled technology development initiatives provide context that describes the elusive and complex nature of organizational change involving technology in the national security domain.

The Government Accountability Office reports that technology development issues (i.e., in the national security domain) occur when design and build is undertaken before technologies are proven and can lead to increased costs and schedule delays (Oakley, 2018). In an example from a large Defense technology initiative, the Project on Government Oversight (POGO) and the Congressional Research Service (CRS) found that unreliable technologies erased promised efficiencies making new costly technology no more efficient than predecessor technology (O'Rourke, 2017). Another example from the Department of Defense compared older proven technology to inefficiencies created by technology development initiatives. An evaluation found that more personnel were required to maintain equipment using the new technology, and

simultaneous use and maintenance of equipment was no longer able to be performed (Mackin, 2013). These examples demonstrate gaps between technology development and actual use.

Organizational change involving technology requires coordinating between technology developers and technology users. Coordinating organizational change encompasses formal and informal processes. Formal processes are defined in written policy and standards. Formal processes are interpreted by organizational actors during implementation of organizational change. Knowledge about how prescribed processes are interpreted in actual practice during organizational change can contribute explanations for outcomes such as the cost of inefficiencies. “Technologies designed at a distance generally are characterized by a design/use gap that requires either substantial reworking of the technology or, if that is impossible and prospective users are powerful enough, its rejection” (Suchman, 2002, p. 143).

Case Study Mission and Technology

The case study organization is situated within the national security domain. The case study organization’s primary mission is to conduct training programs that prepare members to respond to a variety of national security threats and exigencies. The purpose of national security training programs is to assess the capability of organizations to achieve desired readiness levels. Readiness measures the capacity of organizations to meet the requirements of assigned national security missions (CJCS, 2017b). Training assessments are an important output of individual and collective training for groups of responders from member organizations (CJCS, 2017b). Assessments measure individual and group progress towards a specified set of training objectives that contribute to readiness.

During coordinated activities performed by trainers and technology users in various national security organizations, interoperability functions as a form of collaborative

management. Collaborations enable interagency, inter-governmental and other partner organizations to interact and work together. A function of interagency collaboration is to achieve collective policy and administrative goals (Agranoff, 2006; Bardach, 2001).

Two primary technologies are used by the case study organization in the conduct of national security training. First, command and control technologies provide controlling and coordinating functions for participant activities during training. Alternatively, simulation technologies are used to replicate real world elements that enable trainees to practice responses to scenarios found in the national security domain. Command and control and simulation technologies are collectively referred to in this study as information and communication technology (ICT).

First, command and control ICTs are used to manage systems that arrange essential facilities, equipment, communications, procedures, and personnel (DTIC, 2017). Command and control ICTs provide capabilities to plan, direct, and control operations and to accomplish organizational missions and tasks (DTIC, 2017). The process of command and control involves the exercise of authority and direction by personnel assigned to accomplish specific missions in the national security domain (DTIC, 2017).

Next, in addition to command and control ICTs, simulation ICTs are cooperatively selected by training planners and trainees. These ICTs are used to practice national security responses in operational (i.e., mission) environments. Expert planners and designers determine configurations of command and control and simulation ICTs to create training environments that replicate real world context. Real world context is desirable to administer training events also known as exercises or exercise events. Selection of simulation ICTs requires consideration of many command and control-related variables such as exercise and training objectives, type of training (e.g., length of training, stop and start rules and procedures for training events),

organizational structures (e.g., identification of leader and subordinate positions), technological architectures (e.g., how to connect command and control and simulation ICTs), budgetary and other constraints.

Training environments are constructed to replicate real world national security situations. Constructive training environments use virtual objects in virtual environments (Diallo, Ross, Padilla, & Lynch, 2015). In constructive training environments, real objects are represented virtually by icons or images, such as weather, or an organizational group. Constructive environments benefit from the use of simulation ICTs. For example, during national security exercises, simulation ICTs are used in computerized environments that replicate operational constraints that trainees are likely to find in real-world situations (CJCS, 2017b). Simulation ICTs replicate operational constraints such as organizational responsibilities for national assets. For example, the Missile Defense Agency (MDA) is responsible for ballistic missile defense, the National Security Agency (NSA) is responsible for the protection of U.S. communications networks and systems, and the Federal Emergency Management Agency (FEMA) is responsible for coordinating disaster responses. Using these examples, simulation and command and control ICTs could be connected to replicate a training scenario that involves the practice of simultaneous or serial responses by organizations with responsibilities for missile defense, an attack on a utility grid, and humanitarian relief efforts during a natural or man-made national disaster.

In short, simulation and command and control ICTs can be thought of as tools in a larger ICT toolbox that provide the capability to replicate intra-organizational (i.e., collaborative) operations. ICT simulations provide trainees with visualizations and data that can be shared using real-time send-and-receive secure networks. ICT simulations are key to practicing coordinated responses to national security conditions that require prompt action. Responses to

national security exigencies benefit from the collaborative practice of interoperability in training environments that are designed to replicate real-world complexity. Interoperability is discussed in more detail in the next section. The next section draws attention to the importance of studying complex processes as a means to understand organizational change involving technology.

Outcomes

This section provides context to differentiate between types of outcomes in the case study organization. Interoperability is discussed to characterize complex organizational outcomes that are linked to change at a mission-oriented strategic level, and changes that could be linked to lower level organizational decisions by developers and users about technology features. Strategic outcomes are defined here as high-level mission-oriented results in an organization. Strategic outcomes in the case study organization are characterized by overarching and enduring mission-oriented objectives. Specifically, the case study organization's most prominent strategic objective is to provide training to intra-organizational and interagency organizations. Conversely, other types of (lower-level) outcomes in the case study organization refer to direct involvement by participants of change in the development, implementation and use of ICTs. This level of participant involvement refers to the effects of interactions between ICT developers and users on structure and outcomes.

The purpose of this discussion is to orient readers to the ways that organizational change involving ICT links informal interactivity to a priori formal processes and outcomes. Process implementation is characterized by interactivity between technology developers and technology users. Process implementation is defined by informal decisions and actions that determine for example, the operating features of ICT linked to organizational change. Interactivity between ICT developers and users is linked to two outcomes for interoperability that are central to

appreciating the context of change involving ICT in the case study organization. Namely, interoperability outcomes can be measured by successful collaborative planning and successful collaborative decision-making before and during responses to national security exigencies.

Interoperability is a dominant strategic objective and enduring outcome in the case study organization. Interoperability related outcomes consider the case study organization's capacity to fulfill a primary objective, i.e., to provide training programs that make national security organizations effective. Interoperability conceptualizes intergovernmental collaboration within the national security domain (Agranoff, 2006; Bardach, 2001). Interoperability therefore, represents a capacity for intra-organizational and interagency interactivity. This capacity characterizes an a priori outcome in the form of a strategic objective that undergirds organizational change involving technology in the case study organization.

The U.S. national security domain is comprised of collaborations between federal, state, and local agencies, organizations from international partner nations, academia, and private sector support arrangements (CJCS, 2017a). In multi-agency, high risk, high stakes environments, training is made more realistic through the practice of interoperability (House, Power, & Alison, 2013). Training outcomes related to interoperability depend upon replicating interagency and other stakeholder actions that are needed during real world national security responses. Replication of stakeholder actions is made possible by command and control and simulation ICTs.

The design of national security training scenarios assures interoperability through the integration and use of inter-agency and intra-organizational ICTs (CJCS, 2017b). These ICTs were previously defined as various command and control and simulation ICTs. While it is beyond the scope of this work to define all the ICTs that are used in national security training, these ICTs can be thought of as connectors that when arranged, can make intra-organizational

and interagency organizations technologically interoperable. In a previous example, an ICT was defined that is shared among organizations during training to simulate responses during a humanitarian crisis. For review, the Federal Emergency Management Agency working in collaboration with the Department of Defense has the capability to simulate aspects of a national disaster that can be infused into a scenario to train responders. ICT tools are used in national security training to perform tasks for automation of data storage, visualization and graphics, command and control communication between training organizations, and to enable communications between disparate organizational information operating systems (CJCS, 2017b).

Technological integration (i.e., interoperability) of command and control and simulation ICTs can produce two-way communication between ICTs that were not originally intended to interoperate. Technological interoperability between integrated ICTs is foundational to realizing organizational collaboration that is necessary to train for responses to real world scenarios. ICTs that were not originally designed to work together can be configured to function together through the use of innovative networked ICT systems (CJCS, 2017b). Interoperable ICTs function to synchronize the activities of training participants during complex training scenarios involving multiple participant organizations.

As a form of interoperability, technological integration is necessary for human-to-human operational interoperability. Similarly, operational interoperability is defined by collaborative interactions between training participants from multiple organizations (CJCS, 2017b). Outcomes at the operational level of interoperability require ICT systems, and common practices between trainers, operators, and trainees. Operational interoperability is necessary to create realistic training environments (CJCS, 2017b). Technologically connected ICTs and common practices are necessary pre-requisites to conduct national security training.

Therefore, the realization of interoperability during multi-agency training depends upon various types of integration (e.g., between ICTs) to practice national security operations that synchronize effort between participant organizations (House et al., 2013). Prior research confirms that the use of technology can vary in actual use (Pentland & Haerem, 2011). Process interpretations by trainers and trainees during the conduct of national security training contrasts with the need for common processes and formal protocols to practice responses. Trainers and trainees depend upon common tactics, techniques, and procedures to assess the readiness of organizations to respond to national security emergencies and exigencies (CJCS, 2017b). Training in the national security domain and the ICTs that enable it necessarily evolve to imbue realism in training scenarios that reflect changes in real-world threats and exigencies.

When joined with Internet technology, automated simulation capabilities add realism into training scenarios (House et al., 2013; Tolk, Blair, & Diallo, 2013). Low levels of simulated realism in national security training are believed to engender ineffective responses during real-world security operations, a phenomenon known as negative training (CJCS, 2015b). Therefore, use of ICTs contributes to realism and can help to mitigate the risk of negative training attributed to unrealistic scenarios. However, making improvements to ICTs to achieve more realism can have implications that impacts the conduct of training.

Outcomes for operational level interoperability can be affected by changes in ICTs. To illustrate, upgrades to ICTs may take the form of increased capacity to physically connect numerous ICTs. Various ICTs can be used to link disparate ICT command and control communication systems in networks. Interoperability as an outcome relates the capacity to synchronize disparate ICTs for use by inter-organizational and interagency organizations to perform major incident decision-making and multi-agency responses (House et al., 2013). A multitude of issues including capacity, technical and administrative compatibility, redundancy,

and ease-of-use constitute a partial list of variables that must be accounted for during ICT development to prevent over-simplification that leads to inefficiencies, negative training and other undesirable or unanticipated outcomes.

Spotlight on an outcome: Summarizing interoperability. Relationships between technological and other organizational capacities discussed here as interoperability, are defined by the results of collaborative actions and processes in threat and exigency conditions. These processes and actions are replicated during national security training through human-to-human interactions (i.e., trainer to trainee), human-to-technology interactions (e.g., human interaction with ICT driven simulations), and technology-to-technology interactivity (e.g., between ICT) (Tolk et al., 2013). A face value analysis implies that processes (e.g., standards and rules) and practices (e.g., actual actions by organizational agents and other stakeholders) to achieve interoperability are imbued with complexity.

The complex nature of interoperability can be viewed as first, shared planning between multiple organizations to design training scenarios that will be enacted in training events or exercises for national security responses. Next, interoperability is a complex strategic outcome of training that can be accomplished through the practice of shared planning by partner organizations and that would normally precede actual national security operations (Tolk et al., 2013). Shared planning is believed to contribute to the effectiveness of collaborations between organizations in the national security domain during real-world responses (House, Power, & Alison, 2013).

Third, the complex nature of interoperability is seen in the practice of inter-organizational decision-making that takes place during preparations for training and during training that replicates actual national security operations. Complexity is characterized by decision-making before and during training by multi-participant organizations, multiple technology-to-technology

networks and connections that are needed for effective use of command and control communications and simulations that must reach partnered organizations that are often remotely located from one another, for example during humanitarian assistance operations. The use of ICT provides capacity for partner organizations to train for (additional) complexities that simulate real-world time-bound scenarios (House et al., 2013). Integration of ICT enables the practice of inter-organizational and interagency processes. Specific training scenarios and objectives are identified during shared planning to enable the practice of interoperability by organizations in the national security domain (Getha-Taylor, 2007a). Therefore, interoperability in the national security domain requires a “mix of dynamic, multidimensional and context-dependent dynamic capabilities” (Malinauskiene, 2013, p. 68). Capabilities for technological and administrative interoperability provide a diverse group of intra-organizational and interagency partners with capacities for systems and process integration to reach common goals (Malinauskiene, 2013).

Processes

Several coordinating processes are required during development of ICTs in the case study organization. Across the public and private sector, development of technical capabilities is accomplished using requirements management processes. Coordinating technology development is characterized by processes that are required to document problems and prioritize objectives for development of systems and components that satisfy various formal contracts, standards or specifications (Institute of Electrical and Electronics Engineers, 2017).

In the case study organization requirements management processes include, collection of technical and user data to determine process and technical changes that are needed to develop solutions (Snyder & LaRose, 2017). The overarching purpose of coordinating requirements management is to fill gaps in organizational capability through the creation of new solutions (Hooks, 2001; Lopez, 2011). Coordinating requirements management practices in this case study

derive context from shortfalls and gaps in processes and technology-related capabilities within the national security training domain. These gaps give rise to enhancements and innovations for design and development of ICT.

In this study, outputs from coordinating requirements management are defined by enhancements and innovations that are designed to alter or create work processes, procedures, and technologies that are needed to provide national security training. Coordinating changes to organizational processes, systems, and technologies is a form of change management (G. Jacobs, S. Denef, et al., 2013). During requirements management, desired changes to administrative processes and technologies are specified to define capability gaps (Snyder & LaRose, 2017). Financial and other resources are identified and acquired during budgeting for ICT (Snyder & LaRose, 2017). During scheduling for development of ICTs, process solutions and product deliveries are estimated. Finally, technology products are delivered as solutions to end-users.

Organizations in the national security domain coordinate to determine two typical types of training-related requirements that are defined as capability shortfalls (CJCS, 2015a). The Department of Defense defines capability shortfalls as gaps that need to be filled through the creation of solutions (CJCS, 2015a). First, non-material requirements can be resolved or mitigated through policy or process (CJCS, 2015a). Next, material requirements are resolved or mitigated through technology (CJCS, 2015a). When gaps are identified, ancillary coordinating processes are required to make decisions about what needs to be done to fill capability gaps in policy, administrative processes and technology.

In cases where non-material training gaps are identified, organizations in the national security apparatus collaborate to develop training content consisting of scenarios that are later written into exercise plans. Training context is needed to practice inter-organizational and interagency coordination, collaboration and interoperability in preparation for relevant responses

to real-world problems and issues. Training professionals are responsible for planning and designing relevant content for scenarios that consists of objectives that will be practiced by stakeholders in the national security domain. Training content consisting of scenarios and their objectives are intended to ensure preparedness for future or ongoing threats and exigencies. Scenarios and objectives can measure individual and collective responses to threats and exigencies.

Requirements for realistic training originate from a diverse group of national security stakeholders and organizations including the President, Congress, state and local authorities, the public, and international constituents. Economic, political, and even weather-driven data as interpreted by stakeholders in the national security apparatus can shape demands on training and technology development professionals. Technological and administrative requirements for systems and process improvements in the national security apparatus are defined by enhancements and (or) innovations to training-related ICT.

In the case study, ICT enhancements are defined as subtle, less impactful changes to status quo organizational processes and related ICT. Alternatively, innovation is conceptualized as powerful changes to extant ICT or administrative processes that have the potential to disrupt organizational structures and practices (Abernathy & Clark, 1985). Requirements to enhance or innovate ICT beget questions about organizational structure and coordination during the design and development of ICT capabilities that are needed to conduct training in the national security domain. Specifications for design and development of enhancements and innovations to ICTs encompasses coordinating processes in organizations referred to as requirements management (Institute of Electrical and Electronics Engineers, 2017; Lopez, 2011). This section provided context for the study of participant responses to organizational change involving technology.

The template for the remainder of this case study is provided next, in the final section of the introductory chapter.

Overview of Case Study Methods

Advancements in coordinating theory produced a theoretical model of coordinating (Jarzabkowski, Lê, & Feldman, 2012). This model is used in the case study research to investigate and analyze linkages between change processes, structures, process actions and outcomes involving technology in the case study organization. The theoretical model of coordinating is central to investigation of the case study organization and formulation of the research. The theoretical model of coordinating that constitutes a theory of coordinating will be referred to hereafter as coordinating theory. Coordinating theory is operationalized in the case study using interview transcripts that were obtained from the case study organization. The interview transcripts characterize various elements of process associated with organizational change involving technology. Elements of organizational process are conceptualized as performative activities and ostensive patterns (Feldman, 2000). These are defined next.

Collectively, performative and ostensive practices are elements of routines (Feldman & Pentland, 2003). Routines are believed to explain linkages between individual and group agency (Feldman & Pentland, 2003). Data about adaptations to organizational routines contributes understanding about linkages between changes and organizational outcomes (Feldman & Pentland, 2003). Coordinating theory conceptualizes five cycles of interconnected processes that contain performative and ostensive elements. (The five cycles will be discussed in more detail in a theoretical framework in chapter three.) Performative and ostensive factors that emerge from process studies contribute explanations about mediating that occurs during organizational change between structures, processes, agential actions and outcomes (Jarzabkowski et al., 2012). Improved understanding of complex and embedded contextualized linkages represents

opportunities to improve upon explanations for the success and failure of organizational changes involving technology (Jarzabkowski et al., 2012).

Jarzabkowski et al., (2012) coordinating theory resulted from a case study of organizational change involving technology development. Similar to Jarzabkowski et al., (2012), this case study will use interview transcripts to analyze empirical codes that arise from automated content analysis (i.e., machine learning) of the transcripts. The machine learning tool is Leximancer. Empirical codes such as the identification of various technology, processes and outcomes will provide preliminary evidence of change phenomenon in the case study organization. A second data experiment using machine learning, informed by the preliminary evidence is used to develop interpretive codes that are distinguished by performative and ostensive definitions. Performative activities will identify the specific actions that organizational actors engaged in during changes involving technology. Alternatively, ostensive codes will identify patterns of performances by organizational actors as the consistent ways of doing things related to organizational change involving technology.

The interview transcripts provide information about three periods of change involving technology in the organization. The three periods of change documented in the transcripts will be used in the case study as three embedded units of analysis known as episodes. Three episodes of change involving technology in the case study organization provide evidence that will be used to analyze: empirical elements (e.g., technology, processes, outcomes) and interpretive elements (i.e., performative and ostensive) of change within each episode; and secondly, to analyze differences in empirical and interpretive elements between episodes of change involving technology development in the case study organization.

Findings from the various steps of analysis can be compared to the five cycles found in prior research on coordinating organizational change involving technology. Findings are

expected to generalize to organizations within the national security domain of the federal government. Generalization is expected due to similarities in organizational structure and change processes based on federal policy and standard operating procedures for technology development, budgeting, project management, etc.

Preview of Study

The study proceeds with a literature review in chapter two. The review begins with understanding on the state of change management, emphasizing change in the public sector. Next, scholarship on organizational change emphasizes technology and innovation to focus on the topic of ICT development in public organizations. Third, the review explores conceptions of linkages between change and individual and group aspects of implementing innovative technology. Last, the literature review directs attention to theories of coordinating. Scholarship in socio-material and socio-technical approaches to study technology-related change are reviewed to understand relations between humans, administrative structure and technology.

Chapter three defines and explains the theoretical framework. Chapter four defines the research methods used in this case study research. Chapter four adds to discussion on the analysis of empirical and interpretive elements of change. Data sources are detailed. A discussion of content analysis and the machine learning tool exposes the methods that will be used to identify and analyze key themes and concepts.

In chapter five, the methods described in chapter four are used as a basis for discussion of findings and responses to the case study's research question. Factors are identified that contribute explanations about relationships between structures of change, administrative processes and outcomes. Chapter six presents conclusions, limitations, and recommendations for future study.

Two overarching aims characterize this research. The first aim is to determine factors that

contribute explanations about participant responses to organizational change involving technology in the national security domain. The second aim of this research is to analyze three episodes of change in the case study organization to determine how coordinating practices iterate structured change and defined outcomes. Data about processes embedded in episodes of change will be compared to extant findings and coordinating theory. In this way, the research contributes an analysis of organizational change involving technology in the national security domain to the public management and organizational science literature. This contribution is made through a rigorous case study that examines linkages between organizational change involving technology identified by organizational structures such as formal processes, decision-making viewed as interpretive process actions, and outcomes.

CHAPTER TWO LITERATURE REVIEW

Background

The multi-disciplinary literature reviewed here distinguishes various scholarly traditions and research threads within traditions to better understand participant responses to organizational change involving technology in the national security domain. Specifically, the literature selected is meant to inform this study of how processes enacted by agents iterate organizational structures and outcomes. Organizational issues arising from process comport with Waldo's (1968) characterization of public administration as a discipline defined by "problems that have both practical and theoretical dimensions" (p. 2). Similarly, Rutgers (2010) argues, the study of public administration "has to be pluralistic, multi- and/or inter-disciplinary if its students intend to understand 'public administration' comprehensively for both academic and practical purposes" (p. 36).

Scholars posit that the study of public administration is dependent upon actual practices to establish theoretical scope, objectives and methods (Waldo, 1986). Hence, this literature review applies the ambient theme of organizational change to probe the case study research question. Issues and problems in organizational change that were explored in prior research contribute conceptual background for an approach to study how processes iterate structure and outcomes as participants respond to changes involving technology in an organization within the national security domain. Disciplinary variety found in this review aligns with the methodological approaches posited in later chapters. This program of case study research is consistent with calls for multi-disciplinary approaches to research that are believed to foment growth in public administration (Rutgers, 2010).

First, the literature review examines theory and concepts that have distal connections to the research question. The initial scholarship reviewed locates this case study and research

question within proximity of two foundational approaches to study organizations. In these first sections of the chapter, management and organizational science literature are briefly reviewed to understand scholarly interest in complex organizational structures. Organizational Behavior (OB) and Organizational Development (OD) introduce different scholarly approaches to study complexities such as those found in large federal bureaucracies.

The OB and OD section is followed by a discussion that explores organizational change in public administration perspectives. Developments in public administration research provide perspectives on organizational change that explore the role of humans and technology in public organizations. This literature situates street-level bureaucracy research squarely within the disciplinary bounds. Evidence in the literature is brought forward to better understand the impacts of decision making seen as discretion exercised by technology developers in public organizations.

Third, the literature is reviewed to examine other perspectives on organizational change and technology. The study of innovation in this perspective differentiates incremental and radical levels of change. Outputs of innovation are discussed in terms that relate organizational change to diffusion and institutionalization. Innovation is discussed as a forceful process and an outcome that establishes parallels if not equivalence with elements and conceptions of organizational change found in other disciplinary traditions.

Next, the inter-disciplinary nature of organizational change is evident in perspectives from the literature that challenge distinctions based on research traditions for example, between organizational and management science, and sociology and public administration among others. Also, multi-disciplinary research traditions in the study of change assert linkages between humans and technology in the public sector. Multi-disciplinary perspectives buttress the methodological approach to this case study research and bring the review in closer proximity to

this case study problem and question.

The inter-disciplinary literature is followed by sociological perspectives on change that probe how change is implicated by material artifacts and human endeavors. In particular, social mechanisms conceptualize models of micro-macro phenomena to explain the emergent effects of collective behavior in organizations. The literature review begins with front matter on the study of organizational behaviors and development.

Organizational Change as Behaviors and Development

This review begins with two primary areas of scholarship in organizations, namely, organizational development and organizational behavior. Organizational development is defined as the system wide application and transfer of behavioral science knowledge to the planned development, improvement, and reinforcement of the strategies, structures, and processes that lead to organizational effectiveness (Cummings & Worley, 2009). OD research methods enable the study of behavioral change in organizations (Fernandez & Rainey, 2006; Van de Ven & Poole, 1995). OD is a systematic process for applying behavioral science principles and practices to organizations (Worley & Feyerherm, 2003). OD scholarship is differentiated from OB by its proximity to academic disciplines such as sociology that view organizations as open systems (Worley & Feyerherm, 2003).

In practice, OD seeks to maximize the experience of individuals in organizations through interactions that improve the organization's performance. OD theory posits that maximization of organizational performance and individual experience is achieved by balancing humanistic values, strategy formulation, and organizational improvement (Cummings & Worley, 2009). OD scholarship seeks to understand relationships between successful innovation and continuous improvement (Worley & Feyerherm, 2003). OD scholars define organizational complexity as an

open systems environment that changes and evolves with time (Worley & Feyerherm, 2003).

In one example of OD practice, network analysis was used to measure development of interagency collaboration among nonprofits (Cross, Dickman, Newman-Gonchar, & Fagan, 2009). The study found that network data can be collected and used to purposively develop relationships across organizational boundaries (Cross et al., 2009). In another example, researchers found that public and nonprofit managers should improve resource sharing and trust building within and between organizations to promote well-functioning interorganizational networks (Bin, 2008).

Alternatively, organizational behavior scholars view organizations as closed systems at a particular point in time (Rainey, 2009). OB research examines organizational and group processes and organizational issues to improve organizational performance. In contrast to OD, OB scholarship focuses on research and methods that can be applied to specific organizational issues. In an example relevant to the case study, empowerment practices were thought to provide employees with access to job-related knowledge and skills (Fernandez & Moldogaziev, 2011). Researchers found that when public employees were granted discretion to change work processes, performance was positively and substantively influenced (Fernandez & Moldogaziev, 2011).

Organizational behavior research makes inquiries into the development of humans as resources, where performance and efficiency are sought to make improvements within organizations (Rainey, 2009). OB studies explore interfaces between humans in organizations. Knowledge about human interfaces is dependent upon the identification and conceptualization of particular issues embedded in organizations, such as motivation (Latham, 2012; Maslow, 1943). Motivation and leadership are popular topics in OB studies. These studies use a variety of methodological approaches and manifest interests in different aspects of organizational behavior.

Public administration scholars are interested in the study of relationships between motivation and the call to public service (Perry, Hondeghem, & Wise, 2010; Perry & Wise, 1990). In another example of applied OB research, leadership styles were found to impact program results in public organizations (Getha-Taylor, Holmes, Jacobson, Morse, & Sowa, 2011; Getha-Taylor & Morse, 2012).

OB and OD researchers conceptualize complexities in organizational change. OB research in particular, proposes deductive theories that are meant to be applied in practitioner settings; e.g., understanding links between motivation and volunteerism in nonprofits (McDougle, Greenspan, & Handy, 2011) or motivations for public service (Perry et al., 2010). Despite strides in understanding organizational complexity, OB and OD are but two research traditions among other approaches to understanding organizational dynamics. This brief (albeit superficial) review of OB and OD literature makes clear two findings.

First, OB and OD scholars employ two different but apparently contiguous, if not at times overlapping, approaches to understanding organizational behavior in its many forms. In the management discipline, OD's interest in organizational performance is an apparent complement to popular OB issues in individual motivation and organizational leadership. Second, OB and OD research has produced a variety of scholarly findings that trace to empirical research and concepts found in organizational change research (Latour, 2005b; Lewin, 1951; Maslow, 1969). The following section continues this line of review to look more directly at organizational change research and findings in public administration perspectives.

