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Bella Mody

Major professor
BELLA MODY, Ph.D.

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INFORMATION TECHNOLOGY INNOVATION IN THE U.S. ARMY: THE CASE OF THE ADOPTION, ADAPTATION, AND UTILIZATION OF THE STRATEGIC CRISIS EXERCISE INTRANET

By

Linda C. Jantzen

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ABSTRACT

INFORMATION TECHNOLOGY INNOVATION IN THE U.S. ARMY: THE CASE OF THE ADOPTION, ADAPTATION, AND UTILIZATION OF THE STRATEGIC CRISIS EXERCISE INTRANET

By

Linda C. Jantzen

The U.S. Army has undergone dramatic changes in its structure and operating procedures in recent years as a result of the introduction of new information technologies. This study examines the adoption and adaptation of an information technology innovation in a U.S. Army organization. While previous studies have focused on the technologies themselves, this study investigates the process of innovation adoption, with special attention paid to how the technology and the organization influence each other.

Data was collected through direct observation of the Strategic Crisis Exercise (SCE) intranet, in use in the Center for Strategic Leadership (CSL), located at the Army War College in Carlisle Barracks, Pennsylvania. Semi-structured interviews were also conducted with key leaders, system developers, system maintainers, and users of the intranet. Despite the unique military context, theories and frameworks developed for similar studies of information technology innovation adoption in business organizations were found to be valid with minimal modifications.

To Mum and Dad

DISCLAIMER

The views expressed in this report are solely those of the author and do not necessarily reflect the official policy or position of the Army War College, the Department the Army, the Department of Defense, or the United States Government.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

AGIS	Analysis and Gaming Information System
AI	Artificial Intelligence
C2	Command and Control
CINC	Commander in Chief
CSL	Center for Strategic Leadership
DISA	Defense Information Systems Agency
FEMA	Federal Emergency Management Agency
GCCS	Global Command and Control System
HTML	Hypertext Markup Language
IIS	Internet Information System
KEG	Knowledge Engineering Group
LEADCT	Learning Enhancement, Assessment, and Data Collection Tool
MSEL	Master Scenario Event List
NGB	National Guard Bureau
OLE	Object Linking and Embedding
SCE	Strategic Crisis Exercise
SNN	Strategic News Network
STD	Science and Technology Division
SWAMI	Strategic Wargame Automated MSEL Injector

INTRODUCTION

The field of organization and innovation research has produced many case studies of businesses that have reinvented themselves. That is, they have undergone drastic changes in their culture, structure, and procedures as a result of exposure to, adoption, and implementation of information technologies. Indeed, the transformations of a wide spectrum of activities made possible by computer processing and information technology are so profound that they define an age. The Information Revolution now has the status of earlier technological revolutions in agriculture and industry.

Small, medium, and large business enterprises in areas like manufacturing, product development, medicine, retail, banking and transportation have found new sources of wealth, not only by mastering vast material resources, but by harnessing ideas and technology. New technologies for collecting, processing, and disseminating information are now developed and placed on the market so quickly that their adoption and use is considered merely a matter of survival and can hardly be called innovative any more. What interests managers and researchers to a greater extent is the process of adoption and the appropriate meshing of technology with organizational design, processes, strategy, and external relationships (Pennings, 1987). From this point of view, adoption is not the end point but actually just a milestone in a multistage process of innovation

consisting of both adoption and implementation stages. Reinvention, in the business sense, is often thought of in terms of making planned and profound changes to various activities in an organization. For example, downsizing in personnel can be brought about by replacing people with technology, or by automating previously manually performed tasks. Where information technology is involved, reinvention can apply not only to an organization but to a technology. Pennings (1987), for example, showed that word processing is a flexible innovation that can be reinvented under suitable managerial conditions (see Chapter 3).

Innovation is always difficult, but becomes even more complex within a large, bureaucratic organization like the Army. But bureaucracies do innovate, and the question is not whether, but why and how they can change (Rosen, 1991). An organization that has been reinventing itself and reinventing technologies throughout its 224 year history, yet has largely escaped the attention of information technology innovation researchers, is the U.S. Army. The few existing studies of technological innovation in the military focus on the Cold War era development of weapons systems, characterized by product cycles measured in decades, separation of research and development (R&D) and production, and costs in the millions and billions of dollars (Alic, et al., 1992). These vintage models might explain how the Army that emerged from WWI evolved into the

modern technological force that faced up to the Soviet Union and defeated the Iraqi Republican Guards in the early 1990s. However, they contribute little to the field of innovation in information technology, where product cycles are measured in weeks, R&D and production are integrated, and old hierarchies are being discarded in favor of knowledge-empowered employees. Changes in the global environment and events of the recent past call for a reassessment of the assumptions upon which the traditional models of military innovation are based.

In 1991, the Persian Gulf War established new benchmarks for the use of technology in the conduct of war, not just in weapons systems but in information systems that enhanced the Allies' situational awareness and communication capability. Just 5 years later, the Army reinvented itself to implement the provisions of the Dayton Peace Accords in the former Yugoslavia. In Operation Joint Endeavor, information proved to be a powerful weapon used by U.S. forces to monitor troop movements and detect and react to violations of the Dayton agreement. Another spectacular example of reinvention is the Army personnel drawdown of the 1990s, which saw the active component shrink from almost 780,000 to about 480,000, with similar reductions in the reserve component and the civilian work force. Simultaneously, the Army's operational tempo, a measure of the degree to which it is committed to perform various missions around the world, increased an astonishing 300% (Reimer, 1998). Success in

doing so involved fundamental changes not just in the adoption and procurement of new weapons and management technologies, but in the structure, doctrine, training, and competitive strategy of the organization as well.

The achievement of competitive advantage through technology is pursued with no less urgency whether it is a strategic business goal or a matter of national security. In fact, the distinction between the two is getting more and more difficult to discern. In the past, wars were fought for geographic dominance. In the future, national power may be measured by the ability to attain information dominance and the capacity to deprive one's competitors of information (Pfaltzgraff, 1997, p.9). The information revolution has brought changes in technology as well as a change in the nature of competition, be it global military competition or global business competition. Unlike past innovations that tended to bestow an enduring competitive advantage to the innovator, Information Age technologies tend to be equally accessible to all competitors. The discriminator among competitors in such an environment becomes not the possession of the technology, but the way it is used. The term "Revolution" connotes what George Gilder calls a paradigm shift, or the "collapse of formerly pivotal scarcities," and "the rise of new forms of abundance" (Gilder, 1997). Applying this concept to the competitive environment of business and national security, technology is the abundant

resource, while resources such as time and attention are scarce. Time pressures leaders to make decisions in progress, to react faster than the competition. With the explosion of data and limitations of human beings to make use of it all, attention becomes a very scarce resource. Again, in Army as well as business organizations, the goal for information technologies is to be designed and used to free up time and attention for more critical and strategic tasks. Accomplishing this requires finding entirely new ways of doing work, not just more efficient ways of doing work the same way.

Social science researchers in the past have looked to the military as a "laboratory of social innovation". For example, when full scale integration of blacks and of women into the military preceded the same level of integration in society at large, Army organizations in particular were studied as a microcosm of what might be seen in society at large. Today, it behooves researchers to see the Army as a laboratory of technological innovation because of the rate at which new technologies are being tested and adopted, and the swift and visible results.

Chapter 1

RESEARCH OBJECTIVE

In the Army, traditional criteria for assessing the effectiveness of command and control (C2) systems, such as the evaluation criteria identified by Colodney (1995), are based on Army history and doctrine that have in many cases already been superseded by the provisions of the Army's modernization program. The plan of change, called Force XXI, is so named because it defines a process, the successful completion of which will result in Army XXI, a modern force capable of meeting the challenges of the 21st Century, in large part through effective use of information. Part of the implementation of that program is evaluation of new commercial information technologies and their effectiveness in enhancing decision makers' knowledge of the situation. Studies of particular technologies are helpful in evaluating the performance of machines, but are not adequate to explain or assess the complex processes and impacts of the adoption and implementation of modern information technologies. These processes are unique in that their effects are bi-directional. While a tank or an airplane may be used with differing degrees of skill in different organizations, it remains essentially the same technology and is used with the same tactics, techniques, and procedures between one unit and another. Information technologies are flexible in that the same tool can be modified to suit the mission, and the organization can, under

suitable managerial conditions, evolve in its structure and its procedures to optimize the potential of the tool.

Overall and intermediate objectives

The overall objective of this study was to describe the process of the adoption and adaptation of an information technology innovation within the context of an Army organization. The purpose was not to critique or evaluate the process or the technology, but rather to describe the issues involved in meshing organizational design, processes, and external relationships to the introduction of information technology.

This study was intended to link research to a contemporary situation in an attempt to extend current innovation theory to that situation. The intermediate objectives leading up to the objective were to first look at the **adoption** process: the elements of the process, and the surrounding conditions that shape the process including organizational design and culture and the strategic orientation of the leadership. Second, to look at the **adaptation** of the innovation to the organization: explore its uses and impacts, and how and why the innovation was reinvented.

Organization and innovation under study

The organization chosen for this study was the Center for Strategic Leadership (CSL) at the Army War College, Carlisle Barracks, Pennsylvania. Though there

are many innovations in the process of being adopted or being implemented within the Center for Strategic Leadership, the scope of this study was limited to the intranet and associated internally developed applications used to support the annual Strategic Crisis Exercise (SCE). The exercise is a ten-day, computerized, interactive war game in which War College students put to use the concepts they study in the classroom. Center for Strategic Leadership and War College faculty use communication and computer technologies to create a simulation of the distributed, collaborative environment of strategic decision makers at the national security level.

The SCE intranet, the focal innovation of this study, went into operation for the first time in 1997. Therefore the initial impact of the adoption of intranet technology by the CSL can already be observed. It is also in a constant state of change, or reinvention, in response to new requirements from both inside and outside the organization, making it ideal for a study of this type. Many other organizations within the Army use intranet technology as a way to more effectively accomplish every kind of mission from administrative message distribution to training support to operational and decision support of combat units. The Tactical World Wide Web (TACWEB), an intranet developed and used in the Second (US) Infantry Division in the Republic of Korea, was first selected to be the subject of this study. Lack of adequate time, funds, and the

high operational tempo of the Second Infantry Division made it infeasible to do an on-site study of TACWEB, but documentation as well as conversations with TACWEB developers and maintainers contributed to the formulation of research questions and conclusions in this study. Currently TACWEB and other intranets like it are being assessed mainly by the users, developers, and maintainers associated with them. These intranets and their adoption and utilization within a real operational environment as opposed to a simulation, make interesting subjects for future research.

The case of the SCE intranet provides a good starting point for study of technological innovation in a military context because many of the original developers and decision makers are still present at the CSL. Like most other military organizations, the historical evolution of the CSL's roles and missions are well documented (it is interesting to note that the Military History Institute also resides at Carlisle Barracks). Finally, the CSL and the manner in which they conduct the SCE have a real influence on Army policy. This influence is due to two things: 1) the CSL is an education, research, and outreach organization for the highest levels of the Army, specifically the Army Deputy Chief of Staff for Operations (ADCSOPS), and 2) the conduct of the Strategic Crisis Exercise has a direct and personal effect on the War College students and visiting dignitaries

who participate in it, among whom are current and future leaders in the National Security Community.

Specific research questions

The topic of information technology innovation adoption and adaptation in the Army is vast and largely unexplored. This study is a start, limited time and resources notwithstanding. It addresses the following specific research questions:

1. Why and how did the Center for Strategic Leadership adopt the SCE intranet?

2. How did the Center for Strategic Leadership reinvent the SCE intranet?

3. How has the SCE intranet shaped the organizational structures and processes of the Center for Strategic Leadership?

This study is intended to provide a logical basis for, as well as to stimulate interest in doing further research in the area of innovation in the military. It is also intended to illuminate the parallels between the innovation processes of business organizations and modern Army organizations in order to facilitate the sharing of lessons learned on a practical level and theoretical perspectives on a conceptual level. As such, it assumes little or no previous expertise on the part of the reader on the structure and procedures of either business or military organizations.

Organization of this study

Chapter 2 introduces the reader to relevant organization and innovation literature. Chapter 3 describes the case study method and protocol used to investigate the process of innovation in the CSL, the use of the intranet in the SCE, the reinvention process including some of the more recent applications developed to supplement the intranet and the impact of the process on the CSL. Chapter 4 presents the findings. Chapter 5 draws conclusions from the research findings and addresses the larger issues that prompted the overall research objective.

Audiences

The intended audiences for this study are organization and innovation researchers of all disciplines, practitioners of information systems development, management, and implementation, and decision makers in the Army and in business. This research is extremely valuable to each for the following reasons:

1. Researchers seek to develop relevant theory to fill the vacuum of experience created by new technologies. That development requires observations be made in a variety of different contexts to provide a foundation for predictions of the organizational effects of new technologies. The Army provides a new technological context, increasingly related to and interconnected with that of business organizations. This study is not an attempt to invent a new

theory of innovation, but rather to alter, or at least inform current theory based on analysis of the new context. Further, the same technologies are being adopted and implemented in Army organizations as in business organizations.

2. Information practitioners are faced with implementing into their organizations a steady stream of new technologies without experience or a theoretical framework to help integrate them. Most computer innovations are not simply turnkey systems where the purpose is well understood and the functions easy to use. Managers as well as developers have to be both technologically sophisticated and adept at facilitating organizational and attitudinal change. Theory cannot provide foolproof steps for successful implementation, but it can contribute to well informed and well managed implementations that will maximize the potential for more effectively achieving organizational goals.

3. Decision makers must be aware of and skilled at applying different planning and control systems for various stages of the innovation process. Development and adoption of innovations requires experimentation, risk taking, and freedom from bureaucratic control. Yet a degree of strategic control is necessary for successful implementation, guided by monitoring and feedback. Finding an appropriate balance between the two is of particular interest to leaders of innovating organizations. Organizational leaders also seek to understand how they can get the maximum benefit from information without

being overwhelmed by it. Increasingly, business and military leaders are expected to be managers of uncertainty. This study and others like it will help to share the experiences and the lessons of organizations who have, successfully or unsuccessfully, adopted and adapted information technologies.

Chapter 2

LITERATURE REVIEW

An exhaustive review of previous research relevant to all possible aspects of the information technology adoption and adaptation process is impractical and beyond the scope of this study. However, an understanding of existing theory and a review of significant findings from a cross section of the relevant research areas is essential not only as a guide for further investigation, but as a basis for understanding the results of this investigation. Each of the individual views is helpful, but all of them collectively are necessary to provide an adequate basis for a theoretical framework that can be applied to the innovation process in both business and Army organizations. This chapter is divided into the following subsections:

1. Defining Innovation: This section provides a range of views on what an innovation is and how the definition impacts the resulting research effort.

2. Modeling the Innovation Process: This subsection describes how researchers have attempted to model or provide a framework for understanding the innovation and reinvention process in organizations.

3. Applying the Model to Information Technology: This subsection provides examples of how basic models of innovation have been applied to help

understand the adoption and adaptation of information technology in particular, including a detailed example of the case of word processing.

4. Innovation in the Military: This section provides a detailed summary of research on innovation in the military by Stephen P. Rosen (1991), a scholar of national security affairs.

5. Barriers to Innovation: This section addresses the political and social forces that may oppose the innovation adoption process, and describes research into how innovative organizations overcome those barriers.

6. Forecasting the Future: This section describes the work of futurist theorists and how they have influenced the initiation of innovations in business and military organizations.

7. The Human Dimension: This section describes the perspective that an organization's members are, as individuals, also affected by and a part of the reinvention process.

Defining innovation

A meaningful summary of innovation research must begin by delineating what is meant by "innovation". Rogers defines an innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption (1982, p. 11). He later introduced the concept of an innovation-development process, consisting of all of the decisions, activities, and their impacts that occur

throughout the development of an innovation, from recognition of a need through adoption of an innovation to address that need (p. 135). Rogers' primary interest was the diffusion process by which an innovation is communicated among certain populations. This study is confined to one organization and encompasses the initiation and adoption process as well as the reinvention process by which the innovation and the organization both change as a result of their unique combination. Therefore elements of both Rogers' definitions are applicable.

Stephen P. Rosen (1991, p. 7) defines a military innovation as a change in the ideas governing the way a combat organization uses its forces to win. He places emphasis on major changes in organizational structure and doctrine, historically brought about by new developments in technology (nuclear weapons, for example). He describes entirely different innovation processes based on the type of innovation and the context in which they occur. For example, according to Rosen (1991), the process of innovation during peacetime has slightly different elements than during wartime. He also distinguishes between social innovation, which changes the way people behave, and technological innovation, which is concerned with the building of machines (p. 39). Rosen's theory of military innovation will be discussed in more detail later in this chapter. His work is valuable in understanding the innovation process as it pertains to military

organizations, but his distinctions by context or type of innovation make it problematic in making sense of the innovation process within organizations that function in dynamic and competitive environments.

Rogers' definitions apply generically to all types of innovations, including both technologies and techniques for doing things. The type of innovation this study is concerned with is information technology, a specific type of technological innovation involved in the creation, storage, or transmission of information.

Modeling the innovation process

Research in the field of innovations differs in scope and focus. Rogers (1976) and Rosen (1991), for example, looked at the entire process of innovation that starts with identifying the need for a change to solve some problem, and progresses through implementing the solution. One of the earliest and most widely known models of innovation in organizations comes from Rogers' (1976) research on the innovation process as it pertains to communication in organizations. Rogers' focus was on communication patterns, and his model of innovation was developed for innovations in products and practices but not specifically with information technologies in mind. Yet analysis of subsequent models developed for technological innovations shows that other researchers drew heavily on Rogers' research, or at least found strikingly similar elements in

the process of adopting and implementing information technologies. A summary of Rogers' process model of innovation is presented here to provide a solid foundation on which to build an understanding of more contemporary models (See Figure 1).

Rogers' assumptions distinguish his model from previous models, which investigated the time of adoption and the frequency of previously adopted innovations as a measure of an organizations innovativeness. Rogers' four assumptions are (1) innovation is one of a number of possible responses by the organization to a confluence of external forces acting on it, (2) innovation proceeds through a number of stages, representing increasing commitment by the organization, (3) the process is not unidirectional but interactive, subject to backtracking and change, and (4) one of the best measures of effects of innovation is change in the overall effectiveness of the organization (1976, pp. 155-156). He describes two main stages in the innovation process, initiation and implementation. He also stresses that structural characteristics of an organization, such as complexity, formalization, and centralization may have different effects at different times on the process. For example, Rogers cites Sapolsky's (1967) argument that high complexity, low formalization, and low centralization facilitate initiation of an innovation, but these same structural characteristics make it difficult for the organization to implement the innovation.

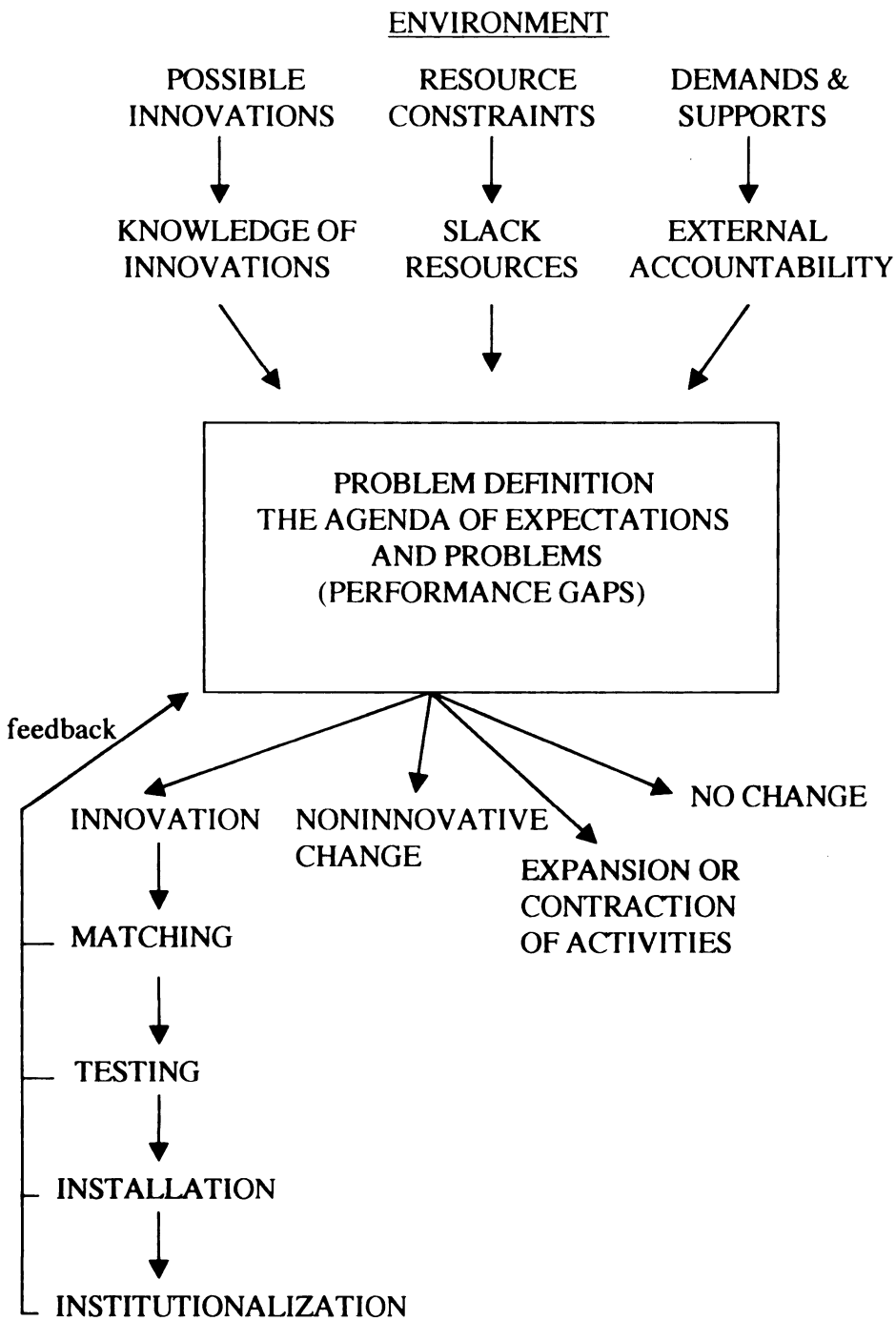

Figure 1. Rogers' (1976) Paradigm of the Innovation Process in Organizations (p. 164)

(Rogers, 1976, p. 156). Therefore, Rogers found, a multistage approach to examining the innovation process was necessary. Even before the first stage in the process of innovation adoption, environmental, structural, and communication factors combine to influence the organization. The problem definition is the process by which the organization defines actual or perceived discrepancies between its expectations and its actual performance. Rogers calls these discrepancies performance gaps (1976, p. 157). Measurement of performance gaps is difficult because they are based largely on perceptions, and thus can be created or disappear as a result of changes in either perceptions or realities. In addition, the effects of performance gaps are bi-directional, that is, a performance gap may inspire a search for an innovation, or alternatively a member's awareness of a useful innovation may create a perceived performance gap (Rogers, 1976, p. 159).