Organizational Change in Public Administration

In contrast to other perspective of change discussed in the review, theories of action, such as Weber (1946) posit the primacy of human rationality as the premise for understanding control

of the material and social world. In rationalistic research traditions, human dominance is believed to explain relations in the natural world (Gherardi, 2012b). In public administration traditions, rational and relational approaches to organizational science are evident. Simon's (1973) rational man is cut from the cloth of Weberian conformity. In a noteworthy exchange with Simon, Argyris (1973) argues for more complex conceptions of organization (i.e., rational) man to include self-actualizing behaviors. Interestingly, this exchange between prominent public administrationists took place immediately following Argyris' service on the Hitch committee. The Hitch committee was responsible for implementing the first management information systems (i.e., ICTs) in the State Department. In a second exchange with Simon in *Public Administration Review*, Argyris (1973) documents his awareness of tension between organization men in the State department and the innovative technologies they were directed to use. The quest to understand relationships between organizational change involving technology and public administration continues in more recent research threads.

Researchers find that the evolution of the use of ICTs in public administration can be viewed in several inter-related institutional changes in government operations, public service delivery, citizen participation, policy and decision making, and governance reform (Liu & Yuan, 2015). The ubiquitous use of ICT in government operations includes Web 2.0, social media, and mobile and wireless ICT applications by citizens. Applications of ICT to governance are believed to impact the way public services are delivered and the way services are perceived by citizens (Liu & Yuan, 2015). One research finding on the evolution of ICT in public organizations concludes that structural weaknesses exist due to a lack of new management approaches, governance structures and policy frameworks for technology use (Liu & Yuan, 2015). Others point to the need to understand the most critical aspect of the relationships between public administration and technology, finding that norms need to be determined to guide

future development and applications (Jorgensen & Earle, 2007).

Notably, scholars comment on the dearth of research on organizational change in public administration journals (Feldman, 2000). Public management scholars posit that new knowledge about mandated change requires explanations about linkages between change and various pediments of change (Feldman, 2010; Feldman & Orlikowski, 2011). Information about interdependent activities between organizational actors is thought to be a rich source of data embedded in the results of organizational change (Bijker, 1995). Scholars interested in understanding change in public organizations call for a focus on the conceptual and real connections between change and outcomes. Feldman (2010) argues there is an unnecessary dichotomization of process and outcomes in public management scholarship, asserting that processes mediate between organizational mandates and organizational structures.

A process study of cultural change during a major reorganization at the HIV/AIDS Services Administration in New York City focused on process to follow changes in program integration, cross-fertilization of ideas, and improvements to internal operations (Issett, Morrissey, & Topping, 2006). Citing findings at different levels of the organization, street-level workers were most affected by organizational changes involving technology. Effectively, the use of swipe cards and interactive voice response systems changed the way street-level workers did their job (Issett et al., 2006).

In the New York study, qualitative research methods were operationalized using document analysis, interviews and site visits. The research endeavored to understand change during three eras that spanned fourteen years of organizational evolution. Similar to other researchers, Issett, et al. (2006) contend that more nuanced findings are needed to produce more powerful explanations of organizational change. Citing Kuhn (2012), the authors recommend further development of organizational change concepts to better understand how various theories

work, and when and where they do not (Issett et al., 2006).

Elsewhere in the literature, nuanced circumstances found in organizations assert linkages between technology and change in organizations (Jorgensen & Earle, 2007; Liu & Yuan, 2015; Orlikowski, 2000; Rivera & Cox, 2014; Tunçalp, 2016). In complex technological environments, public administration researchers recommend cooperation with engineering management researchers to understand the technical aspects of software and the analytic tools that are used to administer public governance (Bryson, 2010; Bryson, Berry, & Yang, 2010). Public administration scholars contend that engineering management practitioners need to clearly differentiate between decisions to adapt, adopt or innovate technologies for public purposes by asking how, and what needs are met (Bryson, Quick, Slotterback, & Crosby, 2013)?

Other studies contend that the nuances of change involving technology constitute key elements public administrators need to better understand to be effective (Jorgensen & Earle, 2007). These authors claim that despite opportunities in new dynamic, global, technology-driven, capitalist economies, many problems will not be solved by marketplace economics (Jorgensen & Earle, 2007). Therefore, governments must address these problems. Given this need, researchers find that the relationship between public administration and change involving technology requires further development (Jorgensen & Earle, 2007). This line of research cites the lack of norms that guide the development of ICT and their applications in use as the most critical aspect of understanding linkages between public administration and technology (Jorgensen & Earle, 2007).

In a review of the literature on the impacts of ICT on the public sector, researchers reported relevant content in more than 1,000 issues of research journals published between 1987 and 2000 (Danziger & Viborg-Andersen, 2002). The impacts of ICT initiatives were divided into four taxonomic domains consisting of 22 categories. “Almost half of the 230 specific findings

identify changes in the capabilities of public sector units to perform functions and more than one-fourth of the findings involve changes in patterns of interaction among political actors” (Danziger & Viborg-Andersen, 2002, p. 591).

In their review of the literature, Danziger and Viborg-Andersen (2002) found few empirical studies of the impacts of ICT on public administration (Danziger & Viborg-Andersen, 2002). In the articles that discussed how ICT were related to change in public organizations, there were scant findings about changes in values or re-orientations related to the practices of public administrators (Danziger & Viborg-Andersen, 2002). Overman and Loraine (1994) posit that the impacts of ICT on public administrators are more symbolic than substantive when compared to findings about linkages between ICTs and cost control, planning, or quality control. Danziger and Viborg-Anderson (2002) conclude that efficiencies and behavioral improvements among line staff in public organizations experience the greatest impacts from ICT initiatives. In contrast, “the higher incidences of negative impacts tend to involve the more subjective effects (of ICT) on people, in their roles as private citizens (e.g., privacy) or as public employees (e.g., job satisfaction, discretion)” (Danziger & Viborg-Andersen, 2002, p. 592). Research developments in the street-level bureaucrat literature echo this theme.

In the vein of street-level bureaucracy, Bovens and Zouridis (2012) coined the term “digital discretion” to discern differences between bureaucratic decision-makers engaged in ICT design and development. These developments are conceptualized in taxonomic distinctions noted in the extant street-level literature. Bovens and Zouridis (2002) proposed a three-tiered model of bureaucratic decision-making to understand the effects of technology-developer discretion on the delivery of public services. The first tier in their model aligns with prior conceptions that view the capacity of street-level bureaucrats to influence organizational outcomes. The next tier of the model conceives discretion and control exercised by ICT systems managers as screen-level

bureaucrats. In the last tier of the model, discretion exercised by the developers of ICT systems assumes that street-level bureaucrats are at least twice removed from decisions about service delivery (Bovens & Zouridis, 2002). These scholars assert that discretionary decision making by “systems designers” and “IT experts in particular are to be regarded as the new equivalents of the former street-level bureaucrats” (Bovens & Zouridis, 2002, p. 181).

Lipskey’s (1980) enduring theme of street-level bureaucracy focuses research on problems inherent in decision-making in public organizations. Public administration scholars conceive street-level policy-making and implementation in a hierarchy of roles enacted within complex public and private organizational networks (Bovens & Zouridis, 2002; Busch & Henrikson, 2018). Ostensibly, street-level bureaucrats make decisions about the “nature, amount and quality of sanctions and benefits provided by their agencies” (Lipsky, 1980, p. 13).

Lipskey’s (2000) challenge to academics and practitioners can be summarized as the need to better understand public administration in an interconnected world. Hupe and Hill (2007b) assert that street-level bureaucrats perform their work in a “micro-network” (p. 284) or “web” (p. 284) of vertical and horizontal relations. Brodtkin (2012) summarizes enduring scholarly interest in and ongoing thematic expansion of street-level bureaucracy noting that Lipskey’s overarching intent (and the intent of this research) is to conduct research on interactivity characterized by complex contexts in public organizations.

Decades after Argyris’ (1973) critiqued rational man organization theory in his documentation of tensions between developers and users of technology, the literature demonstrates unremitting interest in change involving technology in public organizations. In this review, three practice-based examples provide analogous research on technology-dependent change in public organizations. First, scholars sought to better understand how public strategic management knowledge is produced and used, recommending that the use of ICTs should be

integrated into the practice of strategic management (Bryson, Berry, & Yang, 2010). Next, others recommend the study of phenomena to understand linkages between processes and outcomes in public organizations (Feldman, 2010). In the final example, performance measurement practices have been linked to gains in citizen trust (Yang & Holzer, 2006).

Public administration scholars find that better understanding of technology design and implementation in public organizations requires research that transcends macro-micro views of organizational phenomena. Macro (e.g., organizational development of structure and process) and micro (e.g., organizational behavior of individuals and groups) perspectives can force artificial choices between methodological and epistemological alternatives (Colyvas & Jonsson, 2011). Similarly, public management theorists suggest that leaders ought to distance themselves from organizational pathologies that can create overly rigid work environments and restrict change (Lane & Wallis, 2009).

The literature in the foregoing section finds that linkages exist between organizational change and technology in public organizations. Researchers caution that organizational change is more risky and multifaceted than change managers typically assume (Jacobs, Van Witteloostuijn, & Christe-Zeyse, 2013). Scholars find that multiple research traditions may be required to account for external complexity and internal dynamics of organizations. Moreover, findings accentuate the need to understand both external complexity and internal organizational dynamics to co-determine managerial practices that are needed for change (Jacobs et al., 2013). The next section of literature reviewed probes the implications of change involving technological innovation.

Organizational Change Involving Technology

Innovation research is interested in phenomena surrounding the implementation of

technological innovations that substantiate claims of underlying complexity in organizational change involving technology. Research on organizational change links the impacts of ICT design and development to organizational size and structure (McGuire, Agranoff, & Silvia, 2010), the effects of innovative technology on internal processes and routines (Mergel, 2013a, 2013b), and changes to procedures and re-interpretation of work practices (Kiefer & Montjoy, 2006).

Innovation scholars posit that effective change is rooted in powerful designs that are needed to overturn existing structures (Hughes, 2011a). Overturning dominant organizational designs requires radical rather than incremental innovation (Hughes, 2011a). Changes in strategy are representative of organizational innovations. Alternatively, bottom-up activities originated by individuals and groups in organizations can represent another source of innovation. Scholars assert that unanticipated and dynamic individual and group activities explain the complex nature of innovation and change by linking initiatives, information systems, processes, practices and other aspects of organizational life (Getha-Taylor et al., 2011; Getha-Taylor & Morse, 2012). The application of practical knowledge to bureaucratic rules by organizational actors results in organizational adjustments, creations and interpretations (Ives & Olson, 1984; Jarzabkowski et al., 2012; Pentland & Haerem, 2011).

Research on dependencies between organizational change initiatives and innovative technologies finds that end-user involvement during definition of technology design is an indicator of successful technology transition (Isett, Mergel, LeRoux, Mischen, & Rethemeyer, 2011). However, expert practitioners caution that elements of technology implementation may not provide a complete account of design decisions and actual changes that are needed to meet operational requirements (Hooks, 2001). Similarly, innovation scholars find that design processes have the potential to create new, adapt or enhance technologies and related systems and processes (Abernathy & Clark, 1985).

Scholarship in the design and development of innovative government ICT systems posits the need to understand choices about technologies by users and developers (e.g., to adopt extant commercial-off-the-shelf technology, make enhancements to existing technologies-in-use, or develop/build new systems) (Provan & Lemaire, 2012). Scholars link organizational change to innovative technology and assert that coordinating during design and development is comprised of institutional processes and informal practices that are dynamically interpreted by users and developers (Mergel, Schweik, & Fountain, 2009). Scant theory exists to explain how technology developers and technology users in the public sector coordinate to determine requirements for incremental or innovative technologies.

Interactivity between groups of technology end-users and technology developers is characteristic of requirements management processes (Feldman, 2010). A typical cycle of user-developer coordinating during requirements management for technology development in organizations is informed by policy, structures, standards and processes that guide specification of solutions, design decisions, production of documentation, development and ultimately transition of technology solutions to end-users (Brews & Tucci, 2004).

Practitioners assert that a primary purpose of requirements management is to create innovative solutions by collecting data about problems (CJCS, 2015a) The national security community of requirements practitioners defines the management of new administrative and technical capabilities as a process required to accomplish an organization's roles, functions, and missions (CJCS, 2015a). In this view, coordinating ICT development aligns the process of design with organizational change (Orlikowski & Scott, 2008). Studies about organizational practices find coordinating activities between technology users and technology developers link to and contribute to explanations of change (Jarzabkowski et al., 2012; Pentland & Haerem, 2011).

Linkages between changes and outcomes in organizations are thought to take shape during innovation activities (Feldman, 2010; Orlikowski, 2000). Scholars posit, “innovation and change are indigenous aspects of technology-in-use, work practice and organizational life” (Feldman & Orlikowski, 2011; Okhuysen & Bechky, 2009). Researchers submit that decomposition of various organizational phenomena is needed to explain complex elements embedded in innovation and change in organizations (Suchman, 2002). Scholarship in organizational change posits the need to improve understanding about complex linkages that mediate between organizational inputs and outcomes (Nicolini, 2009b). Among these linkages, technology contributes to new organizational outcomes by transforming status quo organizational context (Hooks, 2001; Jarzabkowski et al., 2012; Mergel & Schweik, 2013; Orlikowski, 2007).

Failure to use innovative technologies that were developed in organizations is attributed to rejection of design solutions that were determined during change processes (Suchman, 2002). Failure to use innovative technologies can be defined by incomplete technology transfer at the completion of periods of change. This situation describes the uneven use of standards and processes that standardize technology design and development but fail due to disagreements between users and developers at technology completion (Suchman, 2002). Rejection of organizationally sponsored technologies can result from imbalances between technology developers and users during design and development (Mergel & Bretschneider, 2013; Orlikowski, 1992; Suchman, Blomberg, Orr, & Trigg, 1999).

Scholars and practitioners link disruption of user routines to innovation, finding that disruptive forces offer explanations for failed implementation of new technologies (Lopez, 2011; Suchman, 2002). Problems in coordinating organizational change between users and developers during the design of technologies were also found to contribute to ineffectual technology

implementation (Orlikowski, 2007). Scholars posit that implementation of technology solutions in organizations are most likely to succeed when technology users provide inputs during design and throughout transition of technical solutions (Lopez, 2011). Disagreements exist between developers and users in organizations during the design of innovative technologies (Lopez, 2011). Unnecessary control of design processes by technology developers is conceived in multiple problems related to information flow, and ineffectual local work practices (Suchman, 2002). Suchman (2002) conceptualizes three cases to characterize user responses to developer-centered innovation.

In the first case, failed assumptions by technology developers about organizational work practices and routines result in total rejection of developer-centered technology solutions by users. In a second case, users accept some alterations to work practices driven by newly developed technology and leading to partial implementation and limited use of innovative technology. In a third case, under conditions of developer-centered power, users are forced to abandon old practices in favor of new practices and routines. Scholars posit that control of requirements definition during technology design is an inherently political endeavor (Jarzabkowski et al., 2012; Suchman, 2002). These three responses to developer-centered technology design demonstrate the concomitant problem of contested control between users and developers.

The problem of developer-centered design is illustrative of findings about failed innovation processes in organizations. The problem assumes that developer-centered design of technology can dislocate users during organizational efforts to achieve critical planned changes (Brown, 2014; Gherardi, 2012a). Suchman's (2002) conception of design-from-nowhere asserts that poor design and requirements management practices contribute to sub-optimal organizational outcomes in the form of rejection of technology innovations, mandated

acceptance, or partial acceptance/rejection of new technologies.

Issues stem from incorrect ICT developer assumptions about solutions. Less useful solutions result in limited use of technologies within organizations. In extreme cases of developer-centered design, completed technology solutions do not satisfy user requirements. Mandated or partial acceptance of developer-centered solutions can contribute to unwanted changes in status quo organizational practices and can lead to multiple levels of disruption to status quo organizational behaviors (Suchman, 2002).

Developer-centered design conceives geographic, economic, cultural and experiential differences between developers and users (Bardach, 2004; Barzelay, 2007; Colyvas & Jonsson, 2011; Feldman, 2010; Fernandez & Rainey, 2006). In this view, scholars stress the importance of understanding complex contextual and practical knowledge during decisions related to innovation. Research findings indicate that technology developers often have limited knowledge about the impact of innovations on organizational work practices (Jarzabkowski et al., 2012). Scholars theorize that practical knowledge is embedded in the experience and expertise of end-users, i.e., practitioners (Gorli, Nicolini, & Scaratti, 2015; Greig, Gilmore, Patrick, & Beech, 2013; Suchman, 2002). Therefore, technology developers working sans assistance from technology users may make incorrect assumptions about work practices due to insufficient practical knowledge about organizational missions, practices and routines (Baroudi & Orlikowski, 1988; Von Hippel, 1976).

The literature maintains that better understandings about complex processes embedded in change are needed (Feldman, 2004; Feldman & Orlikowski, 2011; Wetzel & Dievernich, 2014). The successful transfer of tacit user knowledge to developers remains an elusive aspect of coordinating organizational change involving technology design and development in concept and in practice. In this view, coordinating processes to develop innovative technologies requires

layered and nuanced decision making throughout the development process. During technology development, organizational actors make numerous decisions about the ways users will interface with innovative technologies. Additionally, innovation can change the ways users interact with one another (Suchman, 2002). Disagreements between developers and users can require decisions by organizational management and staff to reconcile changes in technology with related changes to the ways work is performed (Schultze & Orlikowski, 2004; Suchman, 2002).

Three key points summarize the literature on innovation practices in organizations. First, innovation scholars posit that effective change is rooted in powerful designs that are needed to overturn existing structures (Schultze & Boland, 2000; Schultze & Orlikowski, 2004). Therefore a research focus on underlying organizational processes contributes to improved understanding of planned change (Suchman, 2002). Next, research finds that technology is an input to organizational outcomes (Liu & Yuan, 2015). Finally, scholars maintain the need for research that improves explanations about links between innovative technology and organizational outcomes (Jarzabkowski et al., 2012; Liu & Yuan, 2015). Understanding about processes and concomitant practices during ICT development could help to define phenomena embedded in organizational change (Jarzabkowski et al., 2012). Scholarly conceptions and findings in other research traditions emerge in contiguous and even overlapping conceptions of organizational change in interdisciplinary perspectives from the literature.

Interdisciplinary Perspectives on Organizational Change

Overlapping or contiguous concepts and findings give rise to debate about multi-disciplinary and pluralistic research among experts in public administration and other scholarly fields (Rutgers, 2010). This literature review pursues proximity between organizational change research and findings, especially as these relate to conceptions of coordinating organizational

change involving ICT design and development. Claims of proximity or overlap between scholarly findings and theory are sought throughout the review. Therefore, the challenge this part of the review takes-up is to cultivate comparisons between scholarly conceptions while curating a broad multi-disciplinary literature.

Many studies of change management quote a finding that 70% of all organizational initiatives fail (Beer & Nohria, 2000; Hughes, 2011b; Kee & Newcomer, 2008; Tobias, 2015). Public management scholars find that 75% of planned change initiatives fail to achieve intended organizational outcomes (Fernandez & Rainey, 2006; Gherardi & Perotta, 2011). This finding from the literature acquits doubt about the prevalence of failure associated with organizational change. The prevalence of the documented failure of planned change in organizations is used by some researchers to call for more case research in organizations (Nicolini, 2013; Nicolini, Mengis, & Swan, 2012).

The persistent failure of organizational change initiatives that is documented by scholars is attended by a lack of consensus on theory and concepts to better explain processes that may be embedded in organizational change (Geiger, 2009; Giddens, 1983). The organizational science literature documents the failure of change as a persistent organizational problem calling attention to findings that indicate complexity, and multiple and conflicting theories (Baroudi & Orlikowski, 1988). Further, there is no agreement on the factors that contribute to the success or failure of change in public organizations (Fernandez & Rainey, 2006).

Studies about changes to organizational policy and standards offer many case-based and therefore context-limited explanations for the success and failure of initiatives (Agranoff & McGuire, 2001; Brews & Tucci, 2004; Gherardi & Perotta, 2011; Mergel, 2012; Pardo, Gil-Garcia, & Luna-Reyes, 2010). Research analogous to this case study found that the impacts of training initiatives to improve collaborative governance varied across public organizations

(Bryson et al., 2013; Feldman, 2010; Mergel et al., 2009; Orlikowski, 2000). The literature abounds with evidence of scholarly consensus that organizational change is inherently complex (Burke, 2002).

Representative examples of research and findings indicate the need for more nuanced understanding of organizational change theory. Van de Ven and Poole (1995) proposed that life cycle, teleology, dialectics, and evolution theories are building blocks for explaining complex change processes in organizations. The authors posit that these theories operate at different levels in organizations; hence, selection and applicability of theory depend upon unique organizational circumstances (Van de Ven & Poole, 1995). Their research proposes that understanding about how these theories interact could lead to conceptual advances and more powerful explanations for complexities and nuances that currently elude organizational change scholars (Van de Ven & Poole, 1995).

Van de Ven and Poole's (1995) plea for scholarly pluralism was more fully conceptualized in their own subsequent research. In Van de Ven and Poole (2005), a multi-tradition typology is proposed to study change. Following research threads in their earlier work, their review categorizes extant scholarship on organizational change into two opposing epistemological stances. These epistemologies manifest in two different but overlapping approaches to change management research. They find that first, actors or things are studied as entities (i.e., nouns), and second, processes constitute the study of actions in organizations (i.e., verbs) (Van de Ven & Poole, 2005). Methodologically, they associate variance and narration with the operationalization of entities and processes (Van de Ven & Poole, 2005).

Given these two epistemological and methodological stances, the authors specify a four-part typology of change. Variance and process methods are operationalized in each epistemological category. In the first category, the study of entities (nouns) is operationalized

first in causal analysis of things using variables (Van de Ven & Poole, 2005). In the second type of entity study, process narrations document change between entities, characterized by narrative analysis of sequences of events, emergent actions and stages or cycles of change (Van de Ven & Poole, 2005). In the second epistemological stance, organizing processes (verbs) are first studied using variance methods such as agent-based models and complex adaptive systems (Van de Ven & Poole, 2005). The second method to conduct research about organizing processes (verbs) is operationalized using narrations about occurrences of collective actions in organizations (Van de Ven & Poole, 2005).

The entity-process typology argues that disciplinary pluralism can lead to research insights and different questions (Van de Ven & Poole, 2005). The authors suggest that opposing epistemologies and methods are needed to conceptualize and study the nuances of organizational change as holistic research problems.

In their final analysis, Van de Ven and Poole (2005) find that apparently opposing epistemologies and methods are in fact complementary. The literature indicates agreement among scholars that coordination of pluralistic theory and concepts in research frameworks can provide richer understanding of organization change than any one epistemological or methodological approach (Feldman, 2010; Fernandez & Rainey, 2006; Nicolini, 2009b; Rerup & Feldman, 2011; Van de Ven & Poole, 2005). Variance approaches contribute understanding about causality between specific elements of organizational change. In addition, narrative approaches produce rich and nuanced findings that help to conceptualize dynamic actions in organizational change. Most scholarly disciplines share the view that stability is the opposite of change (Kozica, Kaiser, & Friesl, 2014; Pentland & Haerem, 2011; Van de Ven & Poole, 2005).

In other developments in the field, Whalen (2014) proposed a multi-disciplinary theory of social ontology to overcome previous theoretical issues in cultural change in organizations. He

argues that organizational change fails due to a lack of understanding of how organizational culture forms and continually adapts to changing circumstances (Whalen, 2014). Whalen's (2012) theory of social ontology combines elements from complexity science (Axelrod & Cohen, 2000; Holland, 1995), social interaction theory (Mead, 1967), transactional strategy (Dewey & Bentley, 1949), negotiated order theory (Dewey & Bentley, 1949), foundational concepts in practice traditions found in structuration theory (Giddens, 1979), folk psychology (Bruner, 1990), and interpretation theory (Ricoeur, 1976).

Sociological perspectives on organizational change are discussed next. The literature on social relations conceives that social mechanisms provide foundations to understand the theoretical framework in chapter three. Social mechanisms are foundational to practice theories, and related scholarship that evolved into the study of sociomateriality. Practice theory and sociomateriality conceive change as a dynamic process-laden enterprise characterized by interconnectedness between humans and material elements in organizations.

Sociological Perspectives on Organizational Change

Social Mechanisms

Social mechanisms emanate from naturalistic research that conceptualizes models of micro-macro phenomena to explain the emergent effects of collective behavior in organizations (Hedstrom & Swedberg, 1998). Macro organizational phenomena conceive organizational development of structure and process, while micro phenomena conceive organizational behavior of individuals and groups (Hedstrom & Swedberg, 1998). Social mechanisms are theorized taxonomies of socially constructed phenomenon (Feldman, Pentland, D'Adderio, & Lazaric, 2016; Spee, Jarzabkowski, & Smets, 2016). Social mechanisms are used to identify differences in institutional forms and structural configurations (Jarzabkowski et al., 2012, p. 907).

Social mechanisms constitute units of analysis that are situated among complex organizational phenomenon (H. Tsoukas & R. Chia, 2002). Social mechanisms conceptualize dynamic processes that are embedded between elements of change and organizational outcomes (Bayerl et al., 2013; Feldman & Orlikowski, 2011). Also, social mechanisms refer to recurrent processes that generate a specific kind of outcome (Adler, 1995; Jarzabkowski et al., 2012; Okhuysen & Bechky, 2009). One type for example, coordinating mechanisms, are useful to explore configurations of macro-micro level phenomenon conceptually situated between inputs for planned change and organizational outcomes (Jarzabkowski et al., 2012; Okhuysen & Bechky, 2009). Fully conceptualized social mechanisms are used in research to formulate interpretations of social processes in organizations (i.e., practices) (Jarzabkowski et al., 2012; Rivera & Cox, 2014).

Hence, social mechanisms are believed to explain the causal reconstruction of processes that account for given macro-micro phenomena in organizations (Davis & Marquis, 2005; Glennan, 1996; Mayntz, 2004; Schmidt & Simone, 1996). Scholars argue that fully conceptualized mechanisms for organizational routines are useful units of analysis to study change (Pentland & Feldman, 2005; Pentland & Haerem, 2011). Scholars claim the study of routines permits observation of behaviors embedded in organizations (Feldman et al., 2016; Pentland & Feldman, 2005). Subsequent to the research cited, routines were found to lack stability that was assumed in prior research. Instead scholars argue for the study of conventions to acquire more nuanced data on organizational routines based on moral background for justifying actions and criticisms (Kozica et al., 2014). Study of conventions used by individuals and groups conceptualizes micro-levels of practices that are enacted within normative organizational rules and procedures (Gomez & Jones, 2000).

Alternatively, diffusion and institutionalization mechanisms conceptualize innovation in

organizations as both process and outcome (Colyvas & Jonsson, 2011). The authors theorize that diffusion functions as an innovation processes comprised of relations and structures (Colyvas & Jonsson, 2011). In addition, institutionalization functions as an outcome consisting of persistence and change (Colyvas & Jonsson, 2011). A three dimensional model was developed to test the proposition that diffusion and institutionalization exist as both process and outcome (Colyvas & Jonsson, 2011). The first dimension determines the objects that flow (i.e., a process) or stick (i.e., an outcome) in organizations. A second process/outcome dimension defines organizational actors who adopt or influence. Last, a final dimension differentiates the social settings through which innovation travels. This social mechanism research found linkages that contribute explanations about diffusion and institutionalization of organizational change initiatives (Colyvas & Jonsson, 2011; Nicolini, Gherardi, & Yanow, 2003).

Routines, conventions, diffusion, and institutionalization are examples of mechanisms that are thought to provide understanding about change in public organizations. Scholars assert that analytically constructed mechanisms constitute rigorous conceptualization of socially constructed activities (Orlikowski, 2000). Social mechanisms conceive theoretical frameworks that help to unpack complex interactions between individuals and material artifacts (Bennett & Checkel, 2015; Brady, Collier, & Seawright, 2010). As a theoretical apparatus, mechanisms organize data about enactments of process such as ostensive patterns and performative practices by interdependent actors asserted in the practice theory tradition (Jarzabkowski et al., 2012; Orlikowski & Scott, 2008). “The ostensive aspect enables people to guide, account for, and refer to specific performances of a routine, and the performative aspect creates, maintains, and modifies the ostensive” (Wenger, 1998, p. 47).

Jarzabkowski, et al. (2012) operationalized performative and ostensive concepts to analyze coordinating activities of interdependent actors during organizational change involving

technology. These organizational change researchers working in the vein of sociomateriality conceived that performative process actions by organizational actors and ostensive patterns of group interactivity were useful to categorize elements of organizational change (Feldman & Orlikowski, 2011). Performative and ostensive categories are seen as component parts in classification schemes for organizational change contexts. Classification takes the form of theoretical social mechanisms that contain performative and ostensive parts. These researchers posited that performative and ostensive parts of a theoretical social mechanism known as coordinating theory can be used to measure interactivity between organizational actors (Feldman & Orlikowski, 2011). Scholars caution that performative and ostensive parts of organizational context may not mirror their formal characterizations in process and policy (Feldman, 2010). Practice theory and developments in sociomateriality are discussed in more detail in chapter three to specify the theoretical framework deployed in this case study.

Limitations in Existing Studies

Three primary aspects in this study of change involving technology are embodied by findings in the literature. First, the literature is imbued with the need to better understand activities that take place between technology users and developers. The scholarly literature is however, short on data and concepts that explain differences in factors that characterize this type of change in public organizations.

Next, the literature furnishes understanding about how actual coordinating practices iterate (i.e., manifest impacts) parts of a theoretical coordinating mechanism (e.g., coordinating theory). Yet, scholars argue for research using additional units of analysis to further conceptualize theoretically general coordinating mechanisms (Feldman, 2010; Jarzabkowski et al., 2012). Coordinating is a central theme in diverse scholarship threads including change

management, strategy, innovation, technology management, collaborative networks, and work-studies. Coordinating mechanisms conceptualize a way to study change as a process that takes place throughout the life cycle of organizational initiatives. Elsewhere, scholars characterize process studies in two ways, first as a “sequence of events, stages or cycles of change” (Van de Ven & Poole, 2005, p. 1387), and second, as “emergent actions and activities by which collective endeavors unfold” (Van de Ven & Poole, 2005, p. 1387).

Thirdly, change management scholars note limitations with variance methods represented by causal analysis of variables and dynamic modeling. “While the variance approach offers good explanations of continuous change driven by deterministic causation, this is a very limited way to conceptualize change and development. It overlooks many critical and interesting aspects of change processes.” (Van de Ven, Angle, & Poole, 2000, p. 29) .

As an alternative, process approaches in the literature point to post-modern/post-humanist views of change in public organizations (Feldman & Orlikowski, 2011; Geiger, 2009; Gorli et al., 2015). Earlier conceptions of change take the position that institutionalization (e.g., refreezing) results from successful cycles of change (Lewin, 1951). In contrast, other scholars posit that social mechanisms conceive the study of linkages between technology and change as continuous reinventions and reinterpretations of interactive processes embedded in organizations (Jarzabkowski et al., 2012; McChesney & Gallagher, 2004).

The literature reviewed suggests that various approaches are relevant to the study of organizational change involving technology in public organizations. However, theory-based evidence in the literature is insufficient to fully explain linkages between organizational change involving technology and the success and failure of outcomes in public organizations (Leonardi & Barley, 2010, p. 25).

Scholarship in elements of organizational change involving technology such as coordinating could benefit from data that considers differences in structure, communication paths, and formal and informal processes linked to technology innovation during change. Scholars across disciplines contend that developments and new understanding about change require more inter-disciplinary approaches to research (Malone & Crowston, 1994; Van de Ven & Poole, 1995, 2005),

Multi-disciplinary traditions apparent in the literature contribute to a lack of consensus on theory and concepts for public administration issues (Rutgers, 2010). For example, there is little agreement on methods to study coordinating processes that are needed to accomplish innovative changes in organizations (Feldman, 2010; Okhuysen & Bechky, 2009). Also, differences between scholars appear in the literature as disagreements about definitions for terms that ostensibly define or describe the elements of change. For example, scholars do not agree on the meaning of concepts that define cooperation, coordination, and collaboration (Getha-Taylor, 2007a, 2007b; H. Tsoukas & R. Chia, 2002).

Research focused on local nuances that can be generalized to other locations is needed to better understand organizational change in its many guises. Intergovernmental and interagency coordinating conceptualizes unique collaborative arrangements needed during responses to national emergencies (Kettl 2003). During hurricane Katrina, the structure of response efforts by security professionals was found to support a theoretical definition of complex organizational change (involving technology) known as contingent coordinating (Morris, Morris, & Jones, 2007). This finding suggests that the process of coordinating organizational change may not be transferrable between organizational contexts. Further, the concept of contingent coordinating characterizes intra-organizational coordinating processes as relevant, complex and little understood phenomenon in public administration theory and praxis. Further, organizational

change involving technology insinuates that classifications are needed to understand a variety of contexts for coordinating organizational change involving technology, especially in public organizations. Thus far, the literature points to the need to classify and categorize the ways different organizations prioritize and enact activities that take place during design, development, and implementation of organizational change in the public sphere. Thus, multiple streams of scholarship in organizational change involving technology advocate for high levels of user involvement.

The concept of technology commodification is illustrative of problems in user involvement and is characterized as the problem of designs from nowhere (Suchman, 2002). Discreet and severable technology that is developed in production facilities distant from technology end-users is termed requirements from nowhere (Suchman, 2002). Similarly, Bovens and Zouridis (2002) posit dichotomous relationships between technology developers and end-users in the systems-level bureaucrat/street-level bureaucrat perspective. Their research asserts that systems-level developers exercise digital discretion that impacts end-user street-level bureaucrats. Despite differences in scholarly traditions, conceptions of commodification and systems-level bureaucracy make similar arguments to better understand factors that relate decision-making by technology experts during change involving technology. However, more information is needed to better understand the factors that explain commodification and digital discretion in different public organizational domains.

Issues surrounding the commodification of technology beg research questions about development practices in the public domain. The review of these concepts recommended the need to better understand differences between technology developers and the users of technology. The ubiquity of Web 2.0 capabilities associated with the internet-of-things foreshadow the need for continued developments in public administration theory and praxis.

Public administration scholars indicate the growing prevalence of administrative reliance upon ICT to interface with a connected public (Mergel & Schweik, 2013). Moreover, more knowledge is needed about the use of ICT in different contexts within the environs of public organizations.

Patterns of findings in the research distinguish nuanced phenomena in organizational change involving ICT in the public domain. However, more research is recommended to distinguish between the impacts of change involving ICT in public organizations, as some impacts such as the effects of ICTs on competition among administrative groups are not easily classified (Danziger & Viborg-Andersen, 2002). The research implies that without better conceptualization of nuanced behaviors in public organizations, issues such as coordination and control during ICT development remain under-explored.

The literature on change presents numerous contributions that recommend improved understanding about elements of ICT development and concomitant linkages to organizational change. Public administration scholars demonstrate an acceptance of practice-based methods to study change. However, the literature review indicates that practice-based studies of coordinating during change involving technology are most frequently published in organization science and technology-oriented journals. How much and what knowledge about ICTs may be needed by future public administrators is unknown. However, this review argues for greater appreciation of the implications of ICTs in public organizations. The proposition that the function of ICTs is less relevant to public administration researchers and practitioners given the availability of expertise in other fields, fails given the empirical evidence presented in this literature review on change involving technology in the public domain.

The literature reviewed in chapter two offers prior explanations about concomitant linkages between organizational change involving technology including the structure of formal processes, process interpretations seen in interactivity between organizational actors, and

outcomes in organizations. Evidence from the literature reviewed informs the decomposition and analysis of this case study research problem to understand how organizational change processes iterate structure and outcomes during ICT development in the national security domain. This case study research analyzes the roles and practices of ICT systems developers and end-users of ICTs that are used during training within intra-organizational and inter-governmental networks and collaborations. In the national security domain, security services are always delivered to a public using ICTs as a tool of governance in practice during training and in-use during real world national and international exigencies.

CHAPTER THREE THEORETICAL FRAMEWORK

Background

This case study examines dynamic processes and how they are interpreted by actors during organizational change involving technology in the national security domain. The case study organization's primary mission is to provide training to stakeholder organizations. Various ICT support the delivery of training services. Specifically, the research answers the question of how processes iterate structure and outcomes as participants respond to changes involving technology in an organization within the national security domain.

The theoretical framework for this research supports examination of three periods, or (hereafter) episodes of change involving technology in the case study organization. In each of the episodes of change the case study organization endeavored to adapt, adopt or build new technologies to support performance improvements in the delivery of national security training. In each of the three episodes of change involving technology, processes were guided by formal standards, rules and policy. The primary research objective enabled by the theoretical framework is to explain how interactivity between organizational actors, restructures stability and change involving technology.

Traditional theoretical frameworks for studying organizational change provide a means to examine variances between change and outcomes. Alternatively, the theoretical framework consisting of practice theory and coordinating theory constitute an assertion that the study of process relationships offers ways to study stability and change in organizations (Jarzabkowski et al., 2012). This study endeavors to bring new understanding to organizational restructuring that takes place given changes involving technology.

First, practice theory presents concepts and arguments for understanding change as dynamic rather than static. Next, sociomateriality is presented as a development on the

continuum of practice theory that introduces the impact of technology on organizational change. Third, in this section, coordinating theory posits that findings about empirically linked processes can help explain stability and change during organizational change involving technology development. These foundations help with understanding of the nexus between organizational change involving technology and how processes iterate (i.e., impact) organizational structures and outcomes. Last in this section, a theoretical framework constituted by coordinating theory is described and defined.

Practice Theory

A so-called “practice-turn” in organizational scholarship was originally suggested by Schatzki (2001). Citing Schatzki (2001), Feldman and Pentland (2003) posit that “phenomena such as knowledge, meaning, human activity, science power, language, social institutions and human transformation occur within and are aspects or components of the field of practices” (p. 94). Practice theory conceives a constructivist epistemology where social reality is characterized as dynamic and continuous processes (Gherardi & Perotta, 2011; Giddens, 1983; Nicolini, 2009b). In contrast, variance studies are epistemologically grounded in the primacy of entities such as organizational structure and standards (Giddens, 1983). The study of variance favors analysis of cause by independent variables acting upon dependent variables (i.e., entities) (Van de Ven & Poole, 2005).

Theoretical generalizations produced through the use of practice theory are not conceived as predictions but are understood as “principles that can explain and guide action” (Feldman & Orlikowski, 2011, p. 1250). Theoretical generalizations conceive relationships or enactments in organizations that “offer insights for understanding other situations while being historically and contextually grounded” (Feldman & Orlikowski, 2011, p. 1250). The authors assert that in

contrast to statistical generalizations that seek universal variation, theoretical generalizations explain context that is dependent upon specific organizational phenomena; i.e., “situated dynamics” (p. 1250). The power of theoretical generalizations rests in their usefulness to understand other contexts due to their transferability (Feldman & Orlikowski, 2011).

Process theorists are interested in the study of work and organization to understand what people actually do in organizations in dynamic, continuous, and process-laden terms (Beach & Pederson, 2013). Practice traditions posit a variety of theoretical approaches to study complexity as humanly conceived configurations of people, objects, technologies and texts (Baroudi & Orlikowski, 1988). A key concept emerging from this body of literature is that practices constitute units of analysis that can contribute to understanding complex organizational phenomena (Bryson, Berry, & Kaifeng, 2010; Feldman, 2010; Feldman & Orlikowski, 2011; Nicolini, 2009a)

Practice scholars view the study of coordinating mechanisms as an ontological shift away from conceptions of mechanisms as stable entities defined by inputs and outputs (Harper, 2000; Oppenheim, 2007; Orlikowski, 2000; Schultze & Boland, 2000). Instead, practice scholars recommend a research focus on continuous processes characterized by interactions between actors, and between actors and their surrounding organizational structures (Gherardi, 2012b). The study of practices is founded on a belief that organizational life is socially constructed. Nicolini (2012b), cites Schmidt and Bannon (1992) and Schmidt and Simone (1996) who conceive that social structures, inequalities, power and meaning are socially constructed. Bjerkenes, et al. (1987) implore organizational science scholars to specify the methods and means that define how work is actually accomplished.

As interpretations of organizational process, work involves interconnected practices by networks of actors involved in processes that seek stable patterns of relationships (Feldman &

Orlikowski, 2011; Orlikowski, 2009; Pentland & Haerem, 2011). Routines are recognizable patterns practiced by interdependent actors (Nicolini, 2009a). Routines conceptualize ongoing interpretations and enactments of process. Researchers propose that routines are the manifestations of practices which are performed interdependently by multiple organizational actors (Lynch, 1993). As micro-processes, practices and their routines represent data that contributes to explanations for the impacts of coordinating on organizing and organization (Orlikowski & Scott, 2008; Rivera & Cox, 2014; Schultze & Orlikowski, 2004).

Organizational routines are defined by practical interpretation and application of organizational policy, plans, procedures and standards (Czarniawska, 2004; Reckwitz, 2002b). Organizational researchers hypothesize that routines generate patterns of action that are few in number and stable over time, and that atypical patterns of action are driven primarily by exceptional inputs (Pentland & Haerem, 2011). Therefore, routines generate unique patterns that continue to change. In research on routine applications of software, Pentland and Haerem (2011) found significant changes in patterns of user activity during a five-month period where no apparent external interventions were present in a case study organization.

Further, changes in the patterns of activity did not reflect improved performance or learning. Changes in patterns of action in the organization were explained by endogenous factors (such as individual experience) (Pentland & Haerem, 2011). In related research, increases in ICT capabilities were found to contribute to changes in routines (Orlikowski & Scott, 2008). Scholars posit that some work conditions require flexible work practices to accommodate “highly sophisticated customer demands, in which continuous variations in routine performance are the default” (Pentland & Haerem, 2011).

In other findings, groups of organizational actors used different practices to implement emergency procedures and disaster management responses despite using the same formal

procedures and protocols (Feldman, 2010; Feldman, Khademian, & Quick, 2009; Pentland & Haerem, 2011). Practice theorists conceptualize research that examines social and material elements of work. Social and material elements in organizations are thought to provide historical and social context for explanations of structure and human activity (Jarzabkowski et al., 2012). Research findings in this tradition posit the explanatory power of practices to better understand phenomenon embedded in change (Hedstrom & Swedberg, 1998; Mayntz, 2004; Stinchcombe, 1991).

Practices refer to mutually constitutive and recursive interactions that are believed to enable the study of stability and change in organizations (Feldman & Pentland, 2003, p. 93). Feldman's theory of routines first conceptualized two primary aspects of organizational interactivity as "performative" (p. 613) and "ostensive" (p. 622). Performative aspects conceptualize interactivity in organizations as cycles of ongoing actor accomplishments in plans, actions, and outcomes. Ostensive aspects refer to patterns of activity created by performative activities, or actor performances. Management scholars conceptualize performative and ostensive activities contending these concepts enable new ways to develop and understand organizational theory in public and private organizations (Pentland & Haerem, 2011).

Findings from this line of research assert that performative and ostensive cycles of coordinating are iteratively constructed during periods of planned change in organizations (Feldman et al., 2016; Kozica et al., 2014; Pentland & Feldman, 2005; Rerup & Feldman, 2011). Performative and ostensive cycles of organizational interactivity are conceived in a conceptual middle ground between dependent and independent change related variables (Feldman, 2000). Specifically, embedded interactivity is believed to be a necessary but mediating condition impacting the implementation of changes in organizations (Jarzabkowski et al., 2012, p. 909).

Macro-micro views of organizations that predominate in other disciplines are believed to

inadequately explain dynamics embedded in the context of organizations (Colyvas & Jonsson, 2011). Instead, a study of organization and organizing such as this case study research of organizational change in the national security domain can be approached through research traditions that recognize the need to intersect the social aspects of organizations with technological considerations. The next sub-section explores developments in practice theory that explicate material and human aspects in organizations and organizing in the study of sociomateriality.

Sociomateriality

The literature on socio-materiality conceptualizes the impacts of technology on organizations and on efforts to organize for change involving ICTs (Orlikowski, 2007). Practice traditions in sociomateriality study organizational technology by examining interdependent activities related to the design of information systems (Luff, Hindmarsh, & Heath, 2000). Practice scholars posit that sociomateriality explains how organizational change is accompanied by technological shifts that change the nature of work (Suchman, 2002).

This section of the review explores prior explanations and conceptions of relationships between organizational change involving technology, and individual and group aspects of implementing innovative technologies. Socio-material traditions and the study of practices conceptualize a relational epistemology that defines post-human endeavors as the combined agency of humans and technology (Baroudi & Orlikowski, 1988). In simplest terms, practice scholars prioritize the study of social relationships within organizations over studies of process inputs and outputs that dichotomize structures and outcomes (Feldman, 2010). A socio-material perspective asserts that knowledge about ongoing interpretations of organizational process are needed to understand how stability is constructed from organizational artifacts, facts, and

relevant social groups (Worley & Feyerherm, 2003).

In socio-material research streams, practice theorists posit that process and structure in organizations can be better understood by bringing group and individual activity, and human interactivity with technology to the forefront of data collection (Giddens, 1983; Schatzki, 1987, 1988). Sociomateriality focuses research on complex organizational interactivity to identify technologies-in-practice as units of analyses, which can in turn be used to understand organizational change (Mayntz, 2004; Reckwitz, 2002b).

Practices constitute the epistemological and ontological underpinning of socio-materiality (Emirbayer, 1997). Proponents of practice theory, and therefore socio-materiality believe that humans do not have primacy over material objects in their social world (Emirbayer, 1997; Giddens, 1983; Nicolini, 2009b; Nicolini et al., 2012; Schatzki, 2001). Practice proponents argue that sociomateriality seeks understanding about unfolding relationships between humans, and between humans and non-human entities in social environments (Emirbayer, 1997). Sociomateriality defines an epistemology that inextricably links the social and material to the study of technology and work practices (Colyvas & Jonsson, 2011). In this view, understanding of linkages between technology and humans requires continuous interpretation and re-interpretation of actor routines (Colyvas & Jonsson, 2011). Also, accountability in organizations is conceptualized as interpretations of rules that cannot be made completely explicit (Hedstrom & Swedberg, 1998).

In public administration research, socio-materiality traces to various organizational change topics including strategic management practices (Moorehead & Griffin, 1992), designing public participation (Beer & Nohria, 2000), the promotion of continuous change in public organizations (Kee & Newcomer, 2008), managing multi-sector and multi-agency interoperability (Beer, 2000; Boston, 2000; Hughes, 2011a; Jacobs et al., 2013; G. Jacobs, Arjen,

& Christe-Zeyse, 2013; Jorgensen & Earle, 2007; Kee & Newcomer, 2008; Pentland & Feldman, 2005; Tobias, 2015; H. Tsoukas & Chia, 2002; Van de Ven & Poole, 1995, 2005), managing change through improved knowledge about context dependent barriers in the external environment (Feldman, 2010), collaborative public administration (Bardach, 2004; Barzelay, 2007; Bryson, Berry, & Yang, 2010), and social media adoption in government (Fernandez & Rainey, 2006; Gherardi & Perotta, 2011; Hughes, 2011a; Jacobs et al., 2013; G. Jacobs, W. Arjen, et al., 2013; Jorgensen & Earle, 2007; Kee & Newcomer, 2008).

Scholars position sociomateriality as a research lens for relationships between individuals, groups, and organizational technologies (Orlikowski, 2007; Scott & Orlikowski, 2013). Sociomaterial research investigates differences between written organizational process and enacted interpretations of process involving technology. Practice-based traditions characterize the design of information systems as socio-material phenomenon in a technological setting (Colyvas & Jonsson, 2011; Orlikowski, 2000). Three practice-based research threads provide historical context for applied sociomaterial research in technological environments.

First, Computer-Supported Cooperative Work (CSCW) studies sought to better understand the ways ICTs are used in organizations to solve problems inherent in coordinating work (Schmidt & Simone, 1996). Early CSCW researchers found that organizations demonstrated a preference for pre-packaged technological solutions over custom designs that may be better suited to work in specific organizational environments (Von Hippel, 1976).

Next, Participatory Design (PD) hypothesizes that involvement of technology users during design and development contributes to successful planned change in organizations (Bodker, 1996; Colyvas & Jonsson, 2011). PD researchers found that technology design creates conflicts and threats to users in organizations due to discontinuity between development projects (Bodker, 1996).

Last, Workplace Studies (WS) conceptualize the need to better understand the ways workers use technology in everyday practices (Nicolini, 2009b). In one finding, an information system at the International Monetary Fund was found to be technically feasible, however users determined that the system would not be useful (Harper, 2000). These examples are representative of early practice-based approaches to research. The findings are representative of the persistence of scholars working in multiple disciplines and research traditions to unpack knowledge about problems related to technology-dependent change in organizations. Computer-Supported Cooperative Work (CSCW), Participatory Design (PD), and Workplace Studies (WS) are relevant to the study of change involving development and deployment of ICTs.

Two perspectives characterize complimentary views in the literature on technology-related change in organizations. First, a technologies-as-tools perspective recognizes change as continuous reconfigurations of work (Jarzabkowski et al., 2012). This view of continuous change is made possible by conceptualizing frequent choices made by technology users as re-interpretations of standardized technological capabilities (Jarzabkowski et al., 2012). In a simple example, this view can be illustrated in the many ways that users can choose to move data in and among modern software.

Similarly, a second perspective contends that macro-micro views of organizational theory such as those found in OB and OD research traditions do not account for the real effects of complexity in organizational contexts (Gorli et al., 2015; Jarzabkowski et al., 2012; Osterlund, 2003, 2004; Schultze, 2000; Schultze & Boland, 2000; Schultze & Orlikowski, 2004). In this view, scholars of organizational change acknowledge that unanticipated and unplanned effects of new technologies are common (Feldman & Orlikowski, 2011; Orlikowski, 2007; Orlikowski & Scott, 2008; Pentland & Haerem, 2011). Further, practice scholars contend that sociomaterial

traditions enable rigorous research methods that respond to the continuous and unanticipated nature of technology-related change in organizations.

Consistent with practice-based traditions, research on sociomateriality emphasizes the acquisition of knowledge about social aspects of change involving technology. The particular aspects of change sought by sociomateriality can be seen in what people do, what they say and talk about, and how they use technology (Nicolini, 2013; Nicolini et al., 2012). Practice theorists conceptualize multiple levels of human and technological interactivity within organizations (Feldman, 2000; Feldman et al., 2016; Pentland & Feldman, 2005; Rerup & Feldman, 2011).

Among relatively recent contributions, coordinating theory represents a development on the continuum of social relations perspectives. Some of the related prior scholarly contributions cited in chapter two include structuration theory (Giddens, 1983), actor network theory (Latour, 2005a), communities-of-practice (Lave & Wenger, 1991) and are contained in the literature on practice theory (Nicolini, 2009b, 2013). In this line of research, sociomateriality (Orlikowski, 2009; Orlikowski & Scott, 2008; Tunçalp, 2016) was discussed and represents a development in the practice literature that binds practices to technology. Coordinating theory follows these developments and is central to the methods that enable this study of organizational change involving technology and is discussed next.

Coordinating Theory

Jarzabowski et al. (2012) conception of coordinating is steeped in decades of practice theoretic traditions. In their conception of practice, coordinating theory accounts for empirical and interpretive elements of enacted performances. Empirical elements account for named aspects of coordinating that actors experienced in their work; e.g., technologies, organizational

policy, services, processes and outcomes. Interpretive elements account for aspects of coordinating that are categorized as performative or ostensive.

Coordinating theory asserts that coordinating mechanisms (i.e., analytical constructs that account for parts of organizing and organization) contain cycles of performative and ostensive activity (Jarzabkowski et al., 2012). Organizational data for performative (repeated actor performances of organizational process) and ostensive (patterns of performance by organizational actors) categories of interactivity conceive mutually constituted parts in cycles of coordinating (Jarzabkowski et al., 2012, p. 907). Coordinating theory conceptualizes an “empirically grounded process model with five performative–ostensive cycles that underpin coordinating” (Jarzabkowski et al., 2012, p. 907). (The five parts of coordinating theory will be discussed in more detail in the next chapter, the analytical framework.)

Coordinating theory provides a construct and method for analysis of a particular type of organizational (social) mechanism constituted by continuous processes that are thought to restructure organizational relationships and activities. Coordinating theory is thought to contribute explanations for instability in organizations (Feldman & Orlikowski, 2011). Performative and ostensive cycles in coordinating theory posit that mutually constitutive and recursive interactions between individuals and groups enable the study of stability and change in organizations (Jarzabkowski et al., 2012).

Coordinating theory endeavors to understand restructuring that takes place given occurrences of organizational change. Jarzabkowski et al. (2012) theorize that cycles of coordinating constitute a social mechanism. Coordinating mechanisms contribute theoretically general constructs that can traverse the study of processes that restructure organizational relationships and activities in various organizations.

A purpose of coordinating theory is to understand dynamic processes embedded in organizational context (Jarzabkowski et al., 2012). Coordinating theory focuses on organizational activities that are conceptually situated as processes that exist between arrays of inputs and outcomes. Practice-based coordinating research strives to gather rich case data to understand dynamic processes interpretations in the form of practices. This approach views interdependent actors as recipients, interpreters and carriers of organizational norms (Suchman, 2002). Similarly, coordinating is required to overcome contested relations between developers and users during the design of information systems (Pentland & Haerem, 2011). Dialectical perspectives found in the literature see developers and users of technology as opponents in a forced partnership, enacted by managers to accomplish changes that are needed for organizational ends (Monteiro & Nicolini, 2015).

Scholars conceptualize the particular effects of technology-related organizational change as a process “by which social orders and technologies configure or adjust to each other through emergent patterns of use” (Feldman & Orlikowski, 2011). Socio-material traditions link coordinating practices involving technology to organizational change (Gherardi & Perotta, 2011). As elements of organizational change, the practice of coordinating constitutes formal and informal forums where ICT users and developers can adjudicate disputes that arise from disagreements on technology requirements and processes to effect organizational change (Suchman, 2002). Therefore, coordinating theory responds to organizational context and data that are needed to define factors that explain linkages between embedded processes and change involving technological innovations in public organizations.

Taken together, cycles of performative and ostensive interactivity constitute a coordinating mechanism (Jarzabkowski et al., 2012). Coordinating theory asserts a robust framework to study performative and ostensive activities within cycles and between cycles of

coordinating that characterize mutually constitutive and recursive relationships. As previously discussed in chapter two and above, performative elements describe actor performances (i.e., interpretations) of process. Ostensive elements are patterns that emerge as the recognized ways of performing processes among groups of individuals. Practice, or interpretation of processes by organizational actors is conceived in routines consisting of performative and ostensive elements (Feldman & Pentland, 2003). The five cycles conceived in coordinating theory are discussed in detail next.