Rogers describes reinvention as distinct from simply importing an innovation from some external source and putting it to use within an organization. Rather, he explains, organizations often adopt a "general concept whose operational meaning gradually unfolds in the process of implementation" (Rogers, 1976, p. 160). Stated another way, reinvention is the way in which an organization modifies both the innovation and its own organizational structure to fit with each other after the decision to adopt has been made. A number of factors influence

the nature and direction of this process beginning prior to the decision to adopt. Rogers divides those factors into four classes: (1) Knowledge of Innovations, (2) External Accountability, (3) Slack Resources, and (4) Organizational Structure (1976, p. 159). Knowledge refers to the awareness of an organization's members as to what innovations are available and perceptions about the salient characteristics of innovations. Knowledge is influenced by the characteristics of the members and the existence of defined search processes such that members will be exposed to literature or demonstrations of new innovations, either on their own time or while acting as a member of the organization. External accountability refers to the degree to which an organization is dependent or responsible to its environment. Rogers proposes that the higher the degree of external accountability, the more innovative the organization will be (1976, p. 160). External accountability also includes a psychological dimension, such as accountability to "reference groups", or those who "ask the questions that the organization must answer" (Rogers, 1976, p. 160). For example, members of military organizations are accountable to higher ranking members, and military organizations have a well-defined position in a structural hierarchy. Business organizations are accountable to customers and investors. External accountability can also be thought of as the formation of expectations, both specified and perceived, stemming from among other things organizational and

professional norms. As with knowledge, the existence and effects of accountability on an organization are influenced by the characteristics of the members and the existence of formal reporting procedures. While external accountability implies some sort of control of an organization's activities by outside individuals or agencies, an organization must also exert some degree of control over its environment in order to be innovative (Rogers, 1976, p. 161). Slack resources refer to those resources that an organization controls that are not already committed to other purposes (Rogers, 1976, p. 161). They may already exist or be deliberately created. Like external accountability, slack resources have a psychological dimension as well as a financial dimension. For example, financial slack may be an objective measure such as total amount of budget increase, or it may be more a more subjective assessment as to total amount of discretionary or anticipated funds. Personnel slack may be an objective measure of total number of employees, or it may be a subjective assessment of how their workload compares with their actual capabilities. Rogers proposes that slack resources are essential for innovation to occur in an organization, and also that a high degree of slack resources may create a perceived performance gap which leads to innovation (1976, p. 162). In the latter case the performance gap comes from the expectation that a responsible organization will maximize their resources and not simply stockpile them. The final factor, organizational structure, refers to

the arrangement of components and subsystems within a system (Rogers, 1976, p. 162). Variables such as the degree of centralized control, the existence of formal procedures, and the complexity and openness of an organization influence the way in which organizations perceive problems, search for solutions, and make decisions.

Each of these factors contributes to the formulation of an organization's agenda, including the decision to develop and/or adopt innovations. However, having become aware of problems or opportunities and having the resources, demand and support structure to implement the innovation process, not all organizations will proceed down the path of adopting and implementing innovations. In Rogers' model, initiating the innovation process is only one of several alternative responses, along with others like noninnovative change, expansion or contraction of present activities, or no change at all (1976, p. 164). Even after the decision is made to initiate the innovation process, full implementation of that innovation is not inevitable. Rogers describes the innovation process in four steps or subprocesses: (1) adoption, or matching, (2) testing, or limited implementation, (3) installation, or full implementation and (4) institutionalization, the process of making the innovation an integral part of the organization's activities (1976, p. 163). Rogers cautions that this process is not unidirectional or uniform. To complete the model, feedback and redirection lines

are added to show that adoption decisions at all stages have a direct bearing on future problem definitions and further innovations.

Applying the model to information technology

Although it was developed in 1976 and not with computer technology or even automated procedures specifically in mind, a comparison of Rogers' descriptive paradigm of the innovation process with a more prescriptive methodology for information systems development found in a contemporary textbook shows how theory can inform and influence practice. A generic methodology called FAST developed by Whitten and Bentley (1998) prescribes phases for information systems development. In the survey phase, the project context, scope, budget, staffing, and schedule are established. In the study phase, both the business and technical issues are identified and analyzed for causes and effects. In the definition phase, business requirements are identified and analyzed for the possible technical solution. Candidate technical solutions that might address the business requirements are identified and analyzed in the configuration phase. The target solution is either designed by the organization (design phase) or specified to a vendor (procurement phase). The system is then built and tested in the construction phase, and put into full implementation in the delivery phase. The phases are grouped into three major stages. The first three phases, survey, study, definition, are collectively known as the systems analysis stage. The next

three phases, configuration, procurement and design, are known as the systems design stage. The last two phases, construction and delivery, are known as the systems implementation stage. The activities prescribed in the FAST methodology for the systems analysis and design stages of development correspond closely with the matching stage in Rogers' paradigm, in which the organization matches a problem or performance gap to an innovation believed to address that problem or close the performance gap. The activities prescribed in the systems configuration stage of development correspond to the testing, installation, and institutionalization stages in Rogers' paradigm. In both cases, the innovation is first partially implemented in order to assess the accuracy of the match and the possible effects, then installed and connected to the activities of the organization, and finally losing the distinction of being an innovation as it becomes an integral part of the organization's ongoing activities. Methodologies such as FAST place emphasis on identifying the proper requirements at the beginning of the process (problem definition and matching) and on proper implementation and maintenance of the system at the end of the process (installation, institutionalization, and feedback) as a recipe for success in developing or adopting information systems.

Another example of the influence of Rogers' paradigm comes from Johnson and Rice's (1983) case study of the reinvention process. Their study

investigated the adoption and adaptation of automated word processing systems when such systems were relatively new to offices. Johnson and Rice used a five-stage model attributed to Rogers and others to summarize their data on the process of adopting and adapting world processing systems in business organizations. As with Rogers' (1976) model, the Johnson and Rice model does not begin nor end with the decision to adopt, but describes an entire process including elements that contribute to the decision, elements of the adoption process, and elements of the reinvention process. The five stages are (1) agenda setting, similar to problem definition, (2) matching, as previously described, the problem from the agenda and the possible solution are brought together, (3) redefining, or defining the attributes of the innovation relative to the organization's needs, (4) structuring, whereby members establish the innovation within the organization's structure in the process of reacting or adjusting to it, and (5) interconnecting, whereby political questions about turf, social benefits, control and access are raised and their solutions negotiated or dictated.

Johnson and Rice focused on one innovation, word processors, and compared data collected from nearly 200 organizations. They compared not only the features put into use, but also the different patterns of implementation (for example, distribution of terminals, division of labor, design of work groups, etc.). Their data reinforced the usefulness of the multi-stage model approach and

highlighted some additional factors in information system adoption. For example, the initial stage in Johnson and Rice's (1983) model, agenda setting, corresponds with Rogers' description of problem definition. As Rogers pointed out, there are multiple factors affecting the problem definition process, including knowledge of innovations, slack resources, external accountability, and organizational structure (1976, p. 159).

Johnson and Rice (1983) found from the case of word processing that it was not sufficient to think of agenda setting from a rational perspective. Instead, they found that decision making was multi-faceted and influenced as much by systematic establishment of goals and objective criteria as by human emotion and ideology (Johnson & Rice, 1983, p. 164). In response to their survey and those of others, the rationales given for initial use of word processing were not uses that would change or improve the organization, increase productivity, or save money. The most common rationale given for initial installation of word processors was "repetitive typing" (Johnson & Rice, 1983, p. 165). This suggests that the real extent of the benefits of replacing traditional typewriters with word processors was not foreseen, but would come about later in the process as users and managers became more experienced with the new tool's capabilities.

In the next phase, matching, Johnson and Rice's data reinforced the importance of top level management support for successful adoption and implementation (1983, p. 164). In addition, they found that the attributes that facilitate adoption during this phase may have the long term effect of either suppressing its potential or generating organizational conflicts in later stages (p. 166). For example, the compatibility, or consistency with the adopter's prior experience, beliefs, and values, was initially high when word processing was placed into the existing centralized typing pools. By simply automating old work procedures rather than using the new tool to create new, more efficient work procedures, the potential of word processing was suppressed.

Communicability, or the visibility of the innovation to potential adopters, was high with respect to the visible results of rapid production, correct formatting and clean copy. Visibility of the higher quality product without a corresponding appreciation for the work involved in producing it had a dual effect in that it led to higher standards for demands on the word processing operators and eventually became the source of tension between requesters of word processing services and operator capabilities. Another attribute, divisibility, was not a strength of the word processing systems in Johnson and Rice's study. Introduction of word processing equipment tended to be large scale rather than incremental. However, as with compatibility, efforts to keep initial systems

simple also worked against developing managerial and employee expertise needed in later stages (Johnson & Rice, 1983, p. 166).

The case of word processing went beyond the stages of innovation adoption, and produced interesting findings related to the reinvention process as well. Johnson and Rice define reinvention as "the degree to which an innovation is changed by the adopter in the process of adoption and implementation after its original development" (1983, p. 169). They stressed that reinvention can occur at any of the five adoption stages. They categorize reinvention into planned or vicarious (intentional versus learning from other's mistakes), and reactive or secondary (solving a problem generated by the innovation versus solving unintended consequences brought on by reinvention) (Johnson & Rice, 1983, p. 170). Recall that reinvention is the process of adapting an organization to an innovation and vice versa. No case study of adoption is complete without following it through the reinvention process, as the consequences of this process will certainly affect future adoption processes.

Johnson and Rice noted that management and innovation practices have a direct impact on organizational effectiveness, successful accomplishment of organizational mission, and perhaps even redefinitions of that mission (1983, p. 176). They observed word processing technology, procedures, and operators in multiple organizations and found that the technology had taken on what they

considered to be different forms as a result of the different managerial conditions and different decisions made throughout the adoption and reinvention process. Each form exhibits increasing amounts of reinvention. In the first form, Low Integration, word processors were used as typewriters, with minimal understanding of, or appreciation for the capabilities of the technology (Johnson & Rice, 1983, p. 176). In the next form, called Standard Adapter: Clockwork Systems, emphasis on short term efficiency creates a reluctance to get new equipment or develop new procedures. Attention is placed on quantity rather than quality of output (Johnson & Rice, 1983, p. 177). In the next form, Expanding Systems: Supervisory Reinvention, applications evolve and functions are added frequently. Supervisors motivate change and put a premium on fast results. They invest in reinvention, and have a significant influence on the attitude of their subordinates (Johnson & Rice, 1983, p. 178). The final form, High Integration: Systemwide Reinvention, differs from Expanding Systems in that word processing was managed rather than supervised. Supervisors and operators cooperated in system development and operation, with a willingness to accept risk and uncertainty in order to experiment and learn (Johnson & Rice, 1983, p. 179). While the latter form, High Integration, appears to be the most desirable for innovation to thrive, it is not always possible or desirable for every type of organization.

The importance of Johnson and Rice's (1983) findings was not to prescribe a recipe for successful innovation, but to illustrate the fact that managerial conditions as well as the participation of those close to the work process can shape both the innovation process and the consequences of it on the organization and the innovation.

Innovation in the military

Few theoretical works can be found that focus on the process of innovation in the case of military organizations. Stephen P. Rosen's analysis, Winning the Next War: Innovation and the Modern Military (1991), is one of the few. Its weakness is that it used mainly historical examples to illustrate and evaluate the innovation process. History does in fact provide many insights, but it is difficult in hindsight to accurately assess the conditions that led to decisions and their outcomes. Examples of past successes or failures are useful to understanding the evolution of the process, but they are inadequate as predictors or measures of current models. Nevertheless, many elements of his work are useful for understanding the current process of innovation in Army organizations. These elements are examined here in some detail.