Performative and Ostensive Cycles of Coordinating

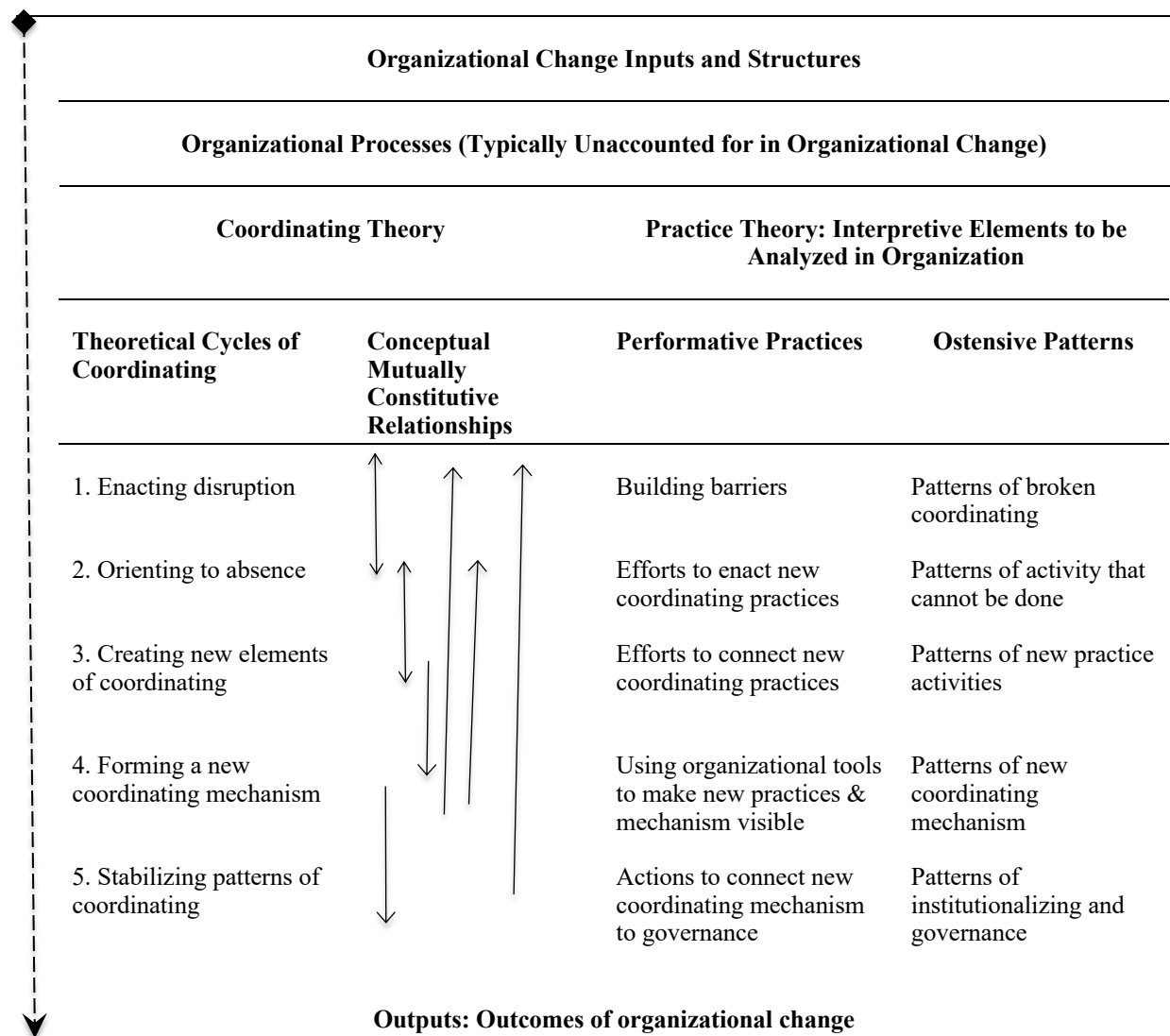
Figure 1 depicts a process view of dynamic coordinating activities in five performative and ostensive cycles. Cycles one to three are mutually constitutive but are not conceived as linear processes (Jarzabkowski et al., 2012). Iterative and connected relationships are depicted in Figure 1. The first theorized performative-ostensive cycle in the coordinating mechanism, enacting disruption consists of activities that prepare the organization for changes involving technology (Jarzabkowski et al., 2012). In cycle one, actors influence organizational responses to change through individual performative conduct that reinforces disruptions that are needed to break down existing interdependencies. Actor performances during disruptions are needed to find new ways to coordinate when disruptions invalidate prior standards and rules. Ostensive patterns define interdependent activities that respond to disruptions and the need for change.

Mutually constitutive properties between first and second cycle coordinating activities account for the loss of formerly enacted or yet to be enacted individual practices in the second cycle that were eliminated by disruptive forces in the first cycle (Jarzabkowski et al., 2012). In the second cycle, orienting to absences, performative aspects include performances by actors that account for attempts to coordinate using process elements that are no longer available. Ostensive

aspects in cycle two include group performances that respond to the absence of formal processes caused by disruptions in cycle one. Performative activities and ostensive patterns reorient actors as they recognize the absence of work processes and the loss of prior practices that are no longer available due to disruptive changes.

Figure 1

*Cycles in a Coordinating Mechanism: Theoretical Framework to Analyze How Processes Iterate Structure and Outcomes During Organizational Change Involving Technology**



* Note: Adapted from “Toward a theory of coordinating: Creating coordinating mechanisms in practice,” by Jarzabkowski, P. Le, J., and Feldman, M., 2012, *Organization Science*, 23, p. 919, Copyright 2012 by The Institute for Operations Research and the Management Sciences.

Mutually constitutive properties in second and third cycle performative and ostensive activities consist of the recognition of formal and informal processes lost in cycle two, and generative forces for invention of new processes and routines in cycle three (Jarzabkowski et al., 2012). In the third cycle, creating elements, performative activities consist of forming new ways to interact. Ostensive elements in the third cycle consist of creating new patterns of interactivity. Performative and ostensive activities in the third cycle create potential for the formation of a reinvented coordinating mechanism in the fourth cycle (Jarzabkowski et al., 2012).

The fourth cycle, forming patterns, is impacted by patterns of disruption in cycle one, and patterns of reorienting that take place in cycle two. The fourth cycle is also impacted by development of new routines in cycle three. Performative activities in cycle four consist of creating links between different elements in the coordinating mechanism. Performative activities also include development of tools that replace old ways of coordinating. New tools produce a new coordinating mechanism characterized by new patterns of activity. Patterns in this cycle are conceptualized as the use of new systems and technologies, relationships, and service arrangements in parallel with the development and interpretive use of new processes (Jarzabkowski et al., 2012). The fourth cycle is foundational to stabilizing that takes place in the fifth, and last cycle (Jarzabkowski et al., 2012).

The fifth cycle, stabilizing patterns, conceptualizes change as diffusion and institutionalization of new routines and formal processes (Jarzabkowski et al., 2012). In the fifth cycle, the full evolution of a coordinating mechanism is conceived in the development of formal procedures that are adopted in organizational governance (Jarzabkowski et al., 2012). During this last cycle, performative activities “connect the emerging coordinating mechanism to overarching organizational governance mechanisms” (Jarzabkowski et al., 2012, p. 919).

Ostensive patterns of interactivity between organizational actors account for the recognition of a formal organizational governance structure.

In the fifth cycle, processes linked to disruptions in the first cycle theorize the start of new disruptions (Jarzabkowski et al., 2012). Therefore, the renewal of coordinating through dynamic performative and ostensive processes in organizational interactivity can be continuously interpreted. Coordinating is a dynamic process, where performative and ostensive processes will constantly be evaluated, broken, and reoriented by organizational actors. Jarzabowski et al. (2012) theorize that the five cycles in a theory of coordinating establish a rigorous scholarly approach to “deconstruct transitions from an existing structure to a new structure” (p. 921). Arrows in Table 1 depict relationships between five cycles in coordinating theory.

Coordinating theory provides a framework for a disciplined approach to understand organizational processes that are used to enact organizational change involving technology. In total, the theoretical framework will be used to categorize interpretive evidence in cycles of change; i.e., performative and ostensive elements that include activities and patterns related to decision-making, mandates, process rules and standards, practices and outcomes. These will be used to explain how processes iterate structure and outcomes as participants respond to changes involving technology in an organization within the national security domain. In this manner, the theoretical framework comprised of overarching practice theory and coordinating theory constitute a lens that informs the phases of the research process that will be covered in detail in chapter four, Research Methods.

CHAPTER FOUR RESEARCH METHODS

Background

The research methods in this case study are informed by the use of coordinating theory to categorize data about interactivity during organizational change involving technology. In particular, as discussed in chapter three, coordinating theory constitutes a theoretical framework comprised of processes that link organizational change involving technology to processes, structures and outcomes. Therefore, this research responds to the question of how processes iterate structure and outcomes as participants respond to changes involving technology in an organization in the national security domain. The methods enable a response to the research question by analyzing evidence and results about the existence of parts in a coordinating mechanism known as coordinating theory, and to analyze linkages between change involving technology in the case study organization.

This chapter is organized into four primary sections: research design, analytical framework, data collection and analysis, and limitations and summary. The first section, research design, discusses the selection of the case study method and the unit of analysis. The first section also discusses the methodological rationale. The second section of the chapter defines an analytical framework that conceives procedures for data collection and analysis. Three experiments are defined in this section. The experiments point to subsequent sections on data, collection and analysis. The third section discusses the use of interviews to constitute reliable data in case study research. The fourth section is comprised of two parts: data collection and data analysis. One secondary data source and techniques and procedures for managing the analysis are discussed. This section also delineates methods for verification, trustworthiness and discusses validity and reliability of the case study research. The last section of the chapter discusses limitations affecting the research methods followed by the chapter summary.

Research Design

Case Study Selection and Unit of Analysis

This case study's research design follows the purpose and nature of the study (Yin, 2014). The purpose of the study is to contribute scholarship in organizational change involving technology to public administration and organizational science. The theoretical framework is operationalized by methods that support the study of relationships between change involving technology and iterations of structure and outcomes across three episodes of organizational history.

Three embedded units of analysis (Yin, 2014) known as “episodes” of change involving technology are appropriate for this case study research for at least three reasons. First, the case study represents an opportunity to empirically test a theoretical process model of change where the unit of analysis provides context that is analogous to the theory. Next, the case study approach to this research is appropriate due to the presence of scope conditions. Scholars posit that scope conditions, characterized by particular circumstances (i.e., more broadly context) can produce insights that are generalizable to case study units of analysis (Mayntz, 2004; Reckwitz, 2002a, 2002b). Scope conditions are defined by context that must be present to activate a theoretical process model (Beach & Pederson, 2013; Bryson, Berry, & Yang, 2010; Davis & Marquis, 2005; Mayntz, 2004; Reckwitz, 2002b).

Last, case study methods are appropriate given an examination of revelatory phenomenon. This case is revelatory given that researchers have limited access to data about change involving technology in the national security domain. The researcher has expertise in organizational change in the national security domain. This experience is thought to fill a gap in subject matter praxis. The topic of national security training is covered in the grey literature by federal evaluators. However, as of this writing, the theoretical stance taken by this case study and

the researcher's access to the case study context is unique in the academic literature.

Rationale

In the case study, empirical evidence will be used to substantiate claims about change involving technology in three embedded units of analysis known as episodes of mandated change. The evidence is abstracted through an a priori process model (i.e., coordinating theory). Analytic generality is derived from case specific context. Pouliot (2015) contends that analytic generality makes cross-case classification and within-case comparison possible. Prior practice studies used theoretical social mechanisms to generalize from case specific context (Baroudi & Orlikowski, 1988). The case study context and associated data provide empirical evidence for this research. Social mechanisms, e.g., Jarzabkowski et al. (2012) coordinating theory used in the case, are conceptualized through abductive research methods that require empirical evidence (Ives, Olson, & Baroudi, 1983). Past studies of organizational change find that coordinating mechanisms are not reified things but are enacted in practice (Ives et al., 1983). In this view, empirical evidence from the case study context is used to substantiate analytically general insights.

Analytically general insights derived from case context offer explanations about dynamic process-outcome linkages. Insights are specified and derive from the context of organizational interactivity in the case study organization. These are characterized as elements of process using coordinating theory. Elements in social mechanisms can be understood as factors that characterize, specify and define interdependent organizational activities. Therefore, analytically general insights have the potential to link organizational change involving technology to processes and outcomes in this case study.

Therefore, this case study methods transform interactivity in the case study organization

that is characterized by informal processes. In the case study organization, informal processes are defined by attempts to coordinate change involving ICT development. Interactivity is defined in the case study as interpretive process actions (i.e., practices) that refer unscripted and informal processes between organizational actors to three embedded units of analysis. The embedded units of analysis are further defined as episodes of change involving technology. The resulting study and analysis compares the results found in the episodes unit of analysis to the five process cycles in coordinating theory. The three embedded units of analysis in the case study have the potential to become generalizable within this case study. Subsequent chapters in this case study will discuss findings and conclusions about generalizability to other organizational contexts, especially within the national security domain.

The case study methods in this research require acceptance of two prerequisites. First, to theorize practices from applied processes, practices must be disaggregated and ordered so they can be reconstructed into a unit of analysis within an analytical narrative (Pouliot, 2015). The unit of analysis posited by this study, episodes of change involving technology, meets the first prerequisite by transforming the case study context into data that promotes generalizability using research traditions in empiricism and interpretation. “The basic rule of transformation is upward aggregation and, conversely, downward specification” (Sartori, 1991, p. 254). The next prerequisite suggests that data collection and analysis methods must aim to capture the logic of local practices to explain within case social effects (Pouliot, 2015). The unit of analysis is studied using interview transcripts that contain narratives about three episodes of change involving technology in the case study organization.

Research methods used in this case study are dependent upon scholarly lenses within interpretivist and social constructionist traditions. Interpretive traditions assert that analytically general insights can be used to determine factors that contribute explanations about mediating

that takes place between inputs and outputs of various types of change (Beach & Pederson, 2013). In this study, research methods are used to classify and organize empirical data about applied change processes, that is, practices. Classification of the data into the sub-parts of the coordinating theory process model known as cycles, contributes to explanations for linkages between change involving technology and structures, processes and outcomes in the case study organization. Abductive methods are used in this case study to assemble a vanguard of case context that joins empirical data with interpretive analysis. In the next section, an analytical framework is defined to inform the case study research results and findings in the next chapter.

Analytical Framework

Figure 2 depicts an analytical framework for this case study of organizational change involving technology in the national security domain. Figure 2 depicts an approach to conduct case study analysis that is consistent with the research methods discussed in this section. The analytical framework helps to determine how organizational change involving technology in the case study organization links to structures of change seen as formal processes and outcomes. Further, the analytical framework demonstrates how research results can link the impacts of informal processes seen as interactivity to change involving technology,

The first column of figure 2 defines the case study framework as three a priori embedded units of analysis that are defined by episodes of change involving technology in the case study organization's history. The second column of figure 2 depicts the first level of investigation to define elements of a priori change mandates. Elements that are subordinate to mandates for organizational change involving technology need to be defined through investigation of the interview transcripts. These elements are conceived in the case study research as organizational structures such as the formal processes that exist to effect organizational change involving

technology.

The third column in figure 2 lists three instances of the process steps (i.e., cycles) in coordinating theory. Coordinating theory is conceived in the case study research as a means to categorize information about organizational change involving technology that is found in each of three episodes of change involving technology in the case study organization. The processes (cycles) represented in coordinating theory provide the means to account for informal interactivity in each episode of organizational change involving technology in the form of performative actions and ostensive patterns. This information can be used to judge the usefulness of coordinating theory to contribute explanations for organizational change involving technology in the case study organization.

The parts of coordinating theory in column III are also used to differentiate between findings in columns II and IV (structures, formal processes and outcomes) from informal interactivity (performative and ostensive aspects) to coordinate change involving technology. The arrows in column III depict research actions that are needed to investigate and examine the impacts of informal interactivity on a priori structures and formal processes in column II, and likewise, the impacts of informal interactivity on a priori outcomes in column IV. Column IV depicts the need to define and analyze elements of a priori outcomes in each episode of organizational change involving technology.

Figure 2

Analytical Framework for a Case Study of Organizational Change Involving Technology

I. Case Study Analysis Framework	II. Analyze Organizational Mandates. How were a priori structures and processes of change involving technology restructured?	III. Analyze: Compare interview data on episodes (unit of analysis) to parts of coordinating theory*.	IV. Analyze: How were a priori outcomes restructured?
Unit of Analysis: Episodes of change involving technology	Case Study Context: A priori goals of organizational change involving ICT	Process Theory: Theory of Coordinating Cycles - Process steps	Case Study Context: A priori outcomes sought in organizational change involving ICT
Episode 1 (Earliest history)	Synchronize: Connect disparate training ICT to achieve technological interoperability.	1. Enact disruption 2. Orient to absences 3. Create elements of coordinating 4. Form patterns of coordinating 5. Stabilize patterns of coordinating	ICT are technologically and operationally interoperable.
Episode 2 (Middle history)	Interoperate: Develop connected ICT into an ICT training system.	1. Enact disruption 2. Orient to absences 3. Create elements of coordinating 4. Form patterns of coordinating 5. Stabilize patterns of coordinating	Improve interoperability between training ICT.
Episode 3 (Latest history)	Integrate: Develop web services for virtual connectivity to ICT training system.	1. Enact disruption 2. Orient to absences 3. Create elements of coordinating 4. Form patterns of coordinating 5. Stabilize patterns of coordinating	Develop an always-on ICT virtual training environment.

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Categorization of interview data by episodes and cycles in coordinating theory enables comparisons between three episodes of change involving technology. These comparisons are discussed next as three experiments on the data gleaned from the interview transcripts. The analytical framework conceives a specific methodology to determine how case study participants responded to organizational change involving technology in the national security domain, and how informal (performative and ostensive) interactivity referred to in the next chapter as process actions, iterates formal a priori structures known as processes, and a priori outcomes.

Case Study Experiments: Operationalizing the Analytical Framework

Three experiments are conducted on the interview transcripts using interpretive content analysis. The first two experiments use machine learning software. A third experiment uses manual coding. The experiments are distinguished by the ways the data is parsed. All experiments on the data are designed to analyze case study context for coordinating change involving technology, and to enable comparison of findings from experiments using machine learning or manual content analysis.

The experiments inform the development of three views of the interview transcript data. First, a holistic view of the interviewee perceptions is investigated in experiment I. Next, in experiment II, the interview transcripts are parsed to contrast two parts of the interview protocol, namely perceptions about organizational structures and outcomes. Last, in experiment III, the interview transcripts are coded to define structures and outcomes. Structures and outcomes are then categorized by episode of organizational change involving technology. Each experiment constitutes a test of the usefulness of coordinating theory to be used in case study analysis. The methods to conduct three experiments on the interview transcripts are listed next.

Experiment One – Use 25 unparsed interview transcripts to model the perceptions of interviewees during episodes of organizational change involving technology.

Analysis Steps:

1. Load 25 interview transcripts into a machine learning tool.
2. Identify and compare outputs to the process steps in coordinating theory. Outputs include themes and concepts, concept maps and thesaurus outputs.
3. Perform coding interventions and repeat processes as/if required.

Experiment Two – Parse 25 interview transcripts into two groups of 25 files each to represent organizational context and outcomes in a model of the perceptions of ICT users during episodes of organizational change involving technology.

Analysis Steps:

1. Disaggregate 25 individual transcripts into two groups of transcript files for organizational context, namely “structure” and “outcomes” that were probed in the second and third parts of the interview protocol.
2. Arrange 50 files into two groups of 25 files each. One group for structures, one for outcomes.
3. Load two groups of files into the machine learning tool so that learning is focused on interviewee perceptions of structure and outcomes.
4. Compare and contrast machine learned outputs to coordinating theory.
5. Perform coding interventions and repeat processes as/if required.

Experiment Three – Compare coordinating theory to three episodes of coordinating organizational change involving technology.

Analysis Steps:

1. Manually code 25 individual interview transcripts to create a coding dictionary of

organizational structures and outcomes.

2. Make a direct comparison of the occurrences of process cycles in coordinating theory to episodes of organizational change involving technology.
3. Perform coding interventions and repeat coding processes as/if required.

Data Collection, and Analysis

Scholars assert that observational methods provide rich data about practices (Pouliot, 2015). Interviews have been used as an alternative to observation in international security studies to inquire about activities that were performed on an everyday basis (Pouliot, 2012). Also, interviews were used to reconstruct background knowledge out of practices that were never observed by the researcher to explain what happened in the Challenger disaster (Vaughn, 2008). This case study follows these methods and uses a data set consisting of interviews to analyze two primary types of evidence.

Pattern evidence provides descriptive statistical data about the frequency of occurrence of themes and concepts and parts of a process model known as coordinating theory. Pattern evidence is established in experiments I and II by categorizing themes, concepts and parts of the coordinating theory process model found in the interview transcripts. In experiment III, patterns are established in findings from the narrative accounts of structures (i.e., a priori formal processes and outcomes) and ICTs. The occurrence and frequency of these actions or entities are used to establish evidence of patterns that are categorized according to three embedded units of analysis known as episodes in this case study research. In all three experiments performative and ostensive categories help to differentiate individual and group interactivity within the process cycles of coordinating theory.

Pattern and account evidence in the case study research are analyzed to understand how

processes iterate structures and outcomes in organizational change involving technology in the case study organization. In addition, the evidence is used to test the usefulness of coordinating theory to explain phenomena linked to organizational change involving technology in the case study. In the case study, account and pattern evidence emerge as outputs from the analysis of interview transcripts in all three experiments.

Data Collection

One secondary data source is used in the study. Transcripts of 25 interviews conducted by the case study organization were provided to the researcher. The researcher received written permission from the case study organization to use the interview transcripts as secondary data for this case study research. (The interview protocol is shown in Appendix A.) This case study research and methods were reviewed and approved by Old Dominion University Institutional Review Board under project number 1394864-1.

Interviews used in the case study research as a secondary data source were originally conducted by the case study organization to evaluate internal ICT development. The interview transcripts provide information about interviewee perceptions of past and present organizational change involving technology in the case study organization. The interview transcripts describe processes and relationships between ICT users and developers during three episodes of organizational change involving technology. The interview transcripts follow a semi-structured protocol consisting of three sections.

In the first section, the case study organization collected demographic information about the interviewees job description and tenure in the organization. The second set of questions asked for information about organizational changes involving technology and followed a line of inquiry that explores the formal structures of technology development processes and interviewee

perceptions of successes and failures of outcomes within the case study organization. The second section titled, “Organizational Context for Managing Technology Development” inquired specifically about the history of organizational change involving technology in formal a priori mandates, changes in process, process that do/didn’t/don’t work, and formal and informal processes. Section three of the protocol titled, “Satisfaction with Organizational Technology” inquired about the interviewees’ individual impressions of satisfaction with organizational ICT. Satisfaction was defined in the interview protocol by the quality of ICT tools (e.g., user interfaces, connectivity, ease of use), usefulness and utilization of ICTs, and ICT user participation/involvement in changes to ICTs. Overall, the interviews probed the perceptions of ICT users regarding ICT development processes and outcomes due to changes involving ICT in the case study organization.

Interviewees were asked to participate by their functional manager. Participants were selected by their managers for their subject matter expertise defined by years of experience in national security training, familiarity with the organizational history of the use of ICTs during training events, and familiarity with the conduct of national security training. The researcher confirmed that none of the interviewees declined to participate. As will be seen in the findings and analysis, the case study organization has a history of change involving ICTs. The history of change involving ICTs in the case study organization is recounted in the perceptions of success and failure characterized by frequent changes in ICT, development processes and organizational objectives. Given this background, the interview transcripts are assumed to be voluntary accounts of lived-experiences. Therefore, the researcher assumes that the interview transcripts provide rich details because the interviewees believed their recollections and perceptions would be used to make improvements in the case study organization.

The ICT user group in the case study organization consists of approximately 200-250 staff members. Interviews were conducted with 22 ICT users, and three interviewees who functioned as users and had some ICT development responsibility. The interview transcripts used in this case study are representative of the community of ICT users in the case study organization. Two ICT user sub-groups constitute the interviewee population and consist of 20 operators and 5 trainers.

The first sub-group of ICT users, operators, set up, test the arrangements of ICTs, and operate the ICTs during training events. Operators control ICTs during training events to create environments that replicate information in real world situations. Operators ensure that effects (i.e., inputs to trainees in the training environment) are delivered during training events that are played-out in scenarios over time, for example hours or even multiple days. ICT training operators work on behalf of the second user sub-group, trainers. Trainers are responsible for the direct (i.e., person-to-person) delivery of training to trainees. This group monitors trainee progress towards the accomplishment of specific training objectives within training scenarios that are enabled by ICTs during training events.

The researcher verified categorization and membership of the two sub-groups with two subject matter expert (SME) analysts in the organization. (These experts each have 20 or more years of experience in national security training and with the case study organization. These same SMEs were later used by the researcher to conduct other member-checks.)

The researcher is the primary instrument in the case study of organizational change involving technology. The researcher's 25 years as a management analyst and as a project management practitioner in a technology development setting within the national security community constitutes credibility to conduct context-based research of organizational change processes involving technology. The researcher had no direct responsibilities for the design of

training or ICTs in the case study organization. It is however, noted that the researcher's experience could be a source of bias in the results and findings of this case study.

Data Analysis

The data is analyzed using qualitative content analysis methods. Content analysis is the systematic qualitative and quantitative analysis of textual data (consisting of documents, texts, etc.) (Saldana, 2013). Content analysis is performed using machine learning and manual coding of the texts of the interview transcripts. A machine learning tool known as Leximancer V4.5 is used to conduct automated content analysis. Leximancer is a Computer Assisted Qualitative Data Analysis Software (CAQDAS) tool that “provides a means of quantifying and displaying the conceptual structure of text, and a means of using information to explore interesting conceptual features” (Leximancer, 2018, p. 3). Leximancer measures the presence and frequency of concepts such as words, phrases, complex definitions, and collections of words (Leximancer, 2018).

Leximancer uses algorithms to produce displays of textual information as concept maps containing themes and concepts that are also represented in a thesaurus of findings (Smith & Humphreys, 2006). In addition, Leximancer conducts relational analysis of identified concepts and measures their co-occurrence within a textual data set (e.g., interview transcripts). Two primary outputs of analysis include a thesaurus of concept terms and a concept map of themes. The thesaurus outputs a statistical report of concepts in order of declining occurrence. The thesaurus provides an analysis of naturalistic language used in the data set. The concept map displays the most important themes and concepts. These outputs are produced for each iteration of analysis of the interview transcripts in two of three experiments.

Two pre-processing steps were necessary to prepare the interview transcripts for

importing into Leximancer. First, interview transcripts in Microsoft Word are pre-formatted to reflect heading styles that differentiate the interviewer questions from interviewee answers (Leximancer, 2018). Next, inter-rater reliability measures were employed to deconflict stop points of discussion and to clarify start points for subsequent questions in the interview protocol. A doctoral level researcher with familiarity of the national security domain and expertise in qualitative research performed an analysis of start and stop points on all the interviews. All disagreements between the researchers were adjudicated as part of the pre-formatting phase. When pre-formatting was completed, approximately 400 pages of interview transcript data in Times New Roman, font size 12, 1.5 line spacing was imported into Leximancer as the first major step in data analysis using the CAQDAS tool. The first step in processing textual data in Leximancer is to create a new project folder. The pre-formatted interview transcripts are imported through the Load-Data function.

The major analytic stages of Leximancer processing include generating Concept Seeds, generating a Thesaurus, and generating a Concept Map (Leximancer, 2018). In accordance with manufacturer instructions, prior to automated content analysis, various settings were adjusted in the tool interfaces to formulate the thesaurus, concept codes, and create compound concepts (Leximancer, 2018). Outputs from Leximancer's analytic stages provided data for interpretation and further analysis by the researcher. The researcher iterated between processing in the tool and researcher analysis of the CAQDAS outputs. These iterations informed researcher decisions to make additional adjustments to the tool settings. An analysis of outputs from the CAQDAS tool by the researcher was the last step in each iteration of processing. At the end of each iteration of processing, the researcher determined if additional iterations of processing the data in the tool were required.

In experiments I and II, at least one processing iteration was conducted using Leximancer default settings for transcript analysis. The transcript analysis function is designed to help researchers document empirically derived differences between iterations of processing (Leximancer, 2018). Analysis of these differences contributes to researcher judgment to accept, reject or modify themes and concepts identified as processing outputs. Transcript analysis in Leximancer requires specific settings in the tool. These settings and benefits are discussed next.