Rosen (1991) proposes that bureaucracies, large organizations with well defined procedures and centralized control, are not hard to change, even though they are actually designed not to change. Bureaucracies, including the military

services, do innovate and change. The question, then, is why and how do they change (Rosen, 1991, p. 3). Rogers agreed with that observation, stating that bureaucracies, which rely on stability for their efficiency, lose that efficiency when rapid change is introduced (Rogers, 1976, p. 149). Yet innovation and change are a regular part of most organizations, including bureaucracies. Another paradox brought up by Rogers (1976) is that the same structural characteristics of an organization that work to facilitate the innovation adoption process later work against the implementation process. He suggested that this problem might be solved if organizations could adapt a dual structure: complex, informal, and decentralized to initiate innovations, while on the other hand low in complexity, formalized, and centralized in order to facilitate implementation (Rogers, 1976, p. 156). If a bureaucracy can be designed for stability and yet adapt itself to accommodate and even to initiate the process of change, perhaps therein lies a clue to creating an organizational structure that could facilitate both initiation and implementation of innovations. Rosen's work takes a first step in addressing this issue by focusing on one very large and stable bureaucracy, the military. Rosen describes the innovation process differently based on whether it occurs in peacetime or wartime, and whether it is a social behavior innovation or a technological one (1991, p. 7). In peacetime, he says, the impetus for innovation can come from a previous catastrophic defeat or from civilian

intervention. Peacetime innovation requires a redefining of values through an ideological struggle over what the next war will look like and how it must be fought to be won (Rosen, 1991, p. 20). This ideology is then transformed into legislation or new tasks, missions, and performance measures for the military. The actors in this scenario are primarily senior military officers. Unlike a Chief Executive Officer of a civilian organization, the senior leaders of the military all come from the ranks. This creates a unique power structure in which diffusion of new ways of doing things comes about very effectively through the creation of new promotion pathways that incorporate the new tasks and performance measures. Civilian intervention can play a part in this process, primarily in the role of reinforcing the senior officers or protecting military innovators against opposition (Rosen, 1991, p. 21).

In his discussion of wartime innovation, Rosen (1991) introduces the concept of feedback in the innovation process. Improving performance of existing tasks is difficult, but learning entirely new tasks is even more difficult under wartime conditions, when time and the availability and reliability of information may be extremely limited. Even under these conditions, feedback can enable reform of certain practices, something that is short of actual innovation. Real innovation becomes necessary when the feedback, or intelligence, lies outside of established categories, or when an inappropriate strategic goal is being pursued.

Stated another way, innovation is required when the old ways are being performed well but not winning the war (Rosen, 1991, p. 35). Wartime innovation can proceed from wartime learning, but learning must go beyond improvement in existing routines. Rosen observed from the cases of the British tank, the American submarine force, and the strategic bombing force of WWII that wartime innovation proceeds from wartime learning. In each case, new strategic goals were defined rather than pursuing old ones. Thus, in wartime, real improvement in effectiveness for a military organization stems not only from the selection of appropriate strategic goals, nor even from the way it conducts operations, but from the proper definition of what and how it should be learning from its wartime experiences.

The more traditional type of innovation usually associated with the military is the building of machines, or weapons. But even this type of innovation has a political component, the recognition of which can shed light on the development and adoption of any technological innovation including both weapons and information technology. Rosen first addresses the misconception that military technological innovation comes about as a result of objective knowledge about enemy capabilities. He found from historical accounts a pattern of both peacetime and wartime research and development (R&D) surprisingly divorced from intelligence about enemy technology (Rosen, 1991, p. 187). Current

innovation decisions have been and are likely to involve the more complex question not of what capabilities the enemy has today, but what major competitors are likely to have five to ten years in the future. Rosen discusses the role of demand and the historical role of scientists in his discussion of technological innovation in the military. The ideal way to decide what technologies to develop is the business approach - estimate future costs and their anticipated benefits. Actual costs of research and development of military technology are highly uncertain because contributions in the effort come not just from within the military but from the collective resources of universities, research labs, and industry. The value yielded from military technology is just as difficult to calculate: how does one measure political and military power or the value of deterrence? The relevant question is what strategies to develop for coping with these uncertainties (Rosen, 1991, p. 53).

In Rosen's analysis of the historical role of scientists in military innovation, he found one view that new ideas for weapons systems come from scientists and engineers and rarely from within the military. Further, this view charged, the military was not even adept at selecting from commercially developed technologies and adapting them for military use (Rosen, 1991, p. 222). Prominent scientist and advisor to the President, Vannevar Bush, argued in 1945 for letting scientists become familiar with the needs of the military, and then proceed with

research independent of military interference (Rosen, 1991, p. 228). This view was valid on its face. Soldiers are trained to make snap decisions with inadequate data, while researchers supposedly know better. Military organizations tend to follow the bureaucratic imperative of self preservation, resisting the introduction of new technologies that lie beyond their existing areas of expertise (Rosen, 1991, p. 231). Once again, however, Rosen's detailed analysis of historical cases served to contradict the assumptions and reinforce the paradox. Rosen found no evidence that bureaucratic pathologies had caused the military to neglect available technologies, nor was there evidence that technological innovations had come about due to the exclusive efforts of either the military or the civilian scientific community.

Rosen concluded that successful innovations are initiated as often during periods of constrained resources as during times of growing budgets. Rather than money, he found, the key to innovation was talent, time, and information (Rosen, 1991, p. 252). Intelligence about the behavior and capabilities of the enemy was only loosely connected to peacetime, wartime, or technological innovation. Innovation is more closely linked to predictions about changes in the security environment that are based on economic, technological, and political factors outside the control of the US or its potential competitors. Successful, useful innovations, Rosen asserts, have an intellectual basis determined by

environmental factors that are independent of fluctuating policy decisions (1991, p. 254). Finally, Rosen recommends the best technique for managing uncertainty is the "low cost hedge": emphasis on research and development (R&D) and on simulated warfare on a range of new technologies and mobilization plans for mass production rather than large scale procurement of any one system. It is more effective, he says, to buy information and defer construction until a new strategic requirement is defined (p. 259). Another interesting finding put forth by Rosen is that he found no clear cut cases of "bad" innovation in the US Military. Mistakes appear to have been the result of failure to innovate rather than inappropriate innovations (Rosen, 1991, p. 53).

Barriers to innovation

Models of innovation and other complex processes seek to demystify and to provide a certain degree of structure and predictability to the dynamics of organizational behavior. As Johnson and Rice (1984) pointed out, the rational perspective on the adoption decision process fails to account for emotional, psychological, and political factors acting on the decisionmaker. Johannes M. Pennings (1987) examined some of the factors that tend to inhibit the process of innovation, including observable but unexplained reluctance on the part of some managers to exploit the opportunities new technology can bring. An understanding of the factors inhibiting adoption or adaptation of innovations

may contribute as much to the decisionmaking process as understanding the factors that facilitate them. Pennings (1987) described the phenomenon of behavioral inertia as "a tendency to persist in a pattern of learned behavior that has become established, even in the face of rather strong temptation to abandon or change it" (p. 57). As a heritable trait, the effects of behavioral inertia will manifest differently in different people and in different groups, adding a subconscious, seemingly unpredictable element to the decision making process. In terms of innovation connected with new technology, says Pennings, "either the benefits of change or the cost of inertia must be extremely powerful before adoption will occur" (1987, p. 19). Inertial forces may have a greater impact on radical adoptions, where sweeping changes are swiftly introduced into an organization and the people are unfamiliar with the technology. The impact on acceptance of the new technology is likely to be fragmentation, delay, and interruption (Pennings, 1987, p. 214). Pennings (1987) found that innovative organizations did not overcome strong emotional barriers per se, but treated them as part of the common, ordinary routine of individuals and of the organization. In his Routine Change model, Pennings introduced several submodels of what he called ordinary routines that can lead to adoption as part of simply the "normal flow of things" (1987, p. 20). He emphasized that these submodels were not determinants of innovation, but instead a way of understanding adoption in

terms of the unfolding of a host of standard operating procedures. For example, an organization may follow defined search routines as part of its problem-solving model and discover new technology as a solution to problems. New technologies may be perceived as critical for market survival and adopted as a result of a routine scan of the capabilities of the organization's competitors. The organization may adopt on the advice of consultants or in response to demands by clients or customers. Accepting that organizational routines can mitigate behavioral inertia and promote innovation leads to a host of possible strategies for formulating technological policies, such as maintaining openness to the environment, tracking and forecasting technological trends, and making structural adaptations like creating unique position, teams, and mechanisms for implementing new technologies (Pennings, 1987, p. 214).

Forecasting the future

As illustrated above, innovation adoption and development decisions come about in many ways. Rational analysis of organizational requirements is but one of them. Factors such as knowledge of innovations, slack resources, and external accountability (see above) focus on the ability to see, understand, and respond to the environment as it exists today. But success in the competitive business and security environment requires the ability to anticipate the requirements of the future. Business and military leaders alike seek not to merely

keep up with their competitors but to stay ahead of them. The perception of necessity may come about more from a vision of the future rather than from some measurable observation or economically calculated value. Contributing to that vision are knowledge of emerging technologies and how they are intended to be used, as well as an informed and enlightened conception of the environment or context in which these technologies will likely be developed and implemented.

Several scholars have sought to describe the future environment and how it will influence the direction and nature of future technologies and ways of using them. Futurist views have had a great impact on military doctrine and strategic business goals, and thus have contributed to decisions to initiate development of new technologies. For example, an Army doctrinal publication, Training and Doctrine Command (TRADOC) Pamphlet 525-5, Force XXI Operations, (1994) lists in its references the works of futurist theorists Alvin and Heidi Toffler. Force XXI Operations describes the conceptual foundations for the conduct of future Army operations in war and in operations other than war involving Force XXI, the US Army of the early twenty-first century. The purpose of the document is to provide a basis for development of supporting concepts, programs, experiments, and initiatives, many of which have already begun.

According to Alvin and Heidi Toffler (1993), historical epochs or waves of socioeconomic change are brought about by revolutionary technological

change. The first (agrarian) wave was characterized by animal domestication and agricultural cultivation, the second (industrial) wave by mass production and mechanization, and the third (information) wave by digitization, computers, and information technologies. The effect of these socioeconomic developments has been to alter the world economy and the goals of military strategy. If the analogy holds, then information is the new basis of power. For example, companies can achieve competitive advantage and thereby make more money through the effective use of information. The Army can control the terms and progress of battle by maximizing the ability to collect and process relevant intelligence and transmit directives while denying this capability to competitors.

Another futurist theorist, George Gilder, describes socioeconomic change in terms of "paradigm shifts" (1997). He explains that "the key to paradigm shifts is the collapse of formerly pivotal scarcities, the rise of new forms of abundance, and the onset of new scarcities. Successful innovators use these new forms of abundance to redress the emergent shortages" (Gilder, 1997). Returning for a moment to Johnson and Rice (1983) information technology creates new information pathways and makes information flow more efficient (p. 158). The very scarce resource in organizations is attention. Information systems should therefore be designed to free up this scarce resource for more crucial tasks than prioritizing, filtering, and editing the flow of information. This requires new ways

of doing work, not just more efficient ways of doing the same work. This example illustrates how a vision of the future environment can be an impetus for innovation in technological and organizational design.

The human dimension of innovation

Reinvention of organizations involves a transformation in the design and strategic goals of the organization, but must also include some corresponding transformation on the part of the people who make up the organization. The human dimension is often mentioned in innovation literature, but research on the effect of new technology on social and cultural change is difficult to find because the results tend to be incomplete or inconclusive until the technology has been in use for a long period within a population. But theories and opinions abound about the effect of the Information Age on human conceptual behavior. Army Colonel Paul T. Harig (1996) postulated that "complexity of life may produce corresponding changes in complexity of mind". He explained that the explosion of information had transformed the meaning of the concept of expertise. In the past, an expert was a repository of facts. Today, an expert is defined by the ability to efficiently find and manipulate data, to recognize patterns and integrate new facts from data without being overwhelmed by it. If the power of computers is in the ability to imitate human intelligence, the power of humans to use computers may require that they adopt a sort of "digital

thinking" pattern, while still retaining the very human traits of intuition, risk-taking, and creative thinking.