In Text Processing settings, Apply Dialogue Tags is selected. Dialogue markers transform transcript text into tags. Tags are inserted by the tool into relevant sentences and displayed under the Auto Tags tab in the Concept Seeds interface (Leximancer, 2018). In the Text Processing Settings, the Prose Test Threshold setting is defaulted to zero (Leximancer, 2018). The zero setting in Prose Test Threshold was chosen because the interview transcripts exhibit colloquialisms and therefore do not conform to stop-word usage (Leximancer, 2018).

In the next step of processing the transcripts for analysis, the researcher ran the Generate Concept Seeds stage. After processing the Concept Seeds stage, the researcher opened the Concept Seeds folder to inspect the Auto Concepts Tab, revealing choices to suppress any of the speakers in the transcripts, including the interviewer (Leximancer, 2018). No suppression was selected. Next, in the Generate Thesaurus phase, concepts were inspected. Next, review of the Concept Coding settings and Mapping Concepts list helped the researcher to determine what concepts would appear on the concept map. In this step, themes and concepts are isolated to explore qualitative and quantitative measures of concept connectedness within themes. These features are useful to explore thematic and conceptual linkages depicted in concept maps.

Concept maps display dominant themes as circles and associated concepts as embedded terms within each concept circle. Concept map outputs are further defined by heat maps with warm colors (e.g., red) being the most important, and cool colors (e.g., blue) being of lesser

importance (Leximancer, 2018). All three map settings were adjusted by the researcher to alter the display of data for % visibility of concepts, % theme size and degrees of rotation for the concept maps. Degrees of rotation do not affect the outputs but enhance the visual display of the concept maps. Alternatively, thesaurus outputs list concepts and report values of connectivity between terms. Connectivity scores provided in Leximancer outputs reflect the degree of relatedness between concepts. Concepts are quantified by count and relevance. Count is a descriptive statistic that ranks the frequency of concept occurrences (Leximancer, 2018). Relevance is a proportional measure of the occurrence of the most important concepts compared to one another (Leximancer, 2018).

Interview transcript files were edited to change the names of formal processes and ICTs in the case study to reflect numbered designations (e.g., process 1, 2, ICT 2, etc.) Numerous iterations of re-processing the transcripts in Leximancer during experiments I and II were conducted by the researcher. Insights gained from an iteration of processing the transcripts in Leximancer beget additional iterations of processing. The researcher made adjustments to various Leximancer settings between iterations of processing. For example, a thesaurus output was made to combine synonymous words or phrases. The researcher documented changes that were made to the value of settings to differentiate iterations of processing within each experiment and to differentiate outputs from each experiment.

Each iteration of processing during the experiments produced a thesaurus and conceptual map. The case context characterized in the thesaurus and the conceptual maps compared and differentiated themes and concepts representing coordinating processes, organizational changes involving technology, and a priori processes and outcomes. In this way, textual content analysis methods were used in the case study research to differentiate and compare linkages that exist

between formal changes involving ICT and their concomitant informal coordinating processes and outcomes characterized in Figure 2.

Interpreting Outputs from Experiments. The following coding steps provide a set of heuristics to guide the researcher during automated and manual content analysis. The steps describe an iterative and cyclical qualitative research process that ensures researcher involvement in the interpretation and meaning-making of the outputs from experiments I, II and III. The effective use of multiple experiments on the data by the researcher is expected to impede researcher bias.

The coding steps follow scholarly recommendations to begin qualitative process research with a holistic perspective in first cycle coding, and then progress to more detail in mid-cycle coding and later return to a holistic perspective (Brady et al., 2010). While actual “coding” is performed using Leximancer V4.5 in experiments I and II, four methodological process steps external to Leximancer and conducted by the researcher will first, infuse rigor into iterative processing of the thesaurus and conceptual maps, and next, assist the researcher to interpret and refine the thesaurus and conceptual maps and other quantitative output from the CAQDAS tool. These methods external to the CAQDAS tool introduce another level of rigor that add meaningfulness to the findings and ensure reproducibility of the case study.

Process coding. Initial reading of the interview transcripts is performed by the researcher to reflect upon and identify indicators of organizational process. Process coding analytic methods search for actions that describe processes that take place over time and are affected by how things change, emerge, occur in sequences, or become implemented (Beach & Pederson, 2013; Brady et al., 2010). During process coding the researcher identifies gerunds (“-ing” words) that indicate action in the data (Beach & Pederson, 2013). This reading can be compared to the outputs from each first run of versions of the data through the CAQDAS.

Provisional coding. During a second reading of outputs, provisional coding builds upon previous research (Saldana, 2013). Cresswell (2012) recommends that provisional coding begins with a start list of five to six codes. In experiment II, after an initial reading, and parsing the interview transcripts into files for context and outcomes, the researcher will develop a list of categories that are informed by Jarzabowski, et al. (2012) five cycles (i.e., parts) of coordinating theory. In a similar manner, following first cycle coding and more analytic reflection, Saldana (2013) cites Rossman and Rallis (1986), recommending identification of additional categories defined by explicit words or phrases. Initial provisional codes are expected to produce themes that represent phrases and sentences described by Rossman and Ellis (2003) as “more subtle and tacit processes” (p. 282).

This reading and tentative list of provisional codes can be compared to outputs from the first runs of processing in Leximancer. Themes from initial processing in Leximancer can be “re-coded” to assign more meaningful, less colloquial terms output in the Leximancer thesaurus. Also, reflection may cause the researcher to search backwards in the data for themes and concepts that the researcher expected to be present and were missing. In this step, the researcher will also look for words in the thesaurus that may be obfuscated by the use of acronyms or synonyms that occur in natural language, are particular to the practitioner community in the case, and that may not be easily translated. This could be particularly useful to identify processes ICTs that have multiple acronyms or synonyms.

Pattern coding. During a final reading of qualitative data, pattern coding can be used by the researcher to identify a final set of categories or themes, causal explanations, relationships among actors, and theoretical constructs (Saldana, 2013). During this phase of interpretive analysis, the researcher will identify and define themes and concepts that can be categorized and compared to the parts of the coordinating theory process model. Factors are identified that

represent patterns of linkages found in interactivity that characterizes organizational change involving technology in the case study organization.

In this case study, qualitative traditions are used to analyze organizational change involving technology. Qualitative traditions typically use deterministic rather than probabilistic methods (Patton, 2002). Determinism in the case study analysis emphasizes research outputs aimed at understanding social phenomenon that takes place between inputs (X) and process outputs (Y) (Jarzabkowski et al., 2012). The use of a powerful CAQDAS machine learning tool provides a means to study the potential of different combinations of X and Y.

A goal of this study therefore, is to analyze and explain case study context for linkages between elements of change involving technology seen as structure, processes and outcomes. The study's dependent context is defined by a priori inputs and outputs of organizational change involving technology defined as the structures of a priori formal processes and objective outcomes. Each embedded unit of analysis (i.e., episode) represents a unique set of potential organizational change involving technology.

Assertions will be made from evidence produced by the analysis of case study data. Case study analysis of local context constitutes interpretations of observations (Erickson, 1986). Saldana (2013) believes that assertions based on qualitative analysis infer theoretical transfer of the particular to the general and can be used to predict patterns of social phenomenon that could be observed in analogous contexts. In related research, Bardach (2004) conceived the "extrapolation problem" as a method to transfer learning and know-how between public organizations. The process of making inferences is theory-like in that case data is used to draw broader conclusions about concepts and hypotheses (Saldana, 2013). Consistent with interpretive traditions, this case study analyzes the usefulness of a theoretical process model known as coordinating theory to understand relations between three episodes of organizational change

involving technology that are characterized by a priori (formal) structures in the form of processes and outcomes, and informal interactivity known as process actions (e.g., ad hoc/unscripted practices).

Verification, Trustworthiness, Validity and Reliability

Two methods are used by the researcher to ensure verification and trustworthiness of the qualitative research. First, methods for verification are embedded in the rigor of the research design. Rigor is defined in the research design by purposefully documenting patterns, developing explanations and analyzing propositions (Miles, Huberman, & Saldana, 2014). Trustworthiness consists of member checks by subject matter experts (SMEs) (Saldana, 2013). Two SMEs were previously referred to in this chapter as staff members in the case study organization who are called upon to discuss terms and context with the researcher to assure that the researcher did not misinterpret technical information (during case study analysis of the data).

Also, interrater reliability is conducted through independent analysis of research data by the researcher and a subject matter expert (Roberts, 2010; Saldana, 2013). This SME is a doctoral level academic with limited experience in national security training and significant experience in qualitative methods involving interviews. This SME conducted an independent review of all the transcripts to analyze start and stop points for interview questions in the transcripts. In this way, independent reasoning informed the researcher's decisions to separate interviewee responses (i.e., to parse the data). Separations were made to identify stop and start points between interviewee responses. Inter-rater reliability particularly strengthens the analysis of experiments one and two.

Four criteria consisting of construct validity, internal validity, external validity, and reliability ensure the quality of case study research design (Yin, 2014). First, construct validity is

the identification of correct operational measures for the concepts being studied. This research implements construct validity by employing scholarly recommendations to use multiple sources of evidence during data collection (Yin, 2014). Account and pattern evidence are compiled from 25 interview transcripts that provide individual perspectives of the case study phenomena.

Second, internal validity is met by using pattern matching to identify recurring performative practices and ostensive patterns identified within the embedded units of analysis. These link the unit of analysis, episodes of change involving technology, to coordinating theory, structures defined as a priori processes and outcomes, and interpretive interactivity defined in the case study as process actions. Comparison of findings between each of the embedded units of analysis will strengthen internal validity. To do this, three experiments compare research results and findings, effectively providing three distinguishable interpretations of the textual (interview) data.

A third criteria for research design quality, defines external validity as the boundaries of the research that limit generalizability of the case findings (Yin, 2014). The design phase of the research was informed by theory. Theory based case designs contribute to external validity and to the overall quality of the research design (Yin, 2014). The theoretical framework is based upon Jarzabkowski et al (2012) coordinating theory. The study seeks to modify, reject or advance coordinating theory. However, it is noted that the case design limits future generalizability of findings to within-case units of analysis and to a narrow population of cases of change involving ICT in the national security domain.

Reliability is the final technique used in the case study to ensure the quality of case study research. Reliability encompasses steps taken by the researcher to ensure that the research operations (e.g., data collection, analysis, etc.) can be replicated (Yin, 2014). During data collection and analysis, the researcher will maintain a case project log in Leximancer to

document interactions with the various interfaces and settings used in the stages of automated content analysis.

Limitations

Limitations beyond the researcher's control are discussed in this section. First, the study requires a preponderance of qualitative methods to produce richly detailed results and findings. Though not a constraint in and of itself, qualitative research requires an investment of time and judgement by the researcher to determine when saturation of case context and data is achieved. This investment and intellectual vesting by the researcher is a preventative measure that guards against undervaluation, misinterpretation, or loss of valuable research data. Following from the previous awareness, despite the researcher's extensive experience in the national security community, the data reflects natural language of a group of specialized practitioners. The researcher is therefore, not an expert national security training practitioner and therefore had to overcome limitations of understanding and interpretation by other means such as member-checking.

This case study will have limited generalizability to other organizations in the national security domain. Foremost, the sample size of the population constrains the generalizability of the case study. The secondary data retrieved from the case organization was limited to a specific time and purpose, therefore the population sample is limited in size to local practitioners. Generalizability was addressed earlier in the chapter to claim the potential for within-case generalizability. The limits of generalizability using analytically general insights were reviewed. However, this research is limited by the context specific environment of organizational change involving training ICT in the case study. The research is potentially more generalizable if the research findings can be shown to have broader applicability to other organizations in the public

domain.

Summarizing the Methods

The research methods for data collection and analysis in this case study are founded in scholarship in public administration and are complemented by sociological perspectives on sociomateriality. The research methods in this case study provide a means to examine the usefulness of coordinating theory to analyze how processes iterate structure and outcomes as participants respond to organizational changes involving technology in the national security domain. The methods support research designed to produce evidence and inferences from study of a unit of analysis defined as time periods, or episodes of change involving technology in the organization. Data about the episodes is obtained from interview transcripts that provide narrative descriptions and perceptions of the case study organization's history.

The study's research methods support findings and results in the next chapter that contribute to prior scholarship on the impacts of coordinating organizational change involving technology, seen as linkages between structures, processes and outcomes. Scholars argue that context driven research is needed to understand the dynamics of change in complex organizational networks (Feldman, 2010; Hupe & Hill, 2007a; Issett et al., 2006). Extant theory posits the study of "coordinating as dynamic activities that are continuously created and modified in order to enact organizational relationships and activities" (Jarzabkowski et al., 2012, p. 907). This case study research extends practice theoretic traditions to public administration environs in the national security domain. This case study takes steps to contribute explanations about little known coordinating processes that explain how processes iterate structure and outcomes as participants respond to changes involving technology in an organization within the national security domain. In the next chapter, research results and findings distinguish evidence

of linkages between organizational change involving technology and structure, processes and outcomes to determine how processes iterate structure and outcomes.

CHAPTER FIVE

RESEARCH RESULTS AND FINDINGS

This study investigated the effects of actor work practices known as process actions on organizational structures and outcomes during changes involving technology for national security functions in the public sector, and it investigated what parts of coordinating theory contribute explanations about the impacts of empirical and interpretive elements of organizational change in the case study. The purpose of the study was achieved by examining findings from the results of content analysis. The outputs of the research characterize linkages between interpretive process actions and empirical structures and outcomes. In addition, the results posit the usefulness of coordinating theory to contribute explanations for organizational change involving technology in the case study organization. Results and findings contained in this chapter respond to the research question: What process actions account for changes to a priori organizational structures and outcomes involving technology in an organization within the national security domain?

Presentation of the research is arranged based on results from three different experiments that differentiate the textual analysis of 25 interview transcripts. (The interview protocol is in Appendix A.) Content analysis in experiments I and II was conducted using a CAQDAS tool. Experiment I focused the content analysis on one folder of 25 transcript files representing the perspectives of the interviewees. Experiment II focused the content analysis on 50 transcript files grouped equally into two folders, one focused on the context of organizational structures, and another group of transcripts focused on the organizational context for outcomes. Experiment I and II analyzed a priori formal structures (i.e., processes and outcomes) and informal process actions seen as unscripted interactivity described by the interviewees. Themes and concepts are used to represent the findings and results of experiments I and II. Excerpts from interview

transcripts trace to themes and concepts and are used to support discussion of the findings and results in the experiments.

Experiment III focused the transcript data and analysis on the context of episodes to differentiate periods of organizational change involving technology in the case study organization, and to compare findings between experiments. This was done by manually coding and analyzing structures and outcomes described by the interviewees in the interview transcripts. The experiments compare and differentiate themes, concepts and their linkages to present findings about how informal, unscripted and interpretive processes iterate a priori structures, processes, and outcomes during organizational change involving technology.

Results and Findings

Coordinating theory provides a framework to categorize interpretive (i.e., performative and ostensive) data originating from the interview transcripts. Coordinating theory posits five process cycles of organizational change that include performative and ostensive elements to categorize process actions into disruptions, re-orientating, preliminary efforts to create new work practices, subsequent formalization of practices and finally, stabilizing that occurs through institutionalization and governance. Coordinating theory and its constituent process cycles and performative and ostensive elements account for interpretations, inventions and re-inventions of a priori processes performed by organizational actors. Interpretive elements were discussed in earlier chapters as representing potential for organizational change.

The findings in this chapter are defined by relationships between formal and informal elements of organizational change involving technology. Formal a priori structure and outcomes are viewed as empirical elements. Empirical elements are found in structures defined by policy,

ICTs, standards and formal processes. Empirical elements of outcomes define formal mandates, goals and objectives of organizational change involving technology.

Alternatively, process actions are interpretive elements defined by informal and emerging interactivity between organizational actors. As process actions, interpretive elements are categorized in the analysis as performative and ostensive actor behaviors. Performative elements describe non-routine informal interactivity between individual and group organizational actors. Ostensive elements account for patterns of informal individual and group interactivity.

Table 1

Experiment I Thematic Results of CAQDAS Content Analysis of 25 Interview Transcripts

Thematic Results / Tests	1	2	3	4	5	6	7	8
processes	2614	2550	2492	2567	2287	2638	2592	2606
technology development	2299	2371	2286	2423	2288	2469	2297	2232
organizational services	2077	1638	1939	2049	2352	1932	1945	1958
legacy technology	1358	1543	1346	1198	1356	1160	1466	1385
probably	354							
disruptions	221		292		268	288	338	338
area	85		214			124	275	
output	87		20		20		20	
technical		583	627	437	478			410
money		326				331		287
tech76ep2		20			86			
better				199				
combative				1				
Total	9095	9031	9216	8874	9135	8942	8933	9216

The three content analysis experiments are characterized by linkages between themes and concepts. Themes and concepts were assigned to empirical and (or) interpretive categories. Key

themes and concepts that emerged from each experiment are categorized to compare findings about linkages between empirical elements of a priori structures and outcomes, and interpretive process actions. Findings for each of the three content analysis experiments are discussed next.

Experiment I Results for CAQDAS Content Analysis of 25 Interview Transcripts

Table 1 shows statistical results of tests in the CAQDAS tool that characterize four themes, ‘organizational services’, ‘legacy technology’, ‘processes’, and ‘technology development’ as the most consistently and frequently occurring themes in eight tests of processing 25 interview transcripts in the CAQDAS tool. Table 3 shows the number of times that a theme co-occurred with all other textual data in the interview transcripts. The consistency of the occurrence of these four themes shown in table 1 provides pattern evidence of the stability of the tests that constitute the experiment, and account evidence for the validity of the results.

Each of eight tests was performed by executing a function in the CAQDAS tool known as reclustering (Leximinacer, 2018). In effect, each reclustering process constitutes a test to search for different associations of textual content in the interview transcripts. Each test produced a different concept map, word counts and relevance proportions between textual data. The final concept map and complete list of concepts associated with the themes, their word-counts and relevance percentages are in Appendix C and are most representative of the findings in experiment I. Table 1 shows that four themes were consistently prominent across all eight tests of the interview transcripts. The themes below the top four themes are provided to characterize the totality of the output from the CAQDAS tool. The top four (most frequently occurring) thematic results in table 1 are used to characterize and substantiate findings shown in table 2.

In experiment I, the themes of ‘organizational services’ and ‘legacy technology’ characterize empirical elements of structure and outcomes in the organization. The

‘organizational services’ theme describes the primary services provided by the organization. The ‘organizational services’ theme and its associated concepts describe the formal frameworks that guide and inform the operations and mission of the case study organization. ‘Organizational services’ relate policies and established processes to define the scope and purpose of the organization’s mission. “These programs support a bigger system...this is where each [stakeholder] had their annual plans approved” (Interview 003, November 27, 2017).

Table 2

Experiment I Findings and Results from Analysis of 25 Interview Transcripts

Themes	Key Concepts	Empirical Elements		Interpretive Elements: Process Actions	
		Structures	Outcomes	Performative	Ostensive
Organizational Services	Collaboration, technology types, formal organization	X			
Legacy Technology	Stakeholders, formal processes, collaborations		X		
Processes	Working, user (using), time, people, look (inquiring), understanding			X	X
Technology Development	Requirements, developer (developing), change (changing), user (using), group, coordinate (coordinating), question (questioning)			X	X

The ‘collaboration’ concept in the ‘organizational services’ theme, describes the structure of formal interfaces with stakeholders and organizations that are serviced by the case study organization.

[A plan] helped clarify how we support the [customers and stakeholders]. This institutionalized the [organization’s mission]. It was governed by a program execution

plan, and program goals and objectives that were authorized by higher authority and followed [how the customers] wanted us to support them. (Interview 003, November 29, 2017).

Similarly, the theme of ‘legacy technology’ describes outcomes from various legacy (existing) technologies. Technology outcomes are described by interviewees as features of existing technologies that are essential to creating specific effects during delivery of training services by the case study organization. As an example, and as discussed in earlier chapters, certain training ICT are differentiated by the types and relative measure of realism they add during individual and group training.

So what the [technology 11] did, basically created a backbone and it allowed various [training customers and stakeholders] to plug in, and talk to each other. So you've allowed the [customer] to develop their [technology] and then the code to allow the interface to occur to allow them to talk to other [technologies]. It made [our technology] more tailorable. Depending on what your training objectives were you could pick the [technology] you needed and you could plug it into our [technology 11] back bone (Interview 003, November 29, 2017)

Improvements to ‘legacy technologies’ in the case study organization are inextricably linked to providing ‘organizational services’.

[Technology 4] was linked to the [organization 145] development group. [The group] focused on...efficiencies to make it cheaper to provide effectiveness at a lower cost with fewer people. [We use] technology to try to offset [the loss of] personnel” (Interview 003, November 27, 2017).

In a similar example, the link between the organization’s services and legacy technology is seen as a function of quality.

The [technology] plans [function] would work with [our organization 162] to understand the...[stakeholders] objectives. And then working with our [organization 34, technology services] to understand how [technology] is needed to support the [customer's requirements], because the [organizational] mantra is ...we are driven [by customer requirements] and supported by [technology] (Interview 003, November 30, 2017).

Concepts in the 'legacy technology' theme make reference to different organizational ICT. The fact that many different organizational ICT exist links technology to delivery of the organization's primary mission and services represented in the 'organizational services' theme. The themes of 'organizational services' and 'legacy technology' characterize familiar and tested structures, and progress towards outcomes. 'Organizational services' and 'legacy technology' are not dependent upon interpretive ad hoc process actions. Findings about structure and outcomes found in 'organizational services' and 'legacy technology' in the case study are empirical in nature.

The 'organizational services' theme refers to how named programs, goals, and objectives are managed. Similarly, the 'legacy technology' theme is characterized by references to defined capabilities and application of these capabilities to the organization's primary mission and services. Proven technologies are assisted by apparently proven organizational services. Proven processes and services have history in the organization. They are well documented and understood by organizational actors and stakeholders.

Next, the themes of 'processes' and 'technology development' contrast with familiar and tested work practices in the structures and outcomes of 'organizational services' and 'legacy technology'. Themes for 'processes' and 'technology development' are characterized by an apparently greater emphasis on interpretation and reinvention of extant work practices. The themes of 'processes' and 'technology development' represent interpretive elements that are

shown in table 4. Interpretive themes and concepts change the focus of findings from a priori (formal) structures and outcomes to interpretive process actions that are characterized in the performative and ostensive behaviors of organizational actors. The interview accounts in experiment I point to the potential of temporary patterns of work practices (i.e., performative actions) to become patterns of ostensive interactivity that may last and have extenuating linkages to the environment of change involving technology in the case study organization.

In contrast to a priori empirical elements of structure and outcomes, the themes of ‘processes’ and ‘technology development’ depict organizational challenges associated with disruptive changes involving the development of new technology. First, the ‘processes’ theme is defined by concepts that describe emerging but potentially repeated actions by individuals and groups (e.g., ‘working’, ‘understanding’). The emergence of routines and work practices characterize interpretations of existing process seen as performative process actions in the case study organization. Further, other concepts in the ‘processes’ theme focus on patterns of what ‘people’ in the organization are saying and doing. These concepts represent process actions that demonstrate reinventions of extant process and invention of new procedures. As an interpretive element of change involving technology, the ‘process’ theme supports innovation in the case study organization. In the ‘processes’ theme, work practices are characterized by administrative decisions that were needed to make progress regarding change involving technology.

“If you know that these working groups, these boards, these cells consistently come into an event...you can start doing some kind of behavior... Not AI, but you can say, we are trying to move to the next level and trying to automate some behaviors associated with it (Interview 001, December 18, 2017).

In the ‘processes’ theme, the concepts of ‘working’ and ‘understanding’ refer to interpretations by organizational actors that were needed to synchronize and coordinate

programmatic, technical and administrative issues. Interpretation was an evident part of interactivity between organizational actors. Interpretations of organizational processes are characterized by the concepts of ‘working’, ‘understanding’ and ‘time’. These concepts describe performative and ostensive process actions between individuals and groups that took place in response to uncertainties associated with new technology development; e.g., cost and unanticipated funding justifications, uncertain and changing project delivery schedules.

Due to resources being constricted there is a lot of manpower that is not available. We had a very collaborative manpower heavy process... each element of work was accomplished by [a] team of people... over the years we lost a lot of staff so some [of the development work] has been aggregated where, it is the same group of people [doing] a greater variety of work.

We are on thin client [technology] now. Before we would have individual, custom-made workstations that had a suite of software on them to do whatever we needed to do, and we would send [administrative] products back and forth. Now it is a much more networked environment. The computer security issues and sensitivity to hacking... have affected the way we work. Everybody is more conscious of how their work and how attachments and emails, etc. can affect the organization (Interview 001, December 14, 2017).

Interpretation of a priori elements of organizational change was evident in interactivity between organizational actors enacting adaptations to new technology. Interpretation of extant a priori structures indicate the performative nature of work practices known as process actions in this case study. The example above illustrates activities that people engaged in as they endeavored to adapt to (e.g., thin client) new technology.

Interviewees provided accounts of multiple disruptive reorganizations that were driven by internal and external forces and the need for efficiencies. The results of efficiencies taken in the organization are evident in accounts about the case study organization's ability to innovate technology that was needed to support delivery of its primary services. The following is an example of performative process actions in the form of reorienting that took place because processes were no longer available due to reorganization.

In administration, you actually reduced your total capacity. The reduction has continued and now is getting to a point where it is becoming unreasonable. When the [reorganization] was made... administrative skill sets were removed from [places] that need them. You end up taking technical people to do administrative work, and as a result you lose some of the edge on your technical applications. At the same time you don't improve your ability to [perform] your administrative functions (Interview 001, December 12, 2017).

In another example, the rapid pace of change brought new and modified expectations for organizational performance. Multiple changes to the organization's structure contributed to the need for invention and improvisation that was required for the organization to maintain its focus on current commitments to stakeholders, while juggling responsibilities for forward looking technological adaptations and innovations.

After [organization 16] was disestablished and [organization 19] came in, you had one organization where development and operations were all together. There were some challenges just because of the sheer scope and effort of one division trying keep an awareness of what was happening in development and still not get overtaken by [current] operations.

So one of the challenges we always have is if you're in charge of current operations, how do you keep that from overtaking what you're looking for in the future? The technology world moves [development] to operations in a much more rapid rate than it ever has. Where you don't have good transitions from development to operations, we see this hugely in government (Interview 003, December 5, 2017).

Next, the 'technology development' theme describes processes that are used to inform adapting, making, or adopting new ICTs in response to specific requirements. Requirements define new features of ICTs that are expected to translate to specific aspects of performance in the case study organization. The 'technology development' theme is characterized by concepts that describe human-to-human interfaces (e.g., 'developing', 'changing', 'using').

The easy ways is to take advantage of some of the technology. We have a lot of meetings. You don't get any meat out of a lot of these meetings. But if you have chat sessions... you can read it when you want to. So, anything that we can do to communicate across - from the users to the developers - and then across users... that's easy. But somebody needs to say...you're gonna' participate (Interview 001, November 30, 2017).

Similarly, the theme of 'technology development' describes relationships between actors involved in decision-making to build new technology. Interactivity between organizational actors in the 'technology development' theme encompass negotiations that took place between technology developers and intended technology users.

So I think in some ways we are kind of the architect that needs to listen to the end customer, and then try to put something together and then go back to the customer and [ask] how does this look? [Does] it look about right? It is important to get initial input. It is important to get an in or out agreement, and then it is important to follow-up to make

sure that whatever it is you did has a positive effect and we get smarter to address the next challenge that comes up (Interview 002, December 5, 2017).

Alternatively, in the technology development theme, new and innovative technologies were associated in interview data with decision making by developers that determined and defined performance aspects of new technology. Interpretation by technology developers was described by interviewees as the determination of performance measures and features of new technology. Formal procedures to elicit information from the intended users of new ICT to determine performance aspects of the ICT were found to be opaque by some interviewees. The effects of new technologies on current work practices were sometimes not understood as illustrated in the excerpt next.