Pennings (1987) observed what he called the gap between the technically possible and the organizationally realizable (p. 77). He also applied the concept of a "cultural lag" to information technologies, where changes in technology move much faster than the culture (collective values, beliefs, ways of doing things). Do the demands of the Information Age now require leaders to be technology experts? Do technology experts need to master social and political skills? As an organization is reinvented, what transformations occur in its members or future members? Pennings (1987) described the "role of boundary spanning individuals', stating that professionals would need social change skills, complimenting their exclusive expertise, to modify beliefs, ideas, and values so that these will fit the imminent technology of their organizations (p. 213).

Walter B. Wriston, former Chairman and Chief Executive Officer of Citicorp/Citibank, and former Chairman of the Economic Policy Advisory Board in the Reagan administration, wrote, "an expert is a person with great knowledge about a legacy system" (1997, p. 181). Henry Kissinger (1994) observed "It is, after all, the responsibility of the expert to operate the familiar and that of the leader to transcend it". It would seem that the need for both "experts" as well as managers and leaders is as important as ever, but the roles and expectations of

both may be significantly different in the Information Age. Recognition of this fact is already written into Army doctrine and into the curriculum at the Army War College, an academic and research institution for educating the nation's senior strategic leaders. For example, among the attributes identified as crucial for the senior commanders and staff in the Army are direct references to managing and responding to change, leading in "learning organizations", fostering a determination to innovate, facility in managing an avalanche of data, exercising "enlightened control", and hands-on skill on computers (Chilcoat, 1995). The reinvention process for members of military and business organizations may well begin with the integration of Information Age concepts into educational curricula.

The common thread throughout the many approaches to innovation and reinvention research examined here is the certainty of change and the need to prepare for and adapt to it. Organizational structures, work, and people must be changed, and information technology is both a cause of and a tool for change.

Chapter 3

RESEARCH METHOD

This study describes how an Army organization innovates. The focus is on contemporary, real life events that are dynamic and ongoing. The preferred strategy in this case is the case study method, relying on direct observation and systematic interviewing.

Case study methodology

This research follows a case study protocol appropriate for the single case (embedded) design as described by Yin (1989, p. 46). The rationale for the single case design is twofold. First, the case of the Center for Strategic Leadership's Strategic Crisis Exercise intranet is revelatory in the sense that the investigator had a unique opportunity to observe a process that is not inaccessible, but very difficult for similarly situated investigators to explore in detail. The investigator's status as an active duty Army officer with a security clearance gave her access, and her experience in planning, operating, and maintaining information technologies within Army organizations gave her a basis from which to construct appropriate interview questions and apply appropriate theory. Second, a single case study is necessary due to resource constraints. The intranet technology adopted by the Center for Strategic Leadership is widely available and is used by many other Army and business organizations. A study of multiple cases would be very valuable and the

investigator invites other researchers to do so. This study should be treated as foundational. It establishes the relevance of studying adoption and reinvention of information technologies within the context of the U.S. Army, and the applicability of existing theory to this unique context.

Unit of analysis

The overall unit of analysis in this study is the Strategic Crisis Exercise (SCE) intranet, adopted by the Center for Strategic Leadership (CSL) in 1997. Within this larger unit of analysis lie several subunits. For example, in order to construct a coherent description of the overall process of adoption and the subsequent reinvention of the SCE intranet, it was necessary to examine the effects of related and intermediate processes and the perspective of different individuals. Each of these stages could be considered as a process in itself and each contributes to the overall process of innovation.

Interview development

With no prior knowledge of the CSL or the SCE intranet, the investigator drafted interview questions based on Rogers' stages of the innovation process in organizations (Rogers, 1982, p. 363). The two main stages identified by Rogers (1982) were 1) Initiation, and 2) Implementation (see Chapter 3).

Within the initiation stage, the intermediate processes and relevant questions related to those processes were as follows:

a. Agenda setting: What was the original intent for the SCE intranet? What was the problem it was intended to solve, or the directive or opportunity it was intended to address?

b. Matching: What benefits were expected to be gained from the use of the SCE intranet? What problems were expected? What were the barriers and facilitators to the final decision to adopt the SCE intranet? What were the risks?

Within the implementation stage, the intermediate processes and relevant questions related to those processes were as follows:

a. Redefining/restructuring: What modifications were made in the SCE intranet to make it fit the organization? What modifications were made in the organization to fit the SCE intranet?

b. Clarifying: How was the SCE intranet introduced for wide use? What were the results, both intended and unintended?

c. Routinizing: How is the SCE intranet currently used? Has the use of the SCE intranet been initiated for any new activities since its adoption? Has it been discontinued for any activities?

This use of Rogers (1982) framework proved very useful in identifying the appropriate individuals to interview and guiding the conduct of the semi-structured interviews.

Interview respondents

Individuals interviewed for this study were categorized into four groups:

System Developers (SD) – those who originally conceived of and designed the system. This category includes systems analysts, programmers, contractors, etc.

System Maintainers (SM) – those who currently maintain the network and make modifications to it in response to mission requirements. This category includes signal (information management) staff, system administrators, etc.

Key Leaders (KL) – the system "owners" who either directed that the system be developed or approved the system as a solution. This category includes the Director of the CSL, the Commandant of the Army War College, etc.

System Users (SU) – those who use the system to accomplish their mission, including students and controllers participating in the Strategic Crisis Exercise.

Although each respondent consented to be interviewed and quoted, confidentiality is maintained in this report by referring to respondents only by their respective category (SD, SM, KL, or SU), and a number (e.g., SD1, SD2 refer to System Developer 1, System Developer 2, and so on).

Prior to the interviews, questions were formulated based upon the processes described above, and tailored to the specific categories of individuals identified here. With the help of a CSL staff officer, respondents from each of the categories were identified and permission to interview obtained. The actual questions asked in the interviews differed from the draft questions

where necessary to pursue unexpected issues raised by the respondents, but the draft questions provided an excellent interview guide for the investigator.

The respondents were chosen based on their qualifications as system developers, maintainers, users, and key leaders as described here. Another important selection factor was respondent availability. The investigator was limited to a four day, on-site visit for observing the SCE intranet and conducting face-to-face interviews. A total of five SDs were interviewed, consisting of four active duty Army officers and one Department of the Army Civilian. Three SMs were interviewed, consisting of one active duty Army officer responsible for the procurement and proper functioning of the hardware and software associated with the intranet, and two responsible for programming patches and modifications. Five KLs were interviewed, consisting of four active duty officers responsible for running the SCE, as well as one Reserve officer responsible for data collection during the SCE. Two SUs were interviewed, consisting of active duty officers who participated in the SCE as Army War College students. Ideally, additional users would have been interviewed to include the controllers who use the intranet to initiate the events that drive the exercise, and observers who critique the response of the students and conduct after action reviews to help students learn from the experience. Since it was not possible to observe an actual SCE in progress, the perspective of the controllers was represented by the KLs who run the SCE and supervise the controllers.

Observation

In addition to on-site interviews, the investigator used additional sources of information including direct observation of the SCE intranet features, its look and feel, and its functionality. In general, an intranet is characterized by the use of Internet technology to provide many of the same functions to a specific organization as the Internet does to the general public. The technology consists of, but is not limited to, Web servers, Web browsers, and hypertext-based applications. The functions include electronic access to information, single user interface to various computer applications, and hardware independent delivery. The attraction of Army and business organizations to intranets is the cost effective and timely approach to the distribution of information.

Other sources of information used by the investigator were information papers and briefings generated by the CSL, archival records and journal articles written by CSL and Army War College personnel, and various government Web sites giving background information on Army doctrine, training policy, and information management policy. The investigator's personal experience as officer-in-charge of communications and automation on the staff of a large Army training center also contributed to the way in which data was collected and interpreted for this case study. This may be seen as a source of bias were this study an evaluation of the SCE intranet or the innovation process of the CSL. However, as stated previously, this study

is not evaluative but descriptive. Therefore, the investigator's background does not add a bias but instead improves her ability to act as an "expert observer" and provide an accurate description and a meaningful analysis of the process.

Data analysis

Rogers' (1982) model aided both data collection and data analysis. Data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence, to address the initial propositions of the study (Yin, 1989, p. 105). The mode of analysis used for this study to address the initial research questions was a variation of the pattern-matching technique (Yin, 1989, p. 109). A predicted pattern was based upon Rogers' model of innovation adoption and Rice's framework for reinvention (see Chapter 3). The findings of the case study helped to validate certain elements of these models when applied in the context of an Army organization, and provided the basis for an alternative model to be fully developed and validated by further study.

External validity

External validity establishes the domain to which a study's findings can be generalized to other cases (Yin, 1989, p. 43). It should be stressed that the findings of this study are not generalizable in a statistical sense. That is, a sample of one case of innovation in one Army organization does not readily generalize to apply to all cases of innovation in all Army organizations. The

innovation of intranet technology is common in many Army organizations but the Center for Strategic Leadership is unique in its mission, structure, and available resources. External validity in this case relies on analytical generalization, in which a particular set of results generalize to some theory (Yin, 1989, p. 43). The evidence in this case was carefully analyzed to show consistency or inconsistency with existing theory described in Chapter 3, thereby providing a theoretical basis for further research in other Army organizations.

Chapter 4

FINDINGS

This chapter describes the subject organization, the organizational mission that the innovation is intended to address, the innovation itself, and how the innovation is used in support of the mission. Following a description of the organization and the innovation of interest, answers to each research question (see Chapter 1) are presented based on interviews, briefings, observations, published reports and other archival data.

The Center for Strategic Leadership

The Center for Strategic Leadership (CSL), located on the grounds of the Army War College at Carlisle Barracks, Pennsylvania, is the U.S. Army's strategic education center where senior military officers and government civilians are schooled in the art of strategic thinking and decision making. The resources of the CSL go toward education and research focused on the decision making process at the inter-agency, national, and strategic level. Its mission of education, research, and outreach support the senior leadership at the Department of the Army, combatant commanders around the world, and the Army War College. The activities of the CSL include support for strategic level political-military simulations for Army War College students, support of Army Staff and Joint Staff exercises, and conduct of interagency

education and training. The Strategic Crisis Exercise (SCE) is one of the activities the CSL conducts in support of the Army War College curriculum.

The Strategic Crisis Exercise

The Strategic Crisis Exercise is an annual, ten-day, computer-supported, practical exercise in which students of the Army War College are able to integrate and apply the knowledge gained during the academic year through experiential learning. The SCE has been conducted at the Army War College since 1995 with the opening of the Center for Strategic Leadership in Collins Hall. Students form cells representing government and military agencies at the national level, such as the National Security Council, Department of Defense, the Department of State, the Department of Commerce, the Joint Staff, and geographic Commanders-in-Chief (CINCs). Faculty and subject matter expert participants take on roles such as military and government staff elements, National Guard Bureau (NGB), Federal Emergency Management Agency (FEMA), the Surgeon General, members of Congress, and media representatives. By visiting or using remote access, guest participants like members of Congress or CINCs will participate as themselves and provide realism for the exercise and mentorship for the students. The cells are physically separated from one another to simulate the real life distances between the agencies involved. Communication between cells is also realistically accomplished through video teleconferencing, telephone and conference calls, and e-mail, for example. The SCE scenario is set nine to

eleven years in the future, when the current students might be Generals serving in key political and military positions. It is conducted with 320 War College Students as players, 150 faculty as observers and controllers, and invited guests who act as observers, players, and mentors. The mission of the CSL is to provide exercise participants with information technology tools that approximate those they might encounter in the future, many of which are enhancements to existing technologies that are already in progress. It is up to the leaders and developers in the Science and Technology Division (STD) of the CSL to keep up with technology trends and to come up with their version of current and upcoming technologies for use in the SCE. They cited the Internet as the most important source of information to keep current on both military and commercial developments. As recently as the early 1990s they would have been limited to the information they could take in through volumes of printed publications that may be out of date by the time they were delivered.