Technologists are great, they can do pretty much everything. But they don't understand the user perspective unless they have been users before. We've tended to migrate into two different camps over time. They are two separate groups completely. Where one group develops the technology or establishes the technology, and the other group uses the technology. And they might understand some of the same words, but they don't speak the same language (Interview 001, December 5, 2017).

The following interview excerpt describes the existence of disagreements between teams of service providers that use organizational ICT, and actors who develop and implement new ICT.

[Technology development]...is being done without a fine-tuned ear from the developer perspective. To what the [technology users] are saying they need. And when you do that, there's opportunities to misfire and miscommunicate, and people are not sure that you're doing what's in their best interest - so you're getting a lot of resistance. You've got the possibility of the right thing happening, but it's happening in a way where people don't

trust each other...the user does not trust that the developer really has his best interest in mind... and really understands what he needs (Interview 001, December 13, 2017).

ICT-in-use require periodic upgrades, enhancements and maintenance and can be distinguished from technology in development. Interviewees characterized new technology development in the case study organization attaching ostensive patterns of group behaviors that manifested in multiple attempts to coordinate change involving technology. Technology users in the organization enacted ostensive patterns of ICT development that were linked to uncertainty about how new technology would work or how it would impact extant a priori structures and outcomes. Concerns about understanding the features and implications of new technology were characterized by performative actions that manifested in accounts of unexpected, frequent, layered and disjointed ad hoc decision making.

If you don't design something that has the synergistic involvement of the folks that need to use it - and the folks that define the requirement in the first place, that needed the solution, if they're not involved... if there isn't a check and balance system that says here's what we thought you said. Here's what we think we're building in response to what we think you thought you said, and here's what we have developed, and here's how much it's going to cost...then you have the higher probability of coming up with a solution that answers your question, not their question. I think that's why we need to keep a non-incestuous look at the way we do development start to finish (Interview 001, December 14, 2017).

In the case study organization, decisions about the features and uses of new technology were not always well synchronized with the community of intended users of the technology. The previous interview excerpts confirm a cautionary account of disjointed actor intentions and inventions of process. The excerpts of interviewee perceptions illustrate many potential avenues

for failure in organizational change involving technology.

The findings in the ‘processes’ and ‘technology development’ themes point to interpretations of formal processes that were needed to make decisions about design and other aspects of new technology development. The findings show conceptual overlap between the ‘processes’ and ‘technology development’ themes. Emerging processes that were needed for decision making was an ongoing aspect and consistent ostensive pattern identified in interviewee accounts of change involving technology in the case study organization. More impactful and disruptive organizational change involving technology resulted in routine instances of unscripted and emergent interactivity between organizational actors. There were many instances of interactivity recounted by interviewees that did not conform to formally documented a priori structures e.g., procedures and processes. Hence, invention through new process actions was required to achieve the otherwise formally documented mandates and goals of organizational change involving technology.

Results and findings in Experiment I provide examples of how patterns of interpretive performative and ostensive behavior found in the themes of ‘processes’ and ‘technology development’ link to empirical elements of a priori structures characterized in themes for ‘organizational services’ and ‘legacy technology’. In the previous interview transcript excerpts, a priori structure and outcomes were impacted by performative aspects of unanticipated decision making that was needed to maintain commitments to current organizational services while balancing the need to make progress on development of future ICT. Account and pattern evidence of recurring invention and re-invention in the case study organization linked interpretive elements to organizational change involving technology. Further, results and findings in experiment I furnished evidence of how unscripted processes iterate a priori processes and outcomes during organizational change involving technology.

Summary Findings for Experiment I

1. The ‘organizational services’ theme described the management of services that embodied the characteristics of well documented programs, goals, and objectives that were understood by organizational actors and stakeholders.

2. In the ‘processes’ theme, the history of the organization shows that over time some processes became well documented and understood by organizational actors and stakeholders. Others did not. Implementation of organizational changes involving technology that were based on outdated or undocumented procedures for work practices contributed to the need for interpretation and invention of a priori structures and outcomes and can be seen in performative and ostensive process actions.

3. ‘Legacy’ technologies that were proven over time and familiar to organizational actors required relatively fewer interpretive process actions.

4. The theme of ‘technology development’ is characterized by performative interpretation and invention activities between organizational actors to coordinate changes involving technology. Performative interactivity associated with the theme of ‘technology development’ was characterized by a pattern of iterating that was described in reoccurring sequences of forming (cycle 3), disrupting (cycle 1), and re-orienting (cycle 2) followed by repetition of the cycle.

Experiment II: Results for CAQDAS Content Analysis of Structures and Outcomes

Findings and results in experiment II compare organizational context represented in 25 interview transcripts that were parsed into two groups of 25 files each for structures and outcomes. These files are constituted by two major sections of the interview protocol. The files establish a means to conduct an experiment that isolates and compares a priori structures (i.e.,

organizational elements, policy, formal processes, and standards) to outcomes (i.e., change mandates, goals and objectives) involving technology in the case study organization. Similar to experiment I, results and findings in experiment I discuss organizational context that provides evidence of linkages between organizational changes in a priori structure and outcomes to interpretive elements defined by performative and ostensive process actions. Experiment II posits an alternative set of results and findings to those discussed in experiment I. Table 3 shows the statistical results of CAQDAS processing. The results constitute account and pattern evidence of stability and validity of four prominent themes that resulted from eight tests of the associations of machine learned text. The four most frequently occurring and consistently recurring themes include ‘organization’, ‘training’, ‘technology’ and ‘use’.

Table 3

Experiment II Thematic Results from Analysis of 50 Interview Transcripts: 25 Structures and 25 Outcomes

Thematic Results / Tests	1	2	3	4	5	6	7	8
organization	2157	2391	2273	2391	2315	2356	2440	2356
training	1368	1455	1594	1455	1594	1438	1594	1438
technology	1337	1804	1804	1804	1753	1804	1569	1804
use	1228	1580	1580	1580	1580	1580	1580	1580
year	88		179		179	179	179	179
tech4 episode 1	5	5	5	5	5	5	5	5
disruption		47		47				
Total	6183	7282	7435	7282	7426	7362	7367	7362

Themes and concepts that emerged from the contexts for structures and outcomes provide a framework to discuss results and findings for the themes and concepts shown in Table 4.

Findings from the contexts of structures and outcomes focus on linkages between performative and ostensive process actions and empirical elements of a priori structures (e.g., formal procedures and governance) and a priori outcomes (e.g., organizational mandates for change involving technology). The theoretical framework identified performative (i.e., individual, informal) and ostensive (i.e., individual and group) patterns of organizational interactivity as occurrences of process actions. Process actions were defined in experiment I as work practices that depict unscripted ad hoc interactivity between organizational actors. The impacts of performative and ostensive process actions can be seen through inventions and reinventions of structures and outcomes by organizational actors. A concept map and complete list of associated concepts with word counts and relevance percentages are in Appendix D.

Table 4

Experiment II Results: Analysis of Perceptions about the Context of Organizational Change Involving Technology (Structures of Process and Outcomes)

Analytic Focus: Two Sections of the Interview Protocol	Results		Interpretive Elements: Process Actions	
	Themes	Key Concepts	Performative	Ostensive
Structures of Organizational Change Involving Technology	Organization	requirements, work, things, development, management, change, process, talk, group, different [new]	X	X
	Training [Primary Services]	trainees, stakeholders, collaborations, time [history], legacy technology	X	X
	Use	trying, level [hierarchy], system, organizational services, technology infrastructure	X	X
Outcomes	Technology	output, satisfaction, quality, need, people, users, doing, talk, question, design	X	X

The theme of ‘organization’ is characterized by the emergence of numerous structures that represent the formal process of organizational change involving technology. The following excerpt recounts multiple attempts by the case study organization to synchronize structural administrative processes for specifying changes involving ICT development.

There was a first stab at a review board. We call it [organization 47]. But why then, are we stopping at a [technology 11] [strategy] or what we call now the [technology 13 document]...capabilities exist for a process. It is all ad hoc and disjointed...People understand what requirements are, in their lane... people understand there is more than [the current primary mission services] associated with our relevance to the customer, whether that's a national security [organization 99] or an agency partner. But those pieces of the puzzle were not even attempted to be drawn together into a coherent picture. Under the previous leadership an initiative was put together to resurrect, again, another requirements working group (Interview 001, December 14, 2017).

Concepts that derive from the preceding interview excerpt relate the concepts of ‘requirements’, ‘work’, ‘technology’ (development), ‘management’, ‘change’, ‘process’, ‘talk’, and ‘groups’ to performative and ostensive elements of organizational interactivity. The performative is viewed in actions to invoke connections between organizational actors. Ostensive behaviors are reflected in repeated patterns of organizing groups to manage change in different ways. The realization of internal and external complexity is a recurring topic in the interview transcripts that describe organizational structure. The theme of ‘organization’ is invoked in the following excerpt to illustrate the complex nature of organizational structures in the federal government, viewed from organizational membership in the national security domain.

You take pronency for fill in the blank... in one enterprise organization there's 33 pages, I can show you this document - 33 pages of [requirements] pronency.

Proponency comes from - everything derives from the secretaries and congress. If you look at training and [ICT] requirements... in Defense, they have their own sub way of doing things. Cyber - that's a whole 'nother community - but none of these communities look the same. They're government structures. You look at our own community - that's different from these five other communities. It's bigger than what we're doing here, but it has an effect on us. Because it gets back to -- from a macro to micro (Interview 001, December 12, 2017).

Concepts that were characterized in the 'organization' theme such as 'change' management, 'requirements management' and 'administrative' make reference to past and present organizational structures. For example, differences in the characteristics of management structures were noted by references to time.

So we got about a year left to be able to achieve that goal. A couple things were very apparent. Users did not have a good understanding what was being built for them. Not only did they not understand what was being built for them, the developer side did not understand the user processes. You had one group that didn't know what was being built but they are forced to accept technology to help them change because of external events. The result of the meeting was that the users would be given a hands-on release of the current state of the tools so that they can determine what processes could possibly be adapted or changed based upon the direction that the tools were going (Interview004, December 5, 2017).

Next, the theme of 'training' represents the evolution of formal processes to deliver the organization's services. The 'training' theme is characterized by concepts that describe 'trainees', 'stakeholders', 'collaborations' (i.e., forms of coordinating with customer organizations) and 'time'. Concepts for 'trainees' and 'stakeholders' locate the organization's

work in the national security community where training takes the form of best practices that were developed over decades. Best practices for delivering training services are characterized by adaptations in training content that reflect changes in risk and threats to national security, for example due to exigencies attributed to political risk or natural disasters. Best practices are applied by organizational actors to adapt, create and deliver training scenarios.

Training was all in house. We brought 2400 people here twice a year. Once in the spring and once in the fall. And we did two live events, here in this building. That's why there used to be a dining hall in the back of the building. So when we brought that in here, they had no concept of deploying. And so of course, we had to - that was a disruption. The [ICT] was supposed to be operational in 1998, and by 2003 it was deemed, it couldn't handle it during the process of organizing the [training] sites, how many people, who was going to support it, what organizations were going to participate (Interview 002, November 29, 2017).

Training was referred to by organizational actors as the creation of art and stories. However, the art of training is exemplified by formal a priori processes that guide the art of training to cater to specific collaborations. The 'collaborations' concept refers to different arrangements of customer organizations that embody interactivity during training between diverse groups of defense and interagency trainees. The concepts of 'art' and 'story' represent the performative and ostensive nature of creativity and reinvention associated with providing training to diverse national security 'collaboration(s)'.

The [training] environment is created through the art of [training] design. They never touch [technology] until it gets close to [training delivery]. [Training design] lives in word documents and power point documents. It takes human beings to take the verbiage

of the story and create the picture in the [technology] that is supporting the story (Interview 002, December 6, 2017).

Artfulness is balanced in the theme of ‘training’ by the pragmatic realities of determining the organizational context for training. Specifically, collaborations define who gets trained, what organizations constitute collaborations.

And then there was this battle with respect to money. We used to meet at an interagency synchronization conference every 6 months. And that was a week-long conference. It culminated with the senior executive showing up in the last two days to be briefed out on where we were going. There was an argument because they were cutting our funding, and we saw over about 5 years that we were going to lose 50% of our [funding]. So at that point we took an action to stand up a working group whose responsibility was to [identify] the top 5 to 10 major hard to do issues (Interview 004, November 29, 2017).

Significantly, changes to training services (i.e., artfully creating new training scenarios) stemmed from changes in external environments such as risk that are contiguous to the case study organization. Best practices that are used in the art of training constitute evidence of an ostensive pattern of coordinating. Seen as art, the creation of training scenarios is characterized as performative and ostensive responses to external change. A pattern of stable best practices in the art of training provided evidence of organizational capacity to adapt and innovate. This capacity is needed to create meaningful training scenarios that respond to external exigencies in the broader environment. Interviewees stated that the capacity to adapt and create the art of training was evident in the earliest periods of organizational change involving technology.

In addition, organizational actors perform the art of training using ‘legacy technology’ that is proven, tested, and familiar. Performative interactivity to operate training technologies

parallels training as art. Operating procedures for training technology are imbued with unscripted process actions that are needed to support the achievement of training objectives. Scripted a priori best practices appear to guide unscripted interpretations in process actions that depend upon the experience of ICT operators.

Finally, the ‘use’ theme characterizes organizational structures that represent the delivery of primary mission services, i.e., national security training. The ‘use’ theme is defined by the concepts of ‘trying’, ‘level’ [hierarchy], ‘system’, ‘organizational services’ and the names of various legacy technologies (i.e., infrastructure).

The [technology] users...[are] a 360 degree set of users. You've got trainers that use the technology, you've got designers that use the technology to design what the trainers want to see, need to see, or should see, or have dictated to see, then you've got the controllers that manipulate and control the technology while the training is ongoing - to make sure the systems are working in order and doing functions (Interviews 002, December 6, 2017).

The ‘system’ concept has dual meanings. One connotation of ‘system’ describes processes that are associated with the best practices of operators who use legacy technologies to support the conduct of training. Another meaning of ‘system’ describes best practices used by trainers, for example collecting observations of trainees to document trainee performances associated with training objectives.

The ‘system’ concept co-locates the formal structure of systematized procedures with performative interactivity that requires interpretation of best practices. In the ‘use’ theme, the concept of ‘system’ is indicative of dependencies between a priori formal processes and interpretations required of operators and trainers in best practices. Ostensive patterns of best practices in the ‘use’ theme are linked to the results of training. Training results were found to

depend upon observations and documentation performed by trainers to verify completion of, or progress towards training objectives. Verification is part of the organization's process that invokes best practices. A priori systems and interpretive process actions coexist in interview transcripts that reference the art of training delivery.

In the 'use' theme, instability was evident in the ostensive pattern of process actions that are associated with the concept of 'services', seen as efforts to fulfill the organization's mission. Patterns of reinvention associated with mission and services were attributed to organizational change initiatives that sought efficiencies as outcomes.

So there was a less costly approach to some quality training in two senses. One, less costly in the sense that the [technology] was free to [the trainees]. We paid for it... but it was free [to the organizations being trained]. [But it was less costly than] the leases of the [old technology] that were very expensive, especially back then... so whenever they could get the live - those guys never left home station. They never started an engine. They're just flying their simulators (Interview 001, December 4, 2017).

The focus in the next section turns to evidence associated with analysis of 25 interview transcript files designated as outcomes. The single theme of 'technology' emerged from this analysis. The 'technology' theme in the outcomes focus of experiment II differentiates between perspectives about legacy technology that are proven and in-use in the organization, and new technologies still in development and awaiting full implementation. 'Technology' in this section also refers to interviewee perceptions of satisfaction with ICT developed in the organization. Machine learning of the (outcomes) files describe the concept of user 'satisfaction' with ICT, technology development processes and other administrative processes. The meaning of satisfaction takes on meaning that is linked to the organizational context of national security.

Most of the technology in the organization is 10 to 20 years old, 30 years old in some cases. And a lot of that is driven by who we are and what we do. We can't afford to fail. So, we're going to be very reticent to leave our little safe, little box, and move to something new. And that is also true of the culture. It makes it very difficult to move to something new and better - when you have a very risk averse environment such as we live in. And so, it really doesn't matter what it is that somebody comes to the table with. **Somebody** in the room is going to go, nope, we don't need any of that. Because it's either too hard and we've got to be really careful because we don't want to do that or it's going to change the way I do things...and that's a risk as well. So, you're gonna fight an uphill battle to get to something new (Interview 001, November 30, 2017).

In the 'technology' theme, the concept of 'quality' of organizational ICT and the processes that are used to produce relevant 'information' refer to improvements in the concept of 'better'.

The [technological] tool[s] are a suite of services. [Technology 13] is going to change processes. It is going to change how design occurs. It may simplify things. I liken it to a file structure where every single individual had their own files and folders on their personal computer [vs] sharing [data] within a common set of files and structure. [Today] everybody has their own personal way of doing business. One person's folder structure is different from the next person's folder structure. But when you share it for efficiencies, for effectiveness - a collective builds the work. That was a significant mind shift (Interview 002, December 6, 2017).

The concept of 'better' suggests that improvements are intended to respond to customer and stakeholder 'need(s)' and 'question(s)'. This assumption illustrates the potential for subjectiveness when describing improvements to ICT. Subjectiveness is represented in the

divergence of perspectives between developers and users about what constitutes improvements to organizational technology. Referring to ICT development, the concept of ‘better’ is illustrative of complexity in technology and the challenge to specify the features and operations of ICT during organizational change involving technology.

So that drove this idea - that simulations could be used to improve training. So where did it wind up first? It wound up first in the agencies. Then, the aerospace industry grabbed onto it as a way to train pilots. Because it was expensive to put a pilot in a plane and fly 5 to 600 hours with him. [Alternatively,] I could put him in a pretend cockpit and he can fly 5 or 600 hours in his pretend cockpit for almost nothing... and then I could put him in a real airplane. Right? I've reduced the risk of crashes and all the other things that come with trying to get a novice to learn how to fly an airplane. (Interview 001, December 6, 2017)

The ‘technology’ theme characterizes interviewee perceptions about the outcomes of technology development in the case study organization in the concept of ‘needs’ to refer to user expectations of prior and ongoing technology development in the case study organization.

The users rejected the current tool suite because of a lack of understanding of it. They said that they weren't involved in the actual development activities. They did not want to proceed further until they had a clear understanding of what was being built for them... they realize that if they just blanketly accepted whatever was given to them, it would not guarantee they would be more efficient or effective at they're craft. The need for increased efficiencies is going to cause the users to figure out new ways to do stuff. Right now there isn't a good link between what processes need to be extended and what the tools capabilities are (Interview 002, December 6, 2017).

Results and findings discussed in experiment II present two additional views of the interview transcripts. Experiment II focused on themes and concepts that describe elements of structures and outcomes of organizational change involving technology. Themes and concepts represented in the context of organizational outcomes point to a pattern of reinvention that links changes in mission services to changes in technology development. Acts of reinventing organizational structures were apparent for example in new administrative forums that were invented to help determine the features of future ICT. However, evidence in the interview transcripts demonstrates that not all of these performative structures and processes evolved into formal structures to govern decision making. Further, the organization's history represented in the results and findings, shows that reinventions attributed to performative process actions did not consistently lead to stable patterns of coordinating organizational change involving technology.

In contrast to changes in structures associated with the themes of 'organization', 'training services' and 'use', changes in the 'technology' theme were driven by developers and users engaged in improvements characterized in concepts for 'quality' and 'satisfaction'. A pattern of reinventing process actions associated with ICT development was accompanied by patterns of creating new governance structures. However, the interviews demonstrated that many of the newly invented governance structures were not sustained by the case study organization. Some of the governance structures were simply abandoned to focus on the next set of change mandates. Others did not prove themselves due to issues of power and disagreements between developers and technology users. Disagreements about decision making authority between developers and technology users were found to be a frequently occurring feature of technology development in the case study organization.

Interviewee perceptions in experiment II link the organizational context of themes for ‘training’, ‘organization’ and ‘use’ to outcomes represented in the theme of ‘technology’. Linkages between structures and outcomes were found to apply to both legacy technologies and new ‘technology’ development. Further, organizational structures were associated with unique periods of time in the organization’s history by interview participants. The effect of organizational change involving technology over three periods of time known as episodes is explored in the results and findings of experiment III, content analysis of episodes of organizational change involving technology.

Experiment III: Results and Findings for Manual Coding of Episodes of Organizational Change Involving Technology

In experiment III, manual coding and analysis of 25 interview transcripts resulted in the identification 170 elements of organizational structure and outcomes. These were categorized into one of three episodes of organizational history, or episodes. The organizational elements consisted of 146 structural forms comprised of 43 technologies, 42 collaborations with external stakeholder organizations, 28 formal administrative program support processes, 18 formal procedures for delivery of organizational services, ten policies for the delivery of services, and five ICT development standards adopted by the case study organization. Manual coding also resulted in identifying 24 outcomes. Last, each organizational element was further associated with a performative or ostensive process action in one of five process cycles in coordinating theory. Findings and the results of coding are summarized in Table 7. Details of coded account and pattern evidence are provided in Appendix E. The episodes of organizational change involving technology are characterized by unique patterns of actor interactivity. Three episodes of organizational change involving technology are compared and contrasted in cycles of

coordinating theory in table 7. Performative and ostensive interactivity occurs in all three episodes. The historic context for each episode and results and findings are discussed next.

Organizational change involving technology in episode one was cancelled at least ten years prior to the case study research. In episode one, the first ICT training system was developed in the case study organization. That first training system was developed to integrate unsynchronized systems. The ICT systems were adapted to demonstrate interoperability between organizational collaborations involving humans and various ICT. Organizational interactivity associated with episode one was referenced the least number of times by interviewees (total 23 performative and ostensive process actions). The cancelled program in episode one shows the least amount of process action interactivity in the coordinating theory process cycles in table 7.

Organizational change involving technology in episode two is ongoing. In episode two, a major ICT was developed to make further improvements to interoperability between humans, ICT, and between humans and ICT. In episode two the case study organization conceived the integration, production and maintenance of ICT that improved upon the ICT developed in episode one. Organizational change involving technology in episode two is linked to existing delivery of organizational services (total 98 performative and ostensive process actions). In episode two, ICT and work processes register the highest level of process actions in each of the five cycles in table 7.

In episode three, change and technology development was ongoing at the start of this case study research. In episode three, organizational change involving ICT development aimed to innovate existing technologies and the ways that organizational services are delivered. Organizational mandates in episode three would innovate the delivery of organizational training services making them available on-demand over the internet. Therefore, organizational change involving technology in episode three seeks to implement significant innovations to ICT in

episode two. At the start of this research, organizational change involving technology envisioned in episode three was not implemented in the structures, outcomes and process actions associated with delivery of the organization's primary training services. The third episode of change involving technology was ascendant in the organization at the time of this research (total 49 performative and ostensive process actions). Emerging yet unproven technology in episode three registers the second highest level of interactivity in each of the five cycles shown in table 7.

Results and findings of manual coding and content analysis in experiment III, the episodes of organizational change, demonstrate linkages between a priori structures and outcomes, and interpretative process actions performed by actors during organizational change involving technology. In particular, results and findings in experiment III provide cues about types of process actions that explain iterations to organizational structure and outcomes. In response to the research question, the cycles in coordinating theory categorize five types of process actions into cycles of performative and ostensive interactivity between organizational actors. Evidence and findings in experiment III are supported by pattern and account evidence in experiments I and II. In table 7, statistical patterns in each of the five cycles of coordinating theory are consistent with the longevity of the episode in the organization's history. Therefore, the frequency of process actions shown in the cycles of coordinating theory in table 7 are relatively proportional to the current use of ICT in the case study organization.

The number of cycle 1 disruptions in episodes two and three suggest that the impacts of organizational change mandates are experienced by actors in similar ways despite differences in time (between episodes two and three). In fact, interviewee accounts of episode two and three cycle 1 (disruptions) and cycle two (re-orienting) were attributed to re-organizations. In an example of cycle 2 (re-orienting) in episodes one and two, management in the case study organization cancelled a formal structure in the form of an institutionalized organizational

change process that was used by actors. Management ‘...objected to some of the products of [process action 49, episode two] because the users voice had fallen to the wayside. That voice was not apparent in the products that were being presented” (Interview 001, December 19, 2017).

In Table 7, organizational adjustments due to cycle 2 (re-orienting) in episode three are explained by interviewee assertions that organizational change involving technology development in episode 2 cascaded into episode three as specifications for new ICT. Findings about re-orienting in cycle 2 in episode two and three suggest the potential for change involving technology to impact the organization in unexpected ways. Tracing this assertion to the interview transcripts in experiment II, the excerpt below demonstrates a policy gap between the goals in episodes two and three.

Another cyber security [policy] requirement we're having to wrestle with is knowing who is on the keyboard at any given time. And they want to make all the [ICT] token enabled. Where you gotta' have a token to go on there. Well, some of the [ICT], when the person pulls their token out, the [training] processes stop. So we run twelve hour shifts. We can't bring the federation down every twelve hours when we're ready to bring the new crew on and the old crew goes off, they can't pull out a token and allow time for the other person to log in with their token and get the [training] process to start back up. (Interview 001, November 29, 2017)

The low number of episode three, cycle 2 (i.e., re-orienting) process actions suggests the limitations of decision making by technology developers to drive changes that affected status quo service delivery. In episode three, interviewees discussed the ways innovative ICT would affect existing work practices and interface with collaborations and stakeholders. In episodes two and three, cycle 2 indicates power conflicts that were documented in experiment I.

Conflicts arose when interpretive process actions were required to prioritize opposing organizational change initiatives involving technology. In episode two, the interview transcripts verify the organization continues to modernize ICT. Simultaneously, in episode three, the case study organization pursued innovations in ICT that affected the structure of current work practices. The two efforts conflicted and appeared to disassociate the developer group in episode three from the their primary ICT user group in episode two.

Well, all the requirements were being written after the fact. We already had a whole slew of tools being designed, so we were going and writing what the requirements would look like for those tools. To describe what they do versus describe the requirement and then fit (develop) a tool. So, we're really taking the requirement and fitting it to the tool, instead of the tool fitting to a requirement. We were backwards (Interview 004, November 27, 2017).

Table 5

Summary of Interpretive Process Actions in Episodes and Cycles of Organizational Change

Cycles / Episodes	1 Disruptions	2 Re-orienting	3 Creating	4 Establishing	5 Stabilizing	Total
1	2 / 9%	1 / 4%	12 / 52%	5 / 22%	3 / 13%	23 / 14%
2	7 / 7%	8 / 8%	65 / 66%	8 / 8%	10 / 10%	98 / 58%
3	6 / 12%	2 / 4%	27 / 55%	6 / 12%	8 / 16%	49 / 29%
Total	14 / 9%	11 / 6%	105 / 61%	19 / 11%	21 / 12%	170 / 100%

Cycle 3, creating new elements of coordinating stands out as the most active cycle in all three episodes, accounting for 61% of all activity in the cycles of coordinating theory. This

finding points to patterns of repeated effort to synchronize the structures of organizational change involving ICT development. An example of this type of activity demonstrates organizational efforts to synchronize change involving technology.

They established a side working group, to define [technology 84] in more detail. It went from providing a capability to our stakeholders, to deciding it was really about [technology 84] and we weren't ready to bite the whole elephant off. The developers analyzed it to see what they might have in their current work and what shifts they could do in order to meet this new requirement. [Answering the big [questions] was very structured...in the beginning. It had to go through [process action 47] to get looked at. Maybe it's not new, it's an enhancement to the current system? It could be sent back to the originator for more information - or sent to a stakeholder (Interview, November 27, 2017).