With the aid of the SCE intranet and other automated tools, the exercise controllers create an environment intended to stress students' analytical and decision making skills. Participants are presented with a series of crises occurring in the U.S. and all over the world including armed conflicts, natural and manmade disasters, peacekeeping and peace enforcement missions. They then decide on the appropriate employment of national military, economic, and political power in response. This must be done within the limits of

available resources (also managed by computer), such as the availability of active duty and reserve military forces and of strategic airlift, etc. The exercise scenario is written to depict realistic situations and present a logical progression of events to which the participants, role-playing as military generals, national security decisionmakers and advisors, must react. The scenarios are sufficiently complex to require the participants to use the information gathering, decision making, and collaborative skills spelled out in the learning objectives for the exercise.

The SCE Intranet

For purposes of this study, SCE intranet refers to that portion of the CSL local area network that is used for internal access of students and faculty participating in the SCE. It includes the physical network, Web server, database server, and browser interface. Certain separate applications that support running, playing, and controlling the SCE and are delivered via the network are covered also, although technically they are currently not a fully integrated part of the intranet. This study was only concerned with the development and use of the intranet as a solution to the requirements of the SCE mission, although the use of the intranet is not limited to the features and functions discussed here.

Just as the National Information Infrastructure (NII) is the nervous system of real-world crisis action, the information infrastructure supporting the facilities of the CSL are the nervous system of the SCE. At Collins Hall, the

building where the CSL is housed, a portion of the NII has been replicated as closely as possible using state-of-the-art information and communication technologies. The new facility provides rooms equipped with visual information support, access to two local area networks (one classified and one unclassified), over 400 PCs and Sun SparcStations, video-teleconferencing capability, printers, large monitors, telephones with internal and external lines, whiteboards and world maps.

Internet/intranet technology is considered one of the most important means of information sharing in the future environment of the SCE. An intranet provides a networking environment with the browser providing a standard software interface to numerous files, applications and databases. Intranet management software allows users to post information as simply as copying a file to a disk drive. Hence the attraction of intranet technology to all types of organizations: accessible technology with a familiar interface and user friendly interactivity. Because a majority of participants are experienced in using the Internet, the SCE intranet meets the requirements of the CSL's automation architecture design philosophy. As stated in a CSL monograph entitled "Simulating the Future: Automated Tools for Strategic Wargames", the goal is to show the students something new, but not to make them spend their time learning how to push new buttons at the expense of strategic thinking, crisis action planning, and the interagency process.

The SCE intranet was designed to support the student/players, faculty/controllers, and guest participants with tools for driving the scenario, gathering information, making decisions, and issuing responses. Previous to the adoption and implementation of the intranet, all of these functions were done manually, with text-based e-mail support, paper copy messages, and with volumes of reference books. The intranet was, as of 1997, comprised of four main sections (see Figure 2): 1) Administrative, containing information about visitors, announcements, schedules, and other notices that fall outside the gameplay. 2) Controller Guide, containing exercise control information that is visible only to the controllers. 3) Student Guide, containing reference information and tutorials for the students. External agency homepages are downloaded and modified to correspond to the scenario for students to obtain data from realistic looking sources. 4) SCE Scenario, containing actual exercise data, including world summary information, maps, news, plans, and intelligence updates. The system used intranet "cookies" to control which information each student desktop can access. For SCE '98, the security control features provided by the Netscape server software ensured that the appropriate information was delivered electronically to the correct participants. For SCE '99, the CSL changed the standard browser from Netscape Navigator to Microsoft Internet Explorer, utilizing the security features of Microsoft NT and Internet Information Server (IIS).

SCE INTRANET DESIGN

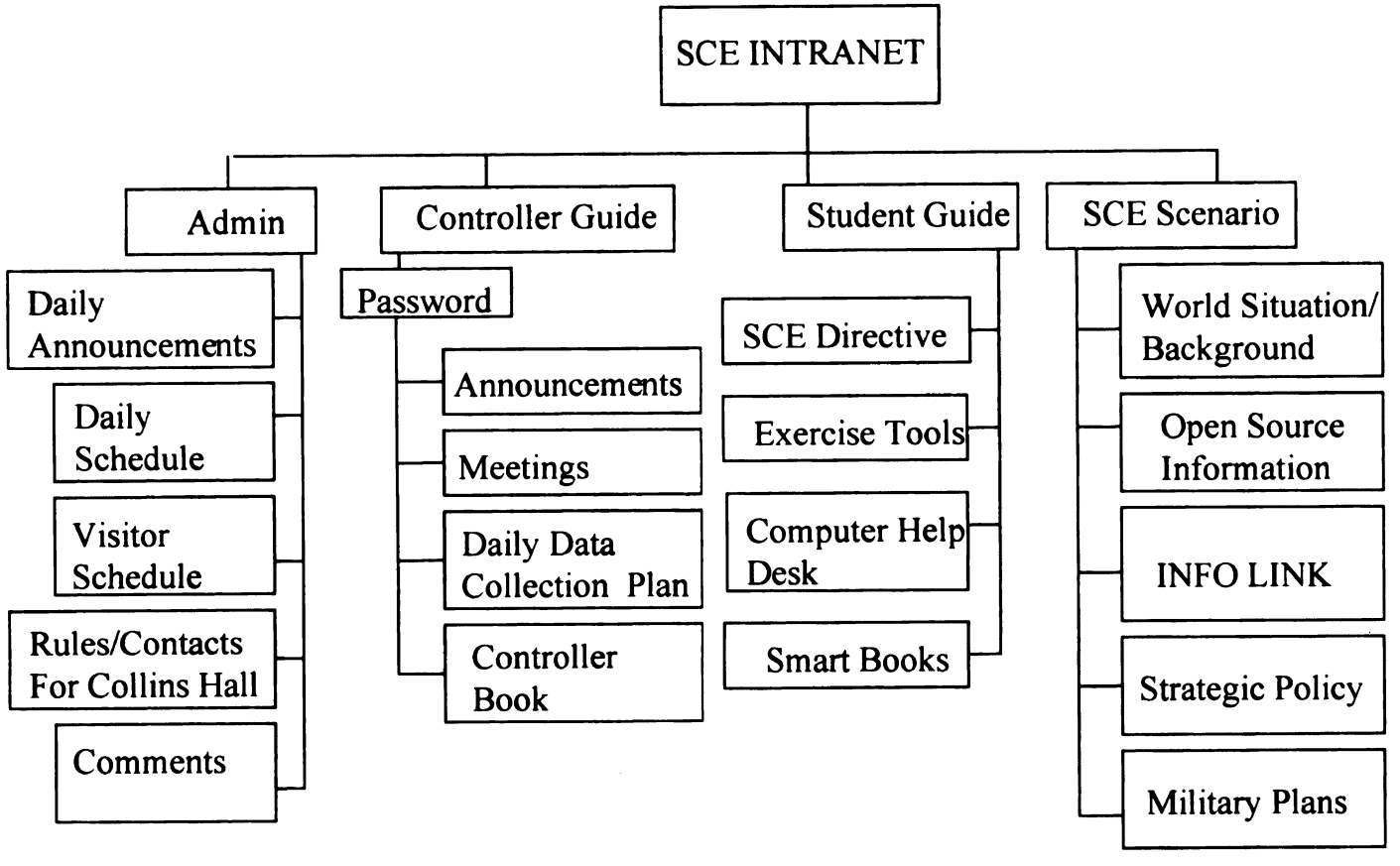

Figure 2. SCE Intranet Design

Running the SCE

The SCE is driven by event selection and notification. A list of messages and other information called the Master Scenario Event List (MSEL) is kept in a database until they are required for the scenario. Messages trigger an event (called an implementer) when broadcast over the network via e-mail or other means to the appropriate student cells. Realism is further enhanced by the ability to apply notional addresses, i.e., address lines that reflect the roleplaying identity rather than the actual name of both senders and recipients. This process of injecting implementers into the game was previously managed and executed manually, a complicated and time-consuming task that slowed down the pace of the game.

For SCE '97, the staff of the Knowledge Engineering Group (KEG) in the Science and Technology Division (STD) of the CSL designed and constructed an automated system that integrated e-mail and a Microsoft Access database via an Object Linking and Embedding (OLE) mail server. This system, called the Strategic Wargame Automated MSEL Injector (SWAMI), selects the appropriate message and releases it to the correct student cells at a scheduled time. SWAMI has a simple user-interface, an embedded connection to a mail server that distributes implementers automatically, and a simple reporting capability with which controllers can pass information to the observers in the student cells. The result was more realistic looking messages, elimination of redundancy and increased flexibility of the game scenario to follow different

threads in response to participants' reactions. Programmers internal to the organization designed, implemented, and fixed initial bugs in the system using widely available Microsoft Visual and Access Basic programming language. For SCE '98, SWAMI was upgraded to automatically update scenario information on the intranet Web pages to keep them consistent with information in the e-mail messages released to the players.

Once the implementer is launched, the participants must develop a response. In real life, the commanders and agency chiefs being role-played by the students have large staffs to develop courses of action and assess the feasibility of each. Operations research analysts in the STD developed a suite of automated decision support tools to replicate much of this process and allow the students to focus on critical evaluation and decision making rather than staff work. Each of these decision support tools is a PC based application linked through a common database, and tailored to the needs of a specific player. Users need only minimal spreadsheet and database expertise to be proficient in the use of any of these tools. The analysts intend for the applications to run through the intranet browser interface. Currently, the applications are not browser based because of problems with slowing down database access.

The SCE employs a data collection team to obtain feedback from the exercise. The main concern of the team is whether students become proficient with the Army War College's learning objectives. The data collection team

observes key events, conducts interviews with students and faculty, interacts with exercise controller, and provides responses to pre-defined questions focusing on issues of interest to the exercise designers and War College instructors. The information is used to conduct reviews of exercise events, to make changes for future SCEs, and to modify the War College curriculum if necessary.

Research Question #1: How did the CSL adopt the SCE intranet?

In 1995, the Strategic Crisis Exercise replaced a year-end practical exercise conducted at Root Hall, the War College classroom facility. The earlier exercise was conducted without automation support in a traditional seminar format. With seminar format, participants sat around a conference table and discuss the situation, their options, and their responses. Players tracked events on a map board and controllers drove the discussion by injecting scenario information into the discussion and depicting counter-responses to student actions on the situation map. The process of how the SCE intranet was initiated in support of the new computerized exercise can be described using Rogers' stages of innovation adoption (1982, p. 363) to organize the sequence of events.

Initiation stage, agenda setting process

Students were not satisfied with seminar format for the practical exercise because of the artificiality of the events and the lack of realistic feedback on the consequences of their decisions. The War College faculty was not

satisfied because it added little value to the classroom instruction and was time and manpower intensive. The exercise developers were not satisfied because the use of manual procedures created redundancy and inconsistency in the scenario. Controllers could not possible keep up with the flow of events and enforce the limitations on feasible responses.

In the aftermath of the Cold War, the Army began a major drawdown of personnel and budget resources. World events signaled a major change in the national security environment as well, and forced a reevaluation of assumptions upon which the Cold War Army was based. The collapse of the Soviet Union, the accelerated pace of new computer technology, and the emergence of armed conflicts in previously stable regions of the world made predicting and preparing for the future extraordinarily difficult. The Army has always used wargames as part of an attempt to manage the uncertainty of identifying, describing, and evaluating possible changes in the way it accomplishes its mission. In the mid 1990s, computer simulations had become a major component of these wargames, first because of the cost savings of simulations over large scale deployment of troops and equipment, and second because of the complexity and interactivity afforded by computers. Computer wargames could be repeated again and again using different scenarios to test different hypotheses and assumptions. The results of the games helped Army leaders to assess new weapons technologies, force structure, and doctrine. Wargames were also used to educate Army leaders in

the art of strategic thinking. At the Army War College, the Center for Strategic Wargaming, precursor to the Center for Strategic Leadership, developed wargames to support the War College curriculum. At the same time, computer and communications technology became more and more critical to the Federal Government and the military in coordinating interagency activities. Collins Hall, a state-of-the-art facility providing conferencing facilities, two classified and two unclassified local area networks, GCCS, video-teleconferencing facilities, and access to the Defense Simulation Internet and the Defense Data Network, and worldwide commercial databases was opened on the grounds of the Army War College in 1995. Although the computer and communications technologies in Collins Hall were installed prior to the creation of the SCE, they provided an opportunity for the new CSL to take advantage of the networks and processing technology to emulate the environment in which War College students were learning to operate.