A summary analysis of the findings and results in all three experiments is discussed next.

Summary View of Results and Findings in Experiments I, II and III

Results and findings of three experiments using automated and manual content analysis were formulated to present the context of organizational change involving technology in the case study. A priori organizational structures and outcomes were compared to informal interpretive process actions defined as performative and ostensive interactivity that ultimately took place over three episodes of time in the case study organization. Themes and concepts that resulted from content analysis constitute evidence of linkages between empirical elements of organizational structure and outcomes and interpretive elements consisting of process actions. Organizational change involving technology in the case study organization was not implemented using only documented processes. Outcomes resulted from unanticipated interactivity that was

not reflected in mandates for organizational change involving technology. The case study results and findings of organizational change involving technology characterize tensions between technology developers and technology users. Differences between technology users included disparities in expectations for design and end-use of ICT well after the start of periods of organizational change.

The remaining sections of this chapter synthesize these and other results and findings from experiments I, II and III. This case study set out to identify processes that iterate structures and outcomes as participants respond to changes involving technology in an organization in the national security domain of the public sector. The analysis in this section synthesizes the findings and results of experiments I, II and III into a taxonomy containing four classifications of processes that impact structures and outcomes during organizational change involving technology.

The results and findings in this case study research were reviewed by two SMEs from the case study organization. Specifically, the SMEs validated the timing of key events in the organization's history and provided clarification about the details of historical events recounted by interviewees. Also, the SMEs verified the list of elements of structure and outcomes in episode three. During verification of the list of structures and outcomes, the SMEs properly associated these with the episodes. In addition, the SMEs reviewed the CAQDAS generated thesaurus outputs from experiments I and II to assist the researcher with determination of where concepts in experiments I and II could be combined to reflect synonyms.

Key findings are listed next. These are not inclusive of all the results and findings in the case study but are representations of important results and findings from the case study research. The lists are believed to be sufficiently representative of results and findings in each experiment such that they substantiate the development of a taxonomy in figure 3. The taxonomy is a

summary analysis of the results and findings in all three experiments and is presented in the next section.

Summary Findings for Experiment I

1. The ‘organizational services’ theme described the management of services that embodied the characteristics of well documented programs, goals, and objectives that were understood by organizational actors and stakeholders.

2. In the ‘processes’ theme, the history of the organization shows that over time some processes became well documented and understood by organizational actors and stakeholders. Others did not. Implementation of organizational changes involving technology that were based on outdated or undocumented procedures for work practices contributed to the need for interpretation and invention of a priori structures and outcomes and can be seen in performative and ostensive process actions.

3. ‘Legacy’ technologies that were proven over time and familiar to organizational actors required relatively fewer interpretive process actions.

4. The theme of ‘technology development’ is characterized by performative interpretation and invention activities between organizational actors to coordinate changes involving technology. Performative interactivity associated with the theme of ‘technology development’ was characterized by a pattern of iterating that was described in reoccurring sequences of forming (cycle 3), disrupting (cycle 1), and re-orienting (cycle 2) followed by repetition of the cycle.

Summary Findings for Experiment II

5. In the ‘organization’ theme, new work practices that were formed (in cycle 3 activity) were not consistently followed by formalizing structures (cycle 4) or institutionalizing new structures in governance and management decision making (cycle 5).

6. In the ‘use’ theme, a pattern of stable best practices and performative artfulness combined to provide organizational capacity to adapt and innovate organizational services that responded to external changes in the broader environment.

7. In the ‘use’ theme, the ‘system’ concept co-locates apriori structures seen in systematized procedures with performative interactivity that requires interpretation of best practices. The concept of ‘system’ indicates dependencies between formal processes and best practices that require interpretive performative interactivities.

8. Change in the ‘technology’ theme is characterized by developers and users engaged in improvements and innovations seen as outcomes in the concepts of ‘quality’ and ‘satisfaction’.

9. Disagreements about decision making authority between developers and technology users were found as a frequently occurring feature in the ‘technology’ theme.

10. Linkages between structures and outcomes and process actions were found to apply to both ‘legacy technologies’ and new ‘technology’ development.

Summary Findings for Experiment III

11. Cycle 3, creating/forming new elements of coordinating, stands out as the most active cycle in all three episodes. Patterns of repeated cycle 3 efforts forefront the need for organizational actors to create or re-create processes for authoritative decision making.

12. The number of disruptions (cycle 1) in episodes one and three suggests that the impacts of change mandates constitute an ostensive pattern of frequent change.

13. The low number of re-orienting process actions in episode three, cycle 2, suggests stasis and lack of power by technology developers to drive changes involving new technology still in development. Evidence of a higher level of disruptions (cycle 1) was followed by almost non-existent re-orienting activities (cycle 2), and then followed by more creating (cycle 3).

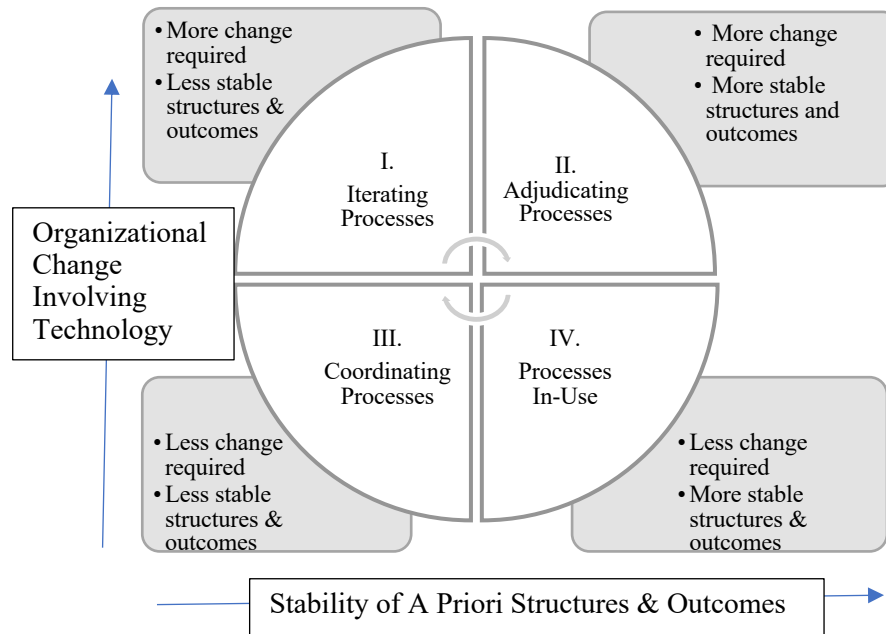
14. In the theme of ‘episodes’, conflicts between organizational actors were evident in interpretive process actions that were invented to prioritize and make decisions about changes to structure and outcomes in order to adjudicate alternatives. In episode two, the organization continued to change processes and modernize technology. At the same time, in episode three, other organizational entities paved a parallel path to innovate technology and work practices related to the delivery of ongoing organizational services characterized in episode two.

Summary Analysis and Synthesis of Experiments I, II and III

The taxonomy in figure 3 posits that results can be portrayed in elements of stability and change. Stability and change were defined in coordinating theory and concepts from sociomateriality as process cycles of change that consist of structures, outcomes and interpretive process actions comprised of performative and ostensive patterns of organizational interactivity. These conceptual elements were operationalized in the analytical framework. Textual data from interview transcripts characterized perspectives of change found in three periods of change known as episodes in the case study. The results and findings identify organizational changes involving technology and define how informal processes iterate formal structures comprised of processes and outcomes in the case study organization. Results and findings are synthesized and appear in figure 1 in four quadrants that conceive types of process actions that were found to

have various impacts on a priori structures and outcomes in the case study organization.

Figure 3. *Taxonomy of Stability and Change Processes that Iterate A Priori Organizational Structures and Outcomes*



First, iterating processes in quadrant I synthesize findings 4, 11, 12, and 13 from content found in individual perspectives and episodes. Iterating processes posit that certain cycles of organizational change will be repeated and are not likely to lead to outcomes. Iterating processes conceive that when more expansive organizational change efforts are combined with significant instability in a priori structures and outcomes, conditions in the organization create stasis that leaves the organization stuck in change. Iterating process actions are characterized by patterns of interactivity between organizational actors where ideas prevail over outcomes in repeated cycles of creating, disrupting, and re-orienting.

Findings from the case study are supported by prior scholarship. Complexity that characterizes the iterating processes quadrant is attributed to a hierarchy of roles performed by organizational actors within complex public and private networks (Busch & Henrikson, 2018).

Researchers found that organization change requires deeper understanding of both external complexity and internal organizational dynamics to determine what managerial practices are needed to administer change (Jacobs et al., 2013). The type of organizational change represented by the iterating processes category is underscored by findings about perceptions of negative effects on internal processes and routines due to innovative technology (Mergel, 2013a, 2013b).

Internal conflict is characteristic of the iterating processes category and the adjudicating processes category posited in the analysis (figure 1). These types of organizational change are conceived as different by degree. Iterating and adjudicating processes share dysfunctions that are embedded in organizations and assert factors that contribute to failed initiatives involving technology. An example from the case study shows that organizational change involving technology requires innovative structures in a priori process as well as innovative technology.

We're not behind in the software tools and software, no I think we're - if not cutting edge, we're using the people developing the cutting edge... we're a big buyer of it. Software tools, I don't think we're behind. I think people wise, management techniques, contracting, there may be a whole bunch of other things that we have a very standard, very conservative process that kind of steps on innovation (Interview 002, November 30, 2017).

Next, adjudicating processes in quadrant II derive from findings 5, 7, 9, and 14 and outcomes and episodes content. These findings posit a category of process actions where tensions between organizational actors, manifest in disagreements about who controls authoritative decision making involving development of ICT linked to organizational change. Decisions manifest as choices between prior, stable, deeply rooted organizational practices, and alternatives that require significant effort to effect organizational change. The themes of organization, use, technology and episodes characterize complex decisions that are made more

problematic by disagreements about structures, outcomes, standards, and procedures that are not accepted by all the actors involved in organizational change. Hence, different conceptions of what needs to change become platforms of contention that require adjudicating. The contentious nature of innovation involving technology is the main theme in bureaucratic decision making.

The concept of digital discretion (Bovens & Zouridis, 2002) provided early foundations to understand change involving technology in public organizations. Bovens and Zouridis (2002) theorize that the boundaries of digital discretion by the street level bureaucrat are defined by strict intra-organizational structures that preclude participative decision making by all stakeholders of technology resources. It is unfortunate that Bovens' and Zouridis' voices remain a piquant source for theorizing the environment of technology development in public organizations. Their message remains a particularly salient point in the literature that informs street level themes captured in more recent experiences in public organizations. Busch and Henriksen (2018) re-confirmed and expanded Bovens and Zouridis (2002) assertion that the structures of public organizations are changing due to ICT. Busch and Henriksen (2018) find that managers may be ill-equipped to understand when discretion is disguised due to the technical nature of decision-making about innovative organizational technology. Technology users may not understand technical language.

Innovation scholars posit that organizational change is rooted in powerful designs that are needed to overturn existing structures (Hughes, 2011a). Overturning dominant organizational designs requires radical rather than incremental innovation (Hughes, 2011a). Findings from the literature support the notion that iterating and adjudicating processes are defined by organizational context. The case study findings suggest that when radical organizational change is accompanied by less stable a priori organizational processes (structures and outcomes), stasis characterizes change in iterating processes such as those seen in the case study evidence for

episode 3. Alternatively, adjudicating processes suggest that progress in change involving innovative technology is possible given the presence of more stable structures and partial or limited agreements about outcomes, despite the presence of contentious issues. Foremost in adjudicating is the organizational capacity to make decisions that are recognized as authoritative.

In quadrant III, coordinating processes are derived from findings 6, 8, 10 and outcomes content. Coordinating processes are characterized by structures and outcomes that provide organizational actors somewhat stable points of departure for organizational change efforts. Somewhat stable coordinating processes are joined by interactivity that requires some re-invention, adaptation, and creativity to effect changes. Coordinating processes are characterized by themes of change that link artfulness, technology quality and satisfaction, mutual understanding of legacy and innovative technologies, and cycles of change that support creation/re-creation of organizational processes and services that are currently being used in the organization. In the coordinating processes category, change is imminent but eminently doable.

Findings in the literature promise the potential for coordinated interactivity. Despite the presence of uncertainty linked to unanticipated aspects of change, dynamic individual and group activities can overcome the complex nature of innovation by linking initiatives, information systems, processes, practices and other aspects of organizational life (Getha-Taylor et al., 2011; Getha-Taylor & Morse, 2012). Coordinating then, is the application of practical knowledge to bureaucratic rules by organizational actors that can result in organizational adjustments, creations and interpretations (Ives & Olson, 1984; Jarzabkowski et al., 2012; Pentland & Haerem, 2011).

Last, processes in-use in quadrant IV integrates findings 1, 2, and 3 from content on individual perspectives to conceive a process type that is characterized by proven structures, outcomes, and processes. The themes of technology, processes, and services posit that the processes in-use type refers to familiar and accepted a priori structures, outcomes and processes.

In addition, the performance of organizational technology has been proven. Processes in-use refer to change efforts that can be achieved using existing organizational processes that are stable; that is, recognized and accepted by organizational actors as the way things get done in the organization. In the processes in-use category, organizational changes involving technology are perceived to be reasonable and achievable. Agreements about overarching change efforts constitute evidence of mutuality and expanded potential for change agents and organizational actors to achieve outcomes through interactivity.

Research results and findings trace to lived-experiences that can be generalized to public administration in the national security domain where enactment of organizational change involves technology as defined in the case study. The case study findings posit the need to understand differences between ICT users and between ICT users and developers early in efforts to enact organizational change involving technology. When viewed through the lens of coordinating theory, findings about the impacts of interpretive performative and ostensive process actions on a priori structure and outcomes point to the need for public administrators to identify and define the ways that technology development and implementation can impact current work practices. The taxonomy of stability and change processes that iterate structure and outcomes posit a way for students and managers of organizational change involving technology in public administration to make sense of organizational context. The taxonomy responds to the need for recognition of the complex features that differentiate public organizations.

CHAPTER SIX

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

In the preceding chapters, the presentation and analysis of data have been reported. Chapter Six summarizes the case study and presents an analysis of the contribution to the state of the art, unexpected results and recommendations for future research, implications for practice, and recommendations for a research agenda. Finally, concluding remarks provide a synthesizing view of the research.

This case study examined an organizational change problem within the national security domain of the public sector involving information and communication technology (ICT) development. Organizational change involving technology is characterized by unpredictable costs, unrealistic delivery schedules, and dubious performance of innovated or enhanced ICT during actual use. Conceptual remedies are needed to decompose the complexity of organizational change involving technology. As shown in prior research and this case study, organizational change involving technology is made more complex by nuanced differences between organizations and the pace of mandated change.

Problematically, analysis of the linkages between organizational actors, a priori structures, processes, and outcomes that contribute to organizational change involving technology is an under-explored area of public administration and organizational science. Organizational change involving technology in the public sector is further characterized by confused practices and ambiguous results that are well documented by scholars who lament the state of knowledge. This case study does not endeavor to present a single unifying view of all the results and findings. Rather, organizational change involving technology is shown to be multi-faceted.

What you have here - the technology that's being provided here is like the light in your car... when you turn it on it comes on, but the problem is you, only when it's not

there is it a problem. So to me, the [organizational] technology is always on. And they don't see it until it's not there (Interview 003, December 4, 2017).

The purpose of this case study is to better understand the impacts of participant responses known as process actions, to the structures of organizational change and outcomes involving technology in the national security domain. This research formulated explanations for interactivity between organizational agents, a priori structures, processes and outcomes in the case study organization. This case study investigated the roles of organizational actors involved in processes to coordinate software, hardware and administrative changes that support management and stakeholder administrative and technological requirements. In this way, this case study defined linkages found in descriptions of interactivity that impacts organizational mandates, formal processes, and outcomes in the case study organization. Improved understanding of complex and embedded contextualized linkages represents opportunities to improve upon explanations for the success and failure of organizational changes involving technology (Jarzabkowski et al., 2012).

This case study investigated the question: How do informal process actions iterate a priori structures and outcomes as participants respond to changes involving technology in an organization within the national security domain? The case study used practice theory and sociomaterial theory to formulate a practice-based theoretical model of coordinating change. Coordinating theory (Jarzabkowski et al., 2012) was used to investigate and analyze linkages between change processes, a priori structures, process actions and outcomes involving technology in the case study organization.

Theory of coordinating conceptualizes five cycles of interconnected processes that contain performative and ostensive elements. Coordinating theory posits change as cycles of disruptions, re-orienting that takes place due to absences created by mandates, creating new

elements of work practice, forming new work practices, and actions to institutionalize new practices (Jarzabkowski et al., 2012). Each cycle is further characterized by performative and ostensive elements that characterize activities that require interpretations and inventions of process. Performative elements constitute actions to interpret organizational process by individuals. Ostensive elements were defined as patterns of group activity. Performative and ostensive elements were drawn from analysis of organizational work practices known as process actions in the case study.

Textual data from interview transcripts was coded to analyze empirical and interpretive content that described change involving technology in the case study. Case study data consisting of twenty-five interview transcripts was used in three experiments of content analysis to substantiate themes and concepts that informed the development of research results and findings. Different views of the textual data represented in the experiments produced results that focused the content analysis on organizational contexts of change involving technology. Experiment I focused on analyzing individual perspectives. Experiment II focused the analysis on the context of structure and outcomes in the case study organization. In experiment III, the context of organizational change involving technology over time was analyzed in three episodes. In all three experiments, empirical codes were used to identify various technologies, and a priori structures and outcomes. Similarly, interpretive codes were used to identify performative and ostensive activities of organizational actors engaged in changes involving technology.

Contribution to the State of the Art

The contribution of this study to extend the knowledge base in public administration and organizational change is discussed next. This study adds understanding to the state of the art in organizational theory within the discipline of public administration in findings and analysis about

under-explored aspects of organizational change. Interactivity and work practices termed process actions was investigated in the case study to determine their linkages to structures and outcomes during organizational change involving technology. This case study contributes research that posits the importance of understanding how public administrators will innovate public practices to evolve organizational ICT as tools of governance. Robust tools of governance have been shown to produce useful information that can be used for analysis and decision support. As discussed in the literature review, Bovins and Zouridis (2002) seminal article conceived the concept of digital discretion. Digital discretion proposes that systems-level bureaucrats determine performance aspects of innovative technologies and hence, service delivery in public organizations.

In subsequent developments in the literature, scholars submit that the trajectory of change in public organizations points to the use of ICTs for decision making, if not decision support (Busch, 2017; Busch & Henrikson, 2018; Mergel & Bretschneider, 2013; Tunçalp, 2016). The evidence in the literature indicates that street-level bureaucrats are being replaced by systems-level bureaucrats who rely upon smart technology to deliver the services of public organizations. In effect, automation due to ICTs changed, and will continue to change service delivery and associated work practices in public organizations. This background suggests issues regarding organizational change involving technology that are critical to developments in public administration research and practice.

This case study research used a novel approach to answer questions about what processes impact the structures and outcomes of organizational change involving technology? The approach to the research informed findings and analysis that identified and defined types of organizational change involving technology that occurred in the case study organization. The research findings and analysis proposed a typology of organizational change processes that

contribute explanations about the impacts of informal processes on a priori structures and outcomes, conceiving iterating, adjudicating, coordinating, and processes in-use. The typology resulting from this research departs from traditional views of organizational change.

Phases and stages views of organizational change were discussed in the literature review as a sequence of points of departure where organizations arrive at objective end points on a journey of organizational change. The phases and stages views frame dominant approaches to research in organizational change in the public administration literature (Fernandez & Rainey, 2006). In contrast, the typology suggested by the findings and analysis of this case study characterize organizational change as more dynamic but bound in time, perhaps in moments. Change is dynamic. In this view, it is not surprising that multiple types of change were shown to occur serially and simultaneously through interpretive process actions and interpretations of work practices by organizational actors. This view of organizational change is consistent with a practice-based approach that is emerging but not yet prominent in the public administration literature (Busch & Henrikson, 2018; Feldman et al., 2016; Pouliot, 2015). In this vein, social and material aspects of change involving technology were explored in the case study organization.

Specifically, social elements were explored in performative elements of interactivity that were shown to impact a priori structures and outcomes. Also, the impacts of technology implementation on work practices explored material aspects of organizational change. The exploration of social and material elements produced an original view of change as episodes in the organization. Three episodes of change in the case study organization were viewed through the perspectives of organizational actors in three experiments of content analysis. The perspectives of organizational actors presented diverse views of current events and a retrospective of earlier organizational change events involving technology. Prior studies suggest

that retrospective approaches are useful to probe understanding that compares contexts of organizational change.

Retrospective approaches to study organizational change are believed to engender deep insights from the actual experiences and observations of organizational actors. “Empirical studies contain cues about how change is perceived but mostly fail to address the sensemaking effort...A deep insight into the ongoing ‘reproduction’ of experiences during and after the change process as such is not being delivered” (Wetzel & Dievernich, 2014, p. 282). In contrast to other qualitative approaches, this study embraced empiricism by gathering evidence of the occurrence of frequencies of structures, outcomes, and performative activities, and the number of named organizational ICT. Quantitative findings were compared to qualitative evidence in the accounts and patterns characterized by interviewees.

A dynamic view of organizational change was presented in the results of the case study research in a framework that explores change as episodes that contain process cycles. The analysis of episodes and cycles infused rigor into temporal aspects of recollections and perspectives provided by organizational actors in interviews. In this study, three episodes were identified to force the identification of backward looking, forward looking, and current perspectives. This dynamic conception of organizational change involving technology is believed to produce insights into performative and ostensive interactivity that impacted organizational changes involving technology. Further, changes were characterized by contiguous and overlapping moments within episodes of organizational history. Moments of change were shown to occur serially and simultaneously in a framework of process cycles that was proposed by Jarzabowski et al. (2012) in coordinating theory. The multi-dimensional perspective produced by the methods in the case study research constitute novel applications of practice theory and sociomaterial systems theory. Research into organizational change involving technology in the

national security domain using practice theory methods represents an unexplored area within the public administration discipline.

The last part of this discussion turns to less prominent contributions to extant research that are noted by the researcher. First, similar to Busch and Henriksen's (2018) findings about ICT policy in public organizations, this study found that structures such as policy directives need interpretation, especially where policy implementation required organization level decisions about the impacts of ICT. This study also adds to research findings on organizational routines, for example Feldman et al. (2016). Each of three episodes of organizational change were characterized by a combination of unique and shared complexities. In each of the episodes the organization benefitted from capacities for interpretation and reinvention of a priori processes. The case study content demonstrated that at times, the organization had limited capacity to adapt routine processes to changing conditions, and contributed to contention between organizational actors. Contention was at times followed by stasis in the change environment. This study finds that organizational capacities for interpretation and creativity should be fostered in adaptive routines to support organizational changes to a priori processes, services, and technologies.

Last, this study adds to findings about definitions for inter-agency dependency that continue to evolve amidst the rapid pace of change that characterizes the public environment (Bonner, 2013; Mihm, 2014; Pendleton, 2010). This study presented a unique example of inter-agency dependency. The study identified organizational outcomes as a potential source of conflict. In the case study organization, conflict surrounding the use of shared technology resources made the acceptance of standards for change involving technology difficult, adding to an already contentious internal environment. In the next section, unexpected results and recommendations are discussed.

Unexpected Results and Recommendations for Future Research

In as much as the findings indicate areas of agreement and disagreement with extant literature and studies, the next sections discuss unexpected results and uses these to make recommendations for more research that responds to alternative questions. The discussion is framed by examples of surprise in sampling, instrumentation and research design. These surprises provide an account and analysis of unanticipated outcomes and results of the case study.

The preponderance of interviewees were experienced users of organizational technology. Perspectives from technology developers were under represented because of differences in the professional experience offered by the interviewees. This was beyond the control of the researcher. While all interviewees presented descriptions of organizational interactivity based upon personal perspectives, upon review of the interview transcripts it became clear that technology developers were underrepresented. Future research should consider a greater focus on the perspectives of technology developers.

This gap in the current case study represents a likelihood that the empirical and interpretive data is skewed toward the technology user perspective. While all interviewees presented descriptions of organizational interactivity that spanned user-developer experiences, upon closer review of the interview transcripts it became clear that interviewees responsible for future technology development were underrepresented. While this study of organizational change is beneficial to understand the technology user perspective, future studies could make direct comparisons of user and developer perspectives on organizational change involving technology.

Design of an interview protocol that more directly tests the process cycles in coordinating theory could produce valuable data and meaningful insights to unique organizational phenomenon. A

more robust interview protocol consisting of primary research data could help generalize case contexts and improve upon theories of practice that explain organizational change involving technology. A revised interview protocol may better operationalize certain variables that were investigated in the analytical framework. The interview transcripts proved to be an adequate source of secondary data to explore the question of organizational change involving technology. The protocol produced nuanced and insightful data even though it was not solely intended for case study research. Future research could employ a dedicated interview protocol to focus on elements of organizational change such as those proposed in the taxonomy in figure 3.

Miles, Huberman and Saldana (2014) cite Maxwell's (1992) classifications of internal validity as key areas of understanding that emerge in qualitative studies. Specifically, descriptive (what happened in specific situations), interpretive (what it means to the people involved), theoretical (the concepts and their relationships that explain actions and meanings), and evaluative (judgements of the worth of actions and meanings) categories provide conceptual guideposts to discuss surprises related to the research design.

First, the range and depth of descriptive detail that surfaced in the transcripts challenged the researcher to distill the textual data while retaining rich interpretive details and meaning intended by the interviewees. Next, interpretation of rich descriptions was more dependent upon the researcher's experience in the domain of national security than was anticipated at the start of the research. Without translation, interview data would be lost to research on organizational change in the domain of national security. This challenge was managed by discussions (member-checks) with experts from within the organization who provided clarifying information about certain work practices and technologies that were identified in the interview transcripts. For example, clarification was necessary to translate some acronyms that were unfamiliar to the researcher.

The theoretical framework was particularly useful to compare CAQDAS outputs from experiments I and II, for example thesaurus outputs. Quantifiable and visual CAQDAS outputs provided a sense of the impacts and prevalence of themes and concepts. Quantifiable and visual information that characterized the prevalence of themes and concepts was useful to analyze the context for organizational change involving technology. CAQDAS outputs produced useful quantitative data that compared findings of frequencies in experiments I and II.

Coordinating theory provided a useful construct for meaning-making about the information that resulted from data collection and analysis of empirical and interpretive elements that emerged from all three experiments. For example, in experiment three, in episode two, themes for 'organization', 'use' and 'technology' aligned with frequencies found in process cycles 3 (creating), 4 (forming new), and 5 (stabilizing). Both experiments indicate strong ties to legacy technologies-in-use in episode 2. However, in experiment three, episode 2, strong ties to legacy technology provided a puzzling contrast to interviewee accounts of planned but untested changes in service in episode 3 using unproven new technology.

In addition, findings in experiment II linked ongoing cycle 3 activity (creating) and cycle 5 activity (stabilizing) to experiment III where a surprising number of cycle 1 activity (disruptions) was followed by a dearth of re-orienting activities in cycle 2. Evidence of linkages between episode 2 and 3 established the likelihood that changes involving new technology in episode 3 had not yet diffused or institutionalized in the organization.

Coordinating theory proved to be a useful tool to operationalize performative and ostensive process cycles. Operationalization of the theoretical elements of stability and change produced findings that led to analysis of organizational interactivity in three views of organizational context that referenced data about three episodes in the organization's history. The framework performed sufficiently as an evaluative tool for machine learned themes and

concepts, and for manual content analysis focused on frequencies of organizational phenomenon. The unanticipated suppleness of the framework provided the means to produce trustworthy and authentic naturalistic research. This research is the first known application of coordinating theory to the study of organizational change involving technology in the national security domain of public administration.