In spite of the availability of sophisticated voice, visual, and data networks at Collins Hall, automation support for the first SCE in 1995 consisted only of e-mail and word processing. The lack of automation skills on the part of the students contributed to the minimal use of technology. As former battalion commanders, they were unused to sitting at the keyboard and unwilling to take the job of downloading and sending e-mail away from their clerks and secretaries. For the second SCE in 1996, the CSL introduced a system called

Analysis and Gaming Information System (AGIS). AGIS was a computerized wargame system originally developed for use at the Joint Warfare Center by using contracted, outsider developers. In the traditional method of development, the organization's operations research analysts translate requirements into pseudo-code and pass it on to contractors to program, usually using a complex programming language like FORTRAN. Army operations research analysts in the CSL typically confined their activities to conducting studies, preparing requirements documents, and interfacing with contracted programmers. In 1996, the new leadership of the CSL took a different view that Army operations research analysts should also do their own programming. The analysts had to quickly pick up or refine their programming skills, especially to work with AGIS, which used a Mosaic-like interface and multiple CD-ROMs and disks to store information. Adding information sources was a major programming effort. Again, the students and exercise developers were not satisfied because the technology that was supposed to make running the exercise more efficient by automating reference materials was so complex to use and to program that the game seemed to be driven by the automation tools instead of by the War College learning objectives. Students spent inordinate amounts of time typing, reading, calculating and trying to make the computer do what they wanted, and less time doing the strategic decision making they were supposed to be learning. One SD referred to this phenomenon as the "tail wagging the dog", meaning

that the tail, or the technology that was supposed to enhance the learning process, was instead driving the conduct of the exercise. At the top of the CSL's agenda for the next SCE was to develop more efficient and user-friendly automation tools.

Initiation stage, matching process

By 1996, the Internet was used widely and had a huge impact on the CSL's ability to develop automated tools to support the exercise. The leaders and developers in the STD set out to use the existing network in Collins Hall to create an "internal Internet" that would deliver the same benefits to the SCE participants as the Internet did to the public and to many businesses: a vehicle for distributed storage of data and applications, a means of enabling network users to also be content providers without extensive technical assistance, flexibility and responsiveness to user demands.

The original intent for the SCE intranet was to provide an automated system to feed intelligence and situational information to the students and enhance the realism of the game. Developers sought to emulate an information system the students would use in real life, the intel-link function of the Global Command and Control System (GCCS). Their objective was to replicate the look and feel of intel-link using exercise data and without making a live connection to the real thing. The staff of the KEG and the operations research analysts found that they could emulate many traditional mainframe based systems using Visual Basic programming language and the

Microsoft Office suite of applications. The programmers themselves were active duty Army officers who were familiar with many of the processes and tools they were tasked to emulate, so application development became a one-person project instead of a major, multi-stage, partially or fully outsourced project. With the power of the intranet, they could deliver not only emulations of existing systems but create applications of their own to accomplish staff functions and force players to stay within the predefined time, space, and resource box imposed by the scenario.

Not everyone was optimistic about the use of the intranet. High expectations among the technology-savvy led to concerns among developers as to whether the system would be ready for its debut in SCE 1997. On the other hand, many of the War College instructors were skeptical that the intranet would be any more useful than previous technologies that didn't live up to the promise of being user-friendly. Although HTML was certainly much easier to use than programming languages like FORTRAN or C, there was still very little expertise in HTML among the instructors and controllers who were needed to create the content for the intranet. The lead intranet SD created the shell for the site, but the participation of the instructors was critical to meet the objective of providing access to content supporting the War College curriculum. The staff who ran the exercise also had to be persuaded to adjust their routines and sacrifice some short-term efficiency learning to use the new system on top of the multitude of other critical tasks

they had to perform. The lead intranet SD used the regular staff meetings as a forum for informing and promoting the benefits of the intranet to the decision makers and future users, who were not experienced in the capabilities of the intranet. He made a concerted effort to convince KLs like the Deputy Commandant at the War College whose attitude toward the new system had a great influence on other members of the organization. He also adopted an onion skin approach to development, in which the intranet in its basic form was implemented first and later expanded to add more functionality as the users got used to it.

Research Question #1 Summary

In summary, the key factors and events leading to **adoption** of intranet technology in the CSL were 1) performance gaps perceived by students, faculty, and exercise developers in the ability to meet learning objectives and the ability to optimize the use of state-of-the-art technology available at Collins Hall, 2) broad guidance and external pressure from Army leadership whose vision was of the CSL as a "high technology laboratory" and a "preeminant strategic wargaming facility", 3) knowledge among leaders and exercise developers about technologies in use in the military and national security organizations they were attempting to emulate, 4) knowledge among exercise developers about current technologies, programming languages and software and the ability to use them to create customized applications, 5) a change in the leadership philosophy that moved from the expectation of long

term contracted software development or the employment of existing wargaming models to internal creation and implementation of customized applications, 6) the impact of the Internet as a model for intranets and a source of information on new technologies and applications, 7) the influence of opinion leaders in convincing users to adopt the new technology, and 8) incremental implementation to allow users to become accustomed to using the basic system before expanding the functionality.

Research Question #2: How did the CSL reinvent the intranet?

The CSL made numerous changes to the SCE intranet in the process of adoption and throughout each stage through to its implementation. Changes were made so quickly in some cases and with so much regularity that it was difficult to distinguish one stage from another. In 1997, the first year the intranet was used in the SCE, Netscape Navigator was the standard browser, largely because Netscape was the standard browser designated by the Defense Information Systems Agency (DISA). For SCE '98, Netscape Navigator was still used, but a Windows NT server was installed on the classified network. Netscape Navigator initially had problems interfacing with the Windows NT server. According to a SM, the decision to convert to Internet Explorer (IE) for both the classified and the unclassified portion of the network, starting with SCE '99, was based on the speed at which IE operates, the fact that it was integrated tightly into the other Microsoft applications, and the use of active server pages with Microsoft Access. Active server pages make it very

easy for users to update content on the intranet, such as daily announcements. The system maintainer said that leaders are very receptive to authoring content themselves, as long as it is easy to learn and do, as an alternative to passing draft documents to a clerk or staff member to post on the intranet. This was a big shift from the days when senior leaders preferred not to operate their own e-mail accounts.

Many of the automated decision support applications used in the SCE came about as a result of the developers themselves recognizing and defining the requirement. One SD credited the recent capability to purchase commercial-off-the-shelf application development tools quickly by credit card with the ease of creating PC based strategic decision aids for the SCE. With these development tools, like Visual Basic and Microsoft Office, he was able to make changes on the fly as opposed to going through a long procurement cycle or contract change.

For data collection and feedback during the exercise, the original system used a simple groupware system. The groupware system would collate the data but not organize it, making it very difficult to extract key points and assemble a useful report. Since 1997 the CSL employed a database system known as the Learning Enhancement, Assessment, and Data Collection Tool (LEADCT), which allowed users to collate data based on learning objective, scenario, student cell, or time of observation by using simple database queries. LEADCT was written in Microsoft Access version 2.1, adopted from

the Joint Warfare Center. According to a KL, the system was cumbersome because it required data collectors to gather information relevant to 57 learning objectives, appropriate for other exercises but far too broad a scope for purposes of the SCE. He became aware of the shortfall through informal feedback from the observer-controllers and data collectors after the exercise. At the time of this writing, SDs were developing a user-friendly alternative to LEADCT called Phoenix. Phoenix will focus on a few learning objectives and questions of interest to instructors and exercise developers to make future improvements. It is also intended to reduce the workload on the data collectors and analysts by automating much of the pre-processing of the report data.

In addition to the initiatives of the leaders and developers to improve the system, another source of change they reported is feedback from students and faculty during and after the SCE. A KL described the measure of success as the "volume of complaining from observer-controllers and students". Many modifications were made immediately and others required additional research or experimentation to resolve consistency and compatibility problems. Updating the scenario was a continuous process in which exercise designers review concept plans, the world summary of civil-military-political conditions and events, area studies furnished by the Central Intelligence Agency, Department of Defense budgets, treaties and agreements, and many Internet references to make the scenario as realistic and futuristic as possible.

Exercise designers updated the scenario portion of the intranet without an intermediary. It was as simple as updating a Microsoft Word document on the hard drive. For SCE '99, an entirely new scenario was being added at the suggestion of a visiting U.S. Embassy representative from Canada. Scenarios are not intended to be a prediction or reproduction of real events, but they are based in reality in order to stimulate the strategic thought and decision making process that students can apply to the issues they will face when they graduate.

Another recent change to the intranet was the improvement of the directory system in 1998. The SD first created the intranet home page but converting the concept slide to an image map, i.e., an image that would appear in the browser window that was divided into "clickable" zones with hyperlinks to different sections of the intranet. Testing the interface and using well designed multi-page Internet sites as a model, the SD made several improvements in the appearance, organization, and content of the SCE intranet interface. Reference material for current year administrative information (e.g., 1998 information for SCE '98) used by controllers and students was placed in a directory called Exercise Guides. All information relevant to the scenario year (e.g., 2008 for SCE '98) was contained in the Scenario Guide directory. A subdirectory was added to the SCE Scenario directory called Strategic News Network (SNN), a fictional news entity, to provide a central source for game related headline briefs, wire service

updates, and overseas news. The Intel Link, which emulates the Global Command and Control System feature of the same name, was renamed Info Link and provided links to replicas of the Web sites of the U.S. military services, major commands, and governmental agencies such as the Department of the Treasury and National Security Agency.

Further changes to the SCE intranet are planned for the future that will both improve the way the exercise is run and help create the technological conditions likely in the next ten years in which the exercise scenario is set. A project has been undertaken in conjunction with George Washington University and the U.S. Army Artificial Intelligence Center to build an agent-based system to teach students about information warfare. A type of software program called an "intelligent advisor" would be available through the intranet to help students respond to a simulated cyber-attack on the intranet during the exercise. Another planned change is in response to the current system of having both classified and unclassified links. An intranet add-in would dynamically modify Web pages on-the-fly to tailor the appearance of links to the user's level of classification. Currently all links are visible and the system either activates them or deactivates them based on Internet "cookies", which are software agents that provide the network with information about the user. Modifications are planned and made with the common goal of increasing information availability, organization, ease of use, and consistency with existing and future inter-service information systems.

Research Question #2 Summary

In summary, the ways in which the CSL reinvented the SCE intranet were 1) conversion from Netscape browser to Internet Explorer browser to enhance speed and interoperability with other Microsoft applications, 2) development of customized decision support tools to simulate the information processing functions of a staff so students could focus on decision making, 3) replacement of a generic groupware system with a more specialized data collection and feedback tool, and subsequently with a customized product to reduce the information processing requirements of data collectors, 4) posting exercise scenario information on the intranet and allowing scenario writers to continuously update it without using an intermediary, 5) improving the directory system to make it more attractive, easier to manage, and easier to expand in the future. Modifications were continuously planned and implemented as a result of routine channels of input from leaders, developers, maintainers and users as they prepare for and conduct the exercise. The primary reasons for the modifications were to add functionality (as with the data collection and decision support tools) or maximize the system's capability (as with the active server pages, interoperable browser, and directory improvements).

Research Question #3: How has the SCE intranet shaped the organization?