Future research should consider how to use the CAQDAS tool, Leximancer to greater effect. Mixed methods could be used in a multi-variate approach to develop statistical tests of the themes and concepts represented in CAQDAS experiments on textual data such as the interview transcripts. In effect, the outputs of each CAQDAS experiment represent a model of organizational change involving technology. Models could be compared to further explore quantitative differences between experiments.

Implications for Practice

Two highly practical and implementable recommendations for practitioners emerge from this study. First, public administrators should seek out opportunities to understand linkages between organizational ICT and work practices. Public administrators need to understand the features of organizational ICT to gain deep appreciation for the ease of use of proposed innovation. Public administrators should have an appreciation for how ICT look and feel and how they are applied in practice as part of a technology development life cycle. This research demonstrates that the impacts of organizational change involving technology on work practices and practitioners should be understood as potential for unintended re-interpretations of a priori structures and outcomes.

Development practices represent a practical avenue of inquiry for any manager of organizational change involving technology. Popular technology development practices emphasize agility and flexibility to make changes during ICT development. Agile practices are

characterized by scalability of technology initiatives to produce less expansive (and presumably less expensive) products that must first be proven as elements of organizational change before full implementation and investment.

Next, standards can set expectations for user involvement and developer responsiveness. Meaningful standards that define ICT development were discussed by interviewees in the case study. The recommendation to develop standards follows the literature, suggesting that administrators should evolve their relationships with stakeholders and third party developers to gain detailed appreciations of the ways that organizational changes involving technology implicate work practices and the delivery of public value (Bryson, Crosby, & Bloomberg, 2015). The development of standards can inform change efforts by organizational actors and offers an example of a considered but implementable approach. Standards may help organizations avoid stasis, a condition in the case study of being stuck in change.

The development of management capacity to steer change involving technology implies a commitment of organizational resources that could be in conflict with the rapid pace of external change and management demands for speedy internal changes. Organizational capacity to understand the implications of technology on governance and other aspects of service delivery are posited by this case study as pursuits worthy of steady investment of organizational resources. In contrast, the risk of abdicating responsibilities to understand the impacts of organizational change involving technology to third parties, beckons conflict and failed change at the close of contractual obligations. As shown in the findings of this case study, disagreements about the ways innovative organizational ICT will be used contribute to the dismal history of failed change in public organizations. This research recommends a measured approach to respond to the inevitable presence of organizational change involving technology.

Recommendations for a Research Agenda

Analysis of findings from this study and prior findings in the literature suggest a program of research that accounts for dynamic change in public organizations. In this vein, research is needed to identify factors that generalize understanding about organizational change involving technology. At the same time, dynamic interpretations of organizational change involving technology require theory that is adaptable to questions and challenges in unique organizational contexts.

Technologism in public administration has a tradition of reliance upon the theoretical vanguards of values and ethics to explain linkages between technological, social, economic and political issues (Frederickson, Smith, Larimer, & Licari, 2012). The apparent trajectory of the technology of public administration indicates that theory is needed to understand the implications of innovations that replace a current era of automated decision support systems with ICTs that are capable of decision making. Transfer of discretionary decision-making away from street-level bureaucrats toward systems developers portends the era of automated decisions by technology. This trajectory of organizational change involving technology deserves the attention of public administration researchers.

On one hand, postmodern views have long promised that technology will bring fairness to the distribution of public services (Farmer, 1995). Variations in the types of technology used in the United States voting system provide a weighty example of potential research in linkages between the technology of public administration and the impacts of interpretive practices that vary between jurisdictions. Other suggestions for research include the exploration of organizational change theory involving technology to explain how standards link to and predict user involvement, satisfaction and broader organizational outcomes.

The need to adopt standards for ICT development and use is a little examined but

inevitable topic of exploration for public administration research, given the trajectory of organizational change involving technology in the public domain, particularly in interagency and other networked public environments. The use of the internet for public purposes is an area that could be investigated to develop a theory of public technology and practice. For example, theory of public technology could inform the rational development of standards and practices that could have future implications for the use of the internet, e.g., as a form of public utility. These and other unanswered issues remain relevant to challenges in the public administration discipline that can be addressed by developments in organizational change involving technology and practice theory.

Regarding the use of CAQDAS in the research, greater acceptance of machine learning could enable researchers with less experience in a particular public organization to quickly analyze data. In this case study research, the interview transcripts required interpretation by the researcher and experts from the case study organization. The opportunity to make sense of the interview data may have been lost to study were it not for the researcher's extensive experience in the national security community and contacts within the case study organization. By contrast, outputs from machine learning provided an initial group of patterns that could have been cross-referenced to policy and procedural documents collected from the organization.

Concluding Remarks

The use of practice theory to examine change involving technology breaks new ground in the public administration research that encompasses the national security domain. Analysis of the findings was synthesized in a taxonomy of process actions that identified what informal processes iterate structure and outcomes as participants respond to organizational changes involving technology. This research asserts iterating, adjudicating, coordinating, and processes

in-use conceive a typology of specific process actions that implicate a priori organizational structures and outcomes and actor interpretations of process as elements of stability and change.

This case study finds that organizational change involving technology should be understood in the context of dynamic interpretations of organizational processes in the vein of practice theory traditions. Results and findings posit a view of organizational change involving technology in public administration that is focused on understanding the effects of interactivity between organizational actors known as process actions. Moreover, case study results and findings suggest that the study of organizational change involving technology is not solely a process-based management endeavor. Rather, the study of organizational change involving technology requires an appreciation of the ways in which ad hoc interpretations seen in interactivity between organizational actors can impact a priori structures and outcomes that define organizational change involving technology. Important but unanticipated creations and inventions of process by organizational actors can have lasting and profound impacts in organizations. This study contributes to a much larger discussion that is needed to re-evaluate theory and praxis associated with organizational change involving technology in public administration.

This case study was born out of the researcher's dissatisfaction with the extant study and practice of organizational change involving technology. Expectations for a super theory that responds to all the complexity in organizational change involving technology is not forthcoming if evidence here and in the literature are indicators. Likewise, the complexity of modern public organizations makes the application of a consulting engagement no more practical, and less practicable given the realities of funding. There is no panacea to explain and enact successful organizational change involving technology in a variety of contexts. However, this case study took a novel methodological approach to formulate results and findings. The case study research

is submitted in the hope that it suffices as one of many pieces of knowledge that are needed to build faith in public programs and policies that must necessarily change due to new and nuanced complexity involving technology. The research concludes noting a sense of urgency, given the great lengths that are required to continually evolve public administration and the study of organizational change involving technology in the direction of ever capable tools of governance.

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APPENDIX A INTERVIEW PROTOCOL

Technology Development Interview Protocol

Date:

Interview Parts

I. Interviewee Demographic Data (10 min)

1. Introduction and Interviewee Background

II. Organizational Context for Managing Technology Development (25 min)

1. Mandates
2. Changes in process
3. Processes that don't work
4. Processes that work
5. Processes that are formalized

III. Satisfaction with Organizational Technology (15 min)

1. Quality of technology tools (e.g., GUI interface, connectivity, ease of use)
2. Usefulness of technology
3. Participation/involvement in changes to technology

Documents Obtained:

Post Interview Comments or Leads:

Protocol Introduction

To facilitate note-taking, I would like to audio tape our conversations today. Please indicate your acknowledgement of human subject requirements. Thank you for agreeing to participate. This interview will last approximately one hour.

Interview Topic

You have been nominated for this interview because you were identified as someone who has a great deal to share about how development is done in the organization. The study does not evaluate individuals. Rather, we are trying to learn more about processes in the organization. We hope this information will help to improve the processes, procedures and standards needed to better manage the life cycle of technologies in the organization. All information between 2000 through the present is relevant.

I. Interviewee Demographic Data

1. Time in organization
 - a. 1-5 years
 - b. 6-10 years
 - c. > 10 years
 2. Time in technical/professional area
 - a. 1-5 years
 - b. 6-10 years
 - c. > 10 years
 3. Technology role in organization
 - a. Technology user
 - b. Technology developer
 4. Management role in organization (staff to manager)
 - a. Staff technologist or analyst
 - b. Management (lower)
 - c. Management (mid- to higher-level)
 5. Briefly describe your role as it relates to development and use of organizational technologies?
- Probe 5a: How are you involved in providing the organization's services?

II. Organizational Context for Managing Technology Development

1. Mandates. Can you recall organizational mandates related to technology development?

Probe 1a: Can you recall administrative or technological disruptions that caused you to change the way you performed your work?

Probe 1b: What new organizational goals have been introduced?

2. Changes in Process. Can you name things or events that required you or your co-workers to make change in how you accomplished your work?

Probe 2a: What things were gone or no longer available to you or your co-workers?

Probe 2b: In what ways did you change the way you performed your work?

Probe 2c: Can you provide examples of how and why your work group or organization demonstrated opposition or resistance to unwanted or unpopular technologies?

3. Processes that don't work. Would you identify processes and timeframes where changes negatively impacted the organization?

Probe 3a: Can you identify work processes that don't work?

Probe 3b: What processes hinder technology development?

4. Processes that work. What processes or roles emerged that help technology development?

Probe 4a: Can you recall the timeframes for the things that worked?

5. Processes that were formalized. Can you describe any current or past work processes that became institutionalized in organizational governance, such as a formal working group, a group charter, or an organizational process signed by someone in a leadership position?

III. Satisfaction with Organizational Technology

1. Quality of organizational technology. What is your opinion of the quality of technology?

Probe 1a: Does the technology work well?

Probe 1b: Are you satisfied with the quality of the technology?

Probe 1c: Did the technology help the organization achieve its goals?

2. Usefulness of technology. Are you satisfied with the outputs from the technology?

Probe 2a: Is the output from the technology useful in your work?

3. Participation/involvement in changes to technology. In your experience, how important is it for users to participate in design and development and later changes to organizational technology?

Probe 3a: Would you provide examples of your personal input to changes in the organization's technology?

APPENDIX B

DICTIONARY

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Empirical Elements		Interpretive Process Actions	
			Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
16	1		Or	M		X
15	1		Or	M		X
2	1	X	St	M	X	
4	1	X		M, Ou	X	
55	1			Ou	X	X
177	1			Ou	X	X
155	1			Ou	X	
52	1	X		Ou		X
58	1	X		Ou		
75	1	X		Ou		
153	1			Ou	X	X
63	1			Ou		X
10	1		Pt	Ou		X
64	1		Or			
124	1		Or			
117	1		Or			
88	1		Or			
39	1		Pa			

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
145	1		Pa			X
125	1		Po			X
67	1	X	Pt			
7	1	X	Pt			
66	1	X	Pt			
164	1	X				X
24	2			GO		
129	2			GO	X	X
136	2			GO		X
154	2			GO	X	X
1	2	X		GO		
9	2	X		GO	X	
121	2			M	X	X
150	2	X		M		
11	2	X		M	X	X
53	2			M		
38	2			M		
122	2	X		M		
126	2	X		M		
56	2			Ou	X	X
62	2			Ou		X
172	2	X		Ou	X	X
74	2	X		Ou	X	X
167	2			Ou		X
168	2	X		Ou	X	X

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
131	2			Ou		X
135	2			Ou		X
68	2			Ou	X	
104	2			Ou	X	
173	2			Ou	X	X
179	2			Ou	X	
59	2			Ou		X
103	2			Ou	X	X
123	2			Ou	X	X
138	2			Ou	X	X
161	2			Ou		X
115	2			Ou	X	X
158	2			Ou		X
171	2			Ou	X	X
12	2	X		Ou		
169	2			Ou	X	
29	2		Or			
100	2		Or			
98	2		Or			
141	2		Or			
81	2		Or			
79	2		Or			
101	2		Or			
99	2		Or			

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
78	2		Or			
90	2		Or			
91	2		Or			
93	2		Or			
92	2		Or			
162	2		Or			
174	2	X	Or			
17	2		Or			
96	2		Or			
95	2		Or			
127	2		Or			
176	2		Or			
180	2		Or			
144	2		Or		X	
102	2		Or			
89	2		Or			
140	2		Or			
128	2		Or			
82	2		Or			
31	2		Or			
20	2		Or		X	
18	2		Or			
21	2		Or			

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
105	2		Or			
87	2		Or			
72	2	X	Pa			
71	2	X	Pa			
112	2	X	Pa			
130	2		Pa			
175	2		Pa			
182	2		Pa			
83	2		Pa		X	
152	2		Pa			X
48	2		Pa		X	
106	2		Pa			
160	2		Pa		X	X
132	2		Pa			
181	2		Pa		X	
183	2		Pa			X
49	2		Pa		X	
40	2		Pa			
46	2		Po		X	
146	2		Po		X	X
43	2		Po			
28	2		Po			
42	2		Po			X
69	2	X	Pt		X	
77	2	X	Pt			

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
76	2	X	Pt			
12	2	X	Pt			
94	2	X	Pt			
108	2	X	Pt			
109	2	X	Pt			
119	2		Pt			
30	2		Pt		X	X
97	2		Pt			
26	2		Pt		X	X
27	2		Pt			X
8	2	X	St		X	
3	2	X	St		X	
147	2		St		X	X
114	3			GO	X	
159	3	X		GO	X	
61	3	X		M		
157	3			M	X	
118	3			M	X	X
51	3			M		
57	3			M	X	

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
166	3			M	X	
50	3			M		
86	3	X	Pt	Ou		
148	3			Ou	X	X
151	3			Ou	X	
6	3	X		Ou	X	X
13	3	X		Ou		
142	3			Ou		X
60	3			Ou		
170	3			Ou	X	X
84	3	X	St	Ou		
45	3		Or			
44	3		Or			
19	3		Or			
65	3		Or			
111	3		Or			
113	3		Or			

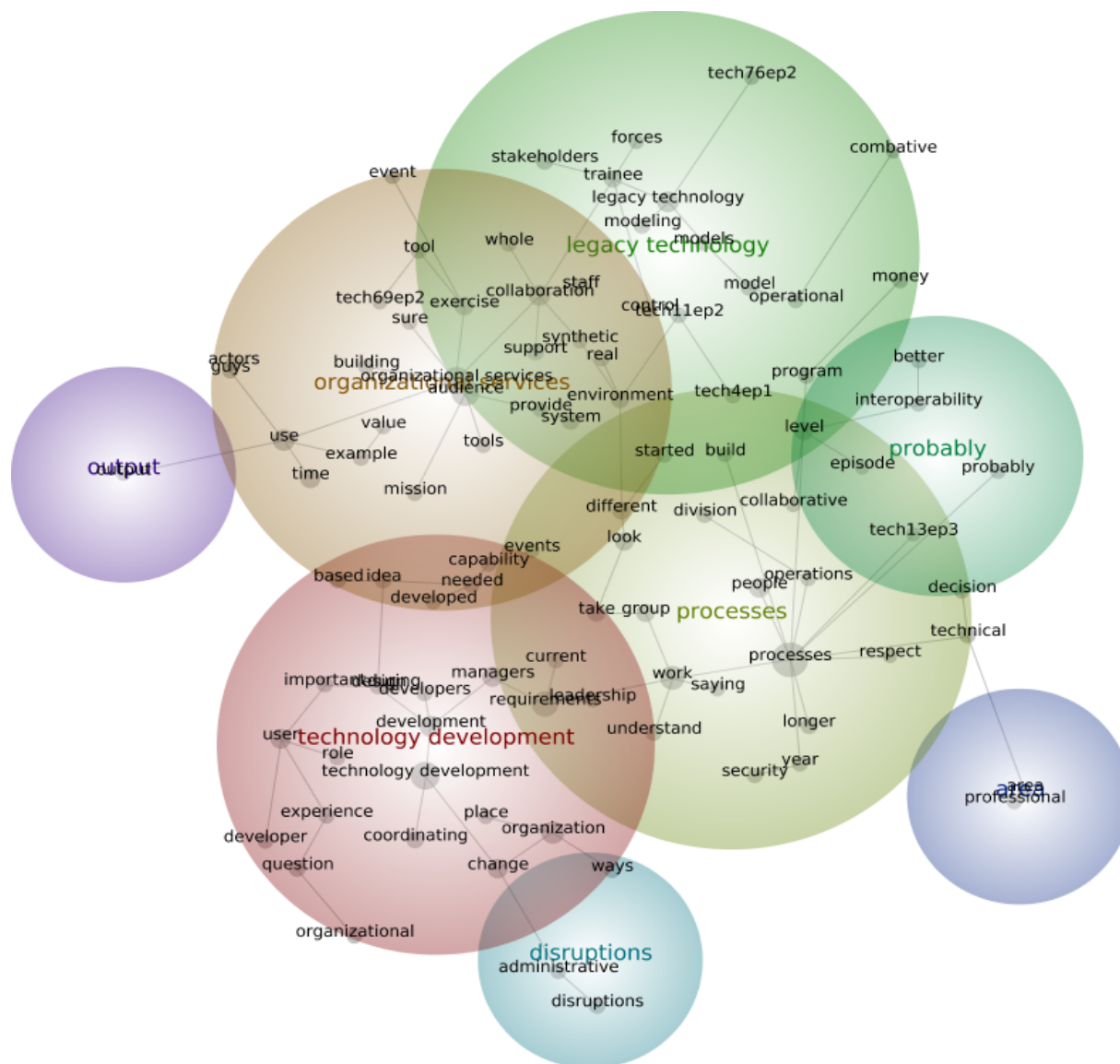
Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
116	3		Or			
149	3		Or			
35	3		Or			
33	3		Or			
34	3		Or			
32	3		Or			
137	3	X	Pa			X
85	3	X	Pa		X	
70	3	X	Pa			
47	3		Pa			X
80	3		Pa		X	

Nbr	Episodes Ep1 Ep2 Ep3	Technology	Structures: Organization (Or), Policy (Po), Process Admin (Pa), Process Services (Ps), Standard (St)	Outcomes: Outcome Unplanned (Ou), Change Mandate (M), Goal (G) or Objective (O)	Coded Performative (Cp)	Coded Ostensive (Co)
107	3		Pa			
110	3		Pa			
156	3		Pa		X	X
41	3		Pa			
165	3		Pa		X	
37	3		Pa			
139	3		Po		X	X
120	3		Po		X	
73	3		Po		X	X
54	3		Po		X	X
178	3		S		X	
163	3	X				X
133	3	X	Pa	M		
25	1, 2	X	Pt	M		
184	1,2,3		Pa	Ou		X
5	1,2,3	X				
143	1,2,3	X				

APPENDIX C

CAQDAS EXPERIMENT I

Machine Learned Concept Map



Experiment I Concepts

Concept	Count	Relevance %
processes	1277	100
technology development	685	54
requirements	589	46
organizational services	552	43
audience	544	43
work	510	40
organization	473	37
use	440	34
legacy technology	369	29
time	356	28
favourable	355	28
people	341	27
user	312	24
collaboration	299	23
change	294	23
development	290	23
managers	289	23
level	235	18
look	213	17
exercise	206	16
different	198	16
system	191	15
trainee	191	15
group	190	15
longer	189	15
stakeholders	178	14
take	171	13
environment	167	13
disruptions	146	11
coordinating	145	11

Concept	Count	Relevance %
program	145	11
technical	145	11
question	139	11
division	137	11
support	135	11
idea	123	10
modeling	122	10
staff	119	9
technology 11 episode 2	112	9
unfavourable	111	9
security	110	9
during	108	8
model	106	8
money	106	8
based	105	8
building	104	8
design	102	8
important	102	8
example	101	8
whole	99	8
probably	99	8
understand	98	8
year	97	8
models	96	8
event	95	7
tool	93	7
needed	90	7
role	90	7
better	90	7
technology 76 episode 2	86	7
area	85	7

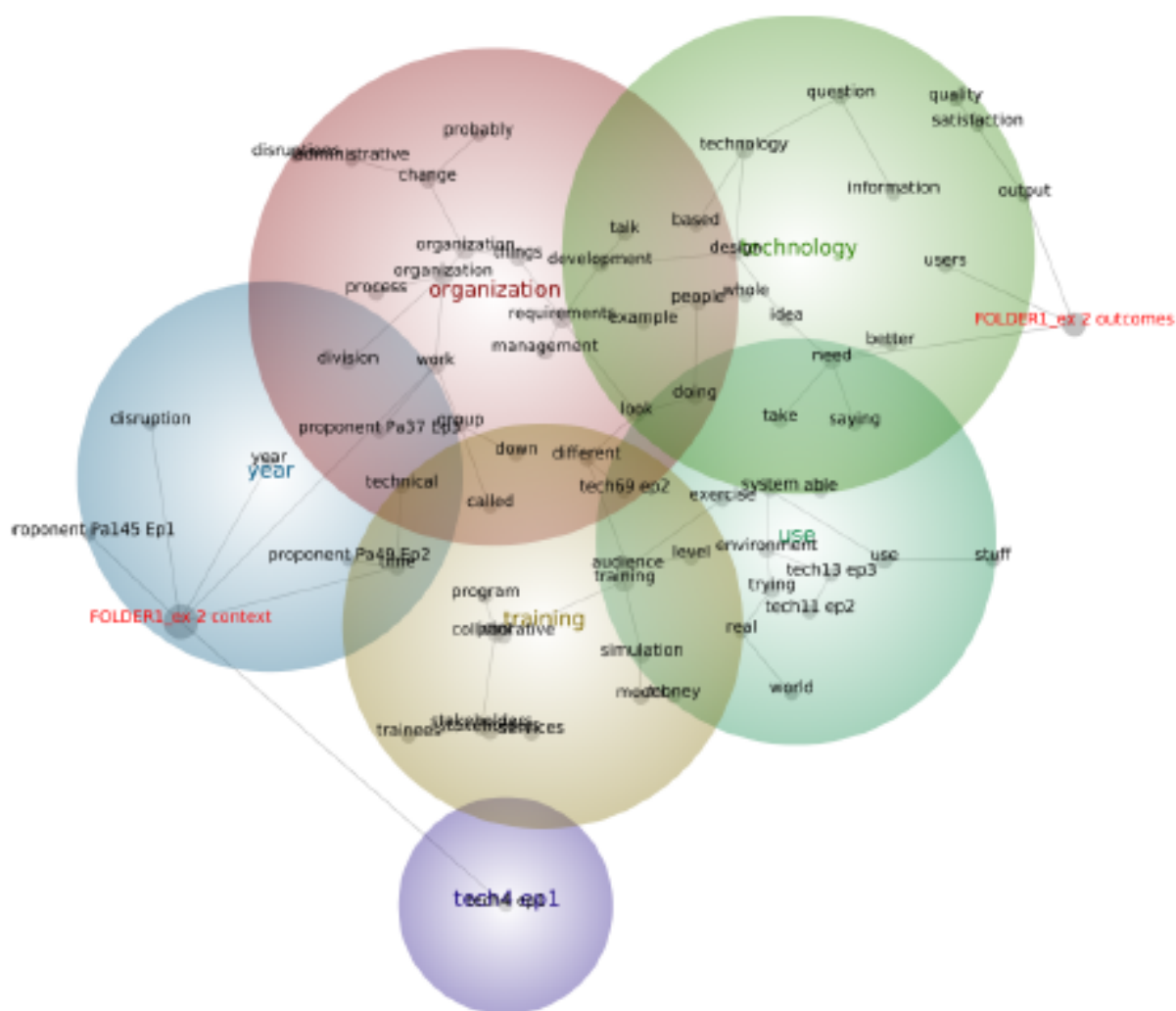
Concept	Count	Relevance %
professional	85	7
sure	84	7
started	83	6
capability	82	6
operations	82	6
saying	82	6
developed	81	6
technology 4 episode 1	81	6
operational	81	6
developers	79	6
tools	79	6
administrative	79	6
mission	78	6
ways	78	6
place	77	6
guys	76	6
actors	76	6
developer	75	6
real	74	6
experience	70	5
provide	69	5
events	69	5
current	66	5
leadership	66	5
build	66	5
control	64	5
organizational	64	5
interoperability	62	5
technology 13 episode 3	60	5
technology 69 episode 2	48	4
forces	46	4

Concept	Count	Relevance %
decision	41	3
respect	39	3
collaborative	38	3
synthetic	35	3
value	31	2
episode	23	2
output	20	2
combative	1	1

APPENDIX D

CAQDAS EXPERIMENT II

Machine Learned Concept Map



Experiment II Concepts

Concept	Count	Relevance %
FOLDER1+ FOLDER2: Context & Outcomes	3058	100
FOLDER2: Outcomes	1556	51
requirements	541	18
organization	491	16
work	485	16
training	481	16
technology	469	15
audience	459	15
organization	400	13
use	398	13
things	394	13
need	365	12
time	350	11
people	331	11
stakeholders	304	10
stakeholders	304	10
change	286	9
development	275	9
users	266	9
process	265	9
talk	256	8
management	247	8
trying	238	8
level	227	7
doing	221	7
joint	217	7
collaborative	217	7
model	214	7
look	211	7
different	193	6
system	184	6
exercise	175	6
group	169	6
information	169	6
take	167	5
environment	161	5
simulation	161	5

Concept	Count	Relevance %
question	159	5
services	158	5
able	151	5
down	141	5
idea	128	4
disruptions	117	4
program	115	4
technology 11 episode 2	113	4
based	107	3
design	106	3
division	104	3
technical	104	3
stuff	104	3
money	103	3
trainees	101	3
example	100	3
world	97	3
whole	93	3
year	88	3
technology 13 episode 3	87	3
probably	86	3
saying	85	3
better	85	3
called	70	2
administrative	69	2
real	69	2
quality	66	2
satisfaction	48	2
output	46	2
disruption	41	1
proponent process action 49, Episode 2	37	1
technology 69 episode 2	35	1
proponent process action 37, Episode 3	14	0
proponent process action 145, Episode 1	6	0
technology 4 episode 1	5	0

VITA

Brian E. Martinez

Old Dominion University, Strome College of Business, School of Public Service
2004 Constant Hall, Norfolk, VA 23529

EDUCATION

M.A., Finance & Management, Webster University, Webster Groves, MO

B.S., Vocational Education, Southern Illinois University, Carbondale, IL

PUBLICATIONS

Martinez, B. (2015) Exploring interagency collaboration in the national security domain: A distinct form of collaboration? In *Advancing collaboration theory: Models, typologies, and evidence*. Edited by John C. Morris and Katrina Miller-Stevens. NY: Routledge

RESEARCH PRESENTED

Martinez, B.; Joannou Menefee, S. (2018, November). *The Cry in the Wilderness: Uncovering, Exploring and Addressing Youth Gun Violence in America*. Panel presentation at North Eastern Conference on Public Administration, Baltimore, MD.

PROFESSIONAL EXPERIENCE

City of Poughkeepsie, NY, Budget Analyst

Department of Defense Civil Service, Office of the Chairman, Joint Chiefs of Staff,

Division/Deputy Chief: Requirements, Development, Plans and Assessment.

Department of Defense, Civil Service, Joint Forces Command, Deputy Director, Resources, Requirements and Analysis.

Military Experience

US Navy, Lieutenant Commander, (Retired). Medals: Defense Meritorious Service, Navy

Commendation/Achievement, Combat Action, Defense Service, Armed Forces Service,

Kuwait Liberation, expeditionary and sea service medals

Certifications

Project Management Professional (PMP), Project Management Institute

Certified Defense Financial Manager with Acquisition Subspecialty

HONORS AND AWARDS

Pi Alpha Alpha, National Honor Society for Public Affairs and Administration

Joint Meritorious Civilian Service, Office of the Chairman, Joint Chiefs of Staff

Phi Kappa Phi, National Honor Society

VOLUNTEER EXPERIENCE

Angel Airlines for Veterans (non-profit), Board of Directors

Mercy Medical Angels (non-profit), Advisory Board Member

Neighborhood revitalization, City of Norfolk, VA