The CSL was set up as a strategic wargaming facility. As such, it was authorized no software support in the way of staff programmers or resources.

The Director of CSL's Science and Technology Division (STD) knew that it was possible to create algorithms for the applications needed for the SCE, but his operations research personnel lacked the skill set for application development. Instead, they were used to running models designed for other computerized wargames in which the focus was staff drills, not high level decision making. The Knowledge Engineering Group (KEG) was formed in the CSL at the direction of a former War College Commandant, but not with the explicit intent of giving the CSL a software development capability. Knowledge Engineering Groups exist in other organizations in the Army, typically composed of two to four personnel with expertise in artificial intelligence (AI), the science of using computers to perform symbolic reasoning and problem solving in a manner similar to the human brain. The development of the intranet and associated decision support tools was not strictly an AI function, but the technical and programming skills of the knowledge engineers made the Chief of the KEG an excellent choice for lead developer of the intranet. In fact, the knowledge engineers and operations research analysts in the STD have provided not only technical solutions, but their operational background as Army officers lets them initiate many of the ideas to make the SCE more realistic or add functionality to the intranet. A KL stated he prefers his own internal programmers to outside consultants or contractors. Outside contractors may spend only a short time with the organization and be very inflexible in doing anything outside of the contract,

whereas SDs assigned to the organization understand and anticipate requirements even when KLs may not be aware that there is a feasible technical solution. They build, maintain, and take pride in their creations over the long term, and can continue to adapt them to fit changing requirements. Their expertise as Army officers eliminates the need for a separate layer of consultants who in many corporations translate the business requirements of the management into the technical language that programmers need. The main problems with internal development are difficulty in acquiring personnel with programming skills and the limited budget available for training them. Though larger projects may still require contractor support, a KL felt that for the majority of requirements, the availability of software development tools makes training his own personnel a better investment than hiring outside consultants and contractors.

Combining the consultant (or business analyst) function with the development (or programmer) function results in programmers who turn out to be one-person project teams. The programmer/developer must investigate the requirements and current capabilities, advise the user of what is possible or feasible from a technical standpoint, and then create the product and make necessary modifications. Sometimes the SD ends up promoting the product and training the users as well. SDs complained that users often cannot articulate their requirements because they are unfamiliar with the technology. SUs learned a great deal about the technology in the process of developing a

solution for operational requirements, but the combination of discovery learning and application development led to a phenomenon where the user continuously changed the requirements and the project never seemed to be finished. On the other hand, less technically savvy KLs felt they needed proactive support from the developers. In their view, the experts in the operational part of the mission don't have time to be code crunchers as well. "I owe them an objective and intent. The developers tie that to the realm of the technologically possible", said one KL. He expected a kind of "pull system" in which developers work on broad guidance, not rigid specifications. "Don't ask what I want", he said, "tell me what you have planned to support the exercise". Such a pull system would be very difficult if development were done by outside contractors, or if the developers did not have some operational background to go along with their technical expertise. Another KL admitted the difficulty in "converting operational vision into bits and bytes". Both SDs and KLs agreed, however, that leaders have a responsibility to have some degree of knowledge and experience about the information technology they use so that they recognize potential technical solutions and can translate their requirements to those who can create the solution.

Organizational culture contributed to reinvention as well. "An informal atmosphere is essential for this type of development", said one KL, "not just rank, but also expertise begets respect. We all rely on a team effort". Another KL stated, "control squelches innovation" and "everyone operates on

the obligation to make it better. We are structured around the Army hierarchical system, of course, but people innovate better when the hierarchy isn't looking over their shoulder. You can't force someone to be innovative, nor punish them for not being innovative".

The use of the Internet and the intranet and the increasing sophistication of the students who participate in the SCE contributed indirectly to change by creating not only a desire for something better, but a strong expectation of it. This expectation is not taken lightly by the leaders and developers in the CSL who know that the War College students of today are among the Army's most successful and influential current and future leaders.

Research Question #3 Summary

In summary, the ways in which the SCE intranet shaped the organization were: 1) Use of members of the organization as the primary software developers instead of using contracted programmers, made possible by the increasing skill level of assigned personnel, investment in training, and the and the relative ease of acquiring and using development tools like Microsoft Visual Basic. 2) Use of "one-person project teams" to identify operational requirements, develop automated solutions, and train users on a common platform that is familiar to both the developers and the users alike. Prior to the adoption of intranet technology, a large number of people might be involved in implementing a single application, including operational personnel to identify requirements, acquisition personnel to write contracts,

outside programmers to develop applications, and contractors to install new programs and specialized hardware. 3) Greater awareness among leaders and users about information technology and greater awareness among computer personnel about operational requirements and the social aspects of implementing a new technology. 4) A more open and informal organizational atmosphere that fosters innovation and allows experimentation. A somewhat informal atmosphere helped the CSL succeed in the initiation stage while the hierarchical structure of the CSL as an Army organization helped it succeed in the implementation stage.

Chapter 5

CONCLUSIONS

This study successfully applied existing innovation and organization research to the case of the adoption and adaptation of the SCE intranet. It demonstrated that theories and frameworks of innovation adoption, adaptation, and implementation that are valid for business organizations are also applicable to military organizations. Using a case study methodology to examine the elements of the adoption process and the conditions that shape that process, and to investigate the mutual adaptation of the innovation and the organization, this study illuminated the parallels between the innovation processes of business and military organizations.

External validity

The results of this study are not generalizable to other Army or business organizations. This study uses analytical generalization to show that the results generalize to existing theories. Further, it provides evidence that the theories should be used as a vehicle for examining other cases, particularly in a military context. Since this was a single case study of a revelatory case, replication is needed to add reliability to the findings. In fact, both the military context and the intranet technology were new in the realm of innovation research, so the possibilities for further research are vast.

This study does not claim to have identified any determinants of adoption or of reinvention. On the contrary, this study helps confirm the finding that technology provides an occasion for, and not a determinant of, organizational change. It was not merely the adoption of an intranet, but the way in which both the technology and the organizations were adapted to one another that made the CSL successful at improving the conduct of the SCE.

Unique aspects of Internet/intranet technology

The abundance and availability of Internet/intranet technology, from the client and server processing hardware to the browser software to the software development tools like Visual Basic, distinguish it from previous information technologies in several important ways.

First, when the same technology is available to the organization as well as to its competitors, adoption becomes not a vehicle for competitive advantage but for survival. The possibility of non-innovative change or no change at all is decreased because both the potential benefits of innovation and the negative consequences of non-innovation are so great.

Second, innovative change is more likely the easier it is to acquire, implement, and modify the technology. In the past, organizations might implement workaround solutions and put off the difficult and expensive process of defining requirements, exploring options, procuring and maintaining complex new computer systems, a process which took an entirely new layer of personnel to accomplish. Today, CSL personnel can find out

about current technologies and quickly purchase the tools to create applications tailored to their needs, rather than search for a prefabricated system and third party support. Although still not structured to authorize programmers specifically, expertise in using tools like Visual Basic and applications like the Microsoft Office suite is becoming so common and easy to acquire that the CSL can successfully adapt other personnel to the task.

Third, digital technology like that used in the SCE intranet is so flexible that modifications can be made immediately and it is sometimes no longer possible to distinguish separate stages of adoption. For example, the testing, installation and institutionalization stages could be combined in a description of the adoption of the SCE intranet. Each time the SCE is conducted, the intranet is being tested. Installation may be considered to be perpetually partial or incomplete because short and long term additions to the intranet are constantly being planned and implemented. And, in the case of the SCE intranet, what has been institutionalized is not just the technology but the ongoing development and improvement of it. Leaders, developers, exercise designers and controllers, data collectors, students, instructors, and even visitors all contribute to the content, features, and functionality of the intranet.

Applicability of Rogers' model

The process of innovation within the context of Army organizations did not contradict theories based on the business model. Though modifications will certainly be appropriate as with any new context, valid theoretical principles will

remain true in Army organizations as well as business organizations. The findings in this study supported much of Rogers' (1982) model of innovation.

Two main stages of innovation, initiation and implementation, were distinguishable in the case of the SCE intranet. However, his four steps or subprocesses in the innovation process, matching, testing, installation, and institutionalization, were not distinguishable as discrete processes.

Rogers' factors affecting the nature and direction of innovation (see Chapter 2 and Rogers, 1976, p. 159) were also applicable. Knowledge had the greatest impact, and it is no longer confined to knowledge of innovations among the technically savvy personnel. This was especially true since system developers and users alike had access to knowledge using the Internet. Both developers and users had some degree of experience using Internet technologies. Technical personnel also had expertise in the operational activities of the organization. Leaders and users obtained ideas for initiating innovations by reading about them or by drawing on their own experiences in using browsers, databases, reference media, and military systems such as GCCS. Knowledgeable users were better able to conceive of and articulate their requirements to the programmers, and programmers with knowledge of the operational requirements of the organization were better able to create and articulate technical solutions to the users.

External accountability was high in the CSL, in the form of the structural hierarchy of the military, published military doctrine and vision statements of

the leadership, and the professional norms common to any Army organization, which include dedication to the mission and pride in performance. For example, from creating an effective intranet the developers perceived a promotion incentive that comes from good performance reports. They also had a continuing commitment to maintaining and improving the system due to their status as members of the organization rather than temporary or contracted employees. The organization was not only accountable to its environment, but also exerted some control over it by maintaining a somewhat informal managerial climate. The overall objectives for the SCE were clearly defined and known to all personnel but only broad guidance was given on how the organization would support those objectives. The effective use by CSL leaders of the talents and resources of the organization, the physical proximity of users and developers to facilitate communication and idea sharing, and the willingness to take risks and tolerate setbacks all contributed to the success of the intranet.

Slack resources were created in personnel whose job descriptions were changed to maximize their talents and their role in supporting the new technology, and in the financial budget by redirecting funds from hiring outside contractors to training members of the organization to program and use advanced features of Microsoft Office applications.

Applicability of Rosen's framework

Rosen's frameworks for peacetime, wartime, and technological innovation in the military (see Chapter 3) were all applicable to the SCE intranet. Army and Joint doctrinal publications provided the decision making procedures that were taught in the War College curriculum and put into practice in the SCE. Leaders, informed by operational experience and the writings of scholars, provided the vision of the future environment and the strategic goals for the organization. Members of the organization all applied their individual expertise to the accomplishment of the common goal either by direction or by their own initiative. Feedback on performance came from repeatedly running simulations and testing and modifying new systems. Costs and benefits of the intranet were measured not just in terms of money, but in terms of how much time and talent is consumed to deliver more information.

Applicability of Pennings' framework

Pennings' behavioral inertia acted to inhibit the adoption of the intranet. Students initially resisted using e-mail and other computer applications in the belief that it was the role of technicians and not warriors. War College instructors resisted the intranet, owing to the complexity of previous technologies that required a new skill set to operate rather than enhancing proficiency in the curriculum. Reluctance was gradually overcome in the course of the routine activities of the organization, such as weekly meetings between CSL and Army War College representatives, annual participation in

planning and conducting the SCE, and ever increasing routine use of the Internet in the classroom, for staff work, and at home. The proliferation of computers in all aspects of society makes their use increasingly routine and even expected in military settings.

The case of the SCE intranet suggests that the term reinvention is not applicable to this type of technology. It is difficult if not impossible to determine where adoption ends and reinvention begins because of the flexibility of the technology. Rather than adopt a specific technology, the CSL adopted the tools to create their own version of an "internal Internet". In the process of creating emulations of the GCCS features, they discovered they could do more with the power of the network and the browser to provide a common interface to the database, reference material, and separate applications. The whole process could more accurately be called continuous adaptation or iterative development.

Where the findings diverged from the theoretical models of the innovation process, the differences were due to the nature of the technology and not to the nature of the organization (i.e., an Army organization instead of a business organization). One hypothesis for further research, then, is technology-centered as opposed to context-centered: the nature of the innovation process is a function of the nature of the technology.

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