

**AUTOMATING LAND MANAGEMENT:
AN ANALYSIS OF INFORMATION TECHNOLOGY
MANAGEMENT CHALLENGES AT THE BUREAU OF LAND
MANAGEMENT**

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ABSTRACT

Given society's massive investment in information technology and the potentially catastrophic consequences of information technology (IT) failures, understanding how IT management policies influence IT management practice and, ultimately, organizational success in implementing and employing information technology is becoming increasingly crucial. This paper describes a study that took place in a large government agency and sheds some light on the interaction of IT policy, practice and success (or, in this case, failure).

Following an exploratory case-study research design, the study employed both interpretivist- and positivist-oriented perspectives to develop a descriptive model that identifies significant factors influencing levels of policy compliance. The model describes the central roles that organizational culture and knowledge play in mediating the effects of information technology, organizational resources and IT management policies on IT policy compliance, implementation and use. The model reflects study participants' common-sense understanding of how IT policies work and why they sometimes fail to work.

While the factors identified in the model may not be surprising, the manner in which they interact provides provocative insights into why organizations often fail to achieve desired levels of policy compliance and how focusing on policy compliance might lead to unanticipated consequences.

Andrew Wenn and Stephen Burgess acted as senior editors for this paper.

Beachboard, J.C., "Automating Land Management: An Analysis of Information Technology Management Challenges at the Bureau of Land Management," *Journal of Information Technology Theory and Application (JITTA)*, 7:1, 2005, 33-50.

INTRODUCTION

Society's ever-increasing reliance on information technology dramatically raises the consequences of IT failure in human and financial terms. IT failures can result in losses exceeding hundreds of millions of dollars and adversely impact the health and safety of the world's population (Cohen 1994; Endoso 1995; Stanglin and Chetwynd 1996; Tillett 1999). IT project failures typically reflect management weaknesses rather than problems with underlying technology. Accordingly, academicians and practitioners have invested considerable energy in developing policies and prescriptions to strengthen IT management practice to help organizations more effectively employ information technology (Van Schaik 1985; Sambamurthy and Zmud 1994; General Accounting Office 1994; Rockart, Earl and Ross 1996; Strassmann 1995; Lewis 1999; Luftman 2004). These recommended practices are grounded in empirical investigations and practical experience and have informed the development of IT management policies and practices within a variety of organizational settings.

Much of the prescriptive IT management literature reflects a rationalist view concerning the expected benefits to be derived from adhering to recommended practices. An organization has resources, described in terms of data, technology, and business and IT knowledge, and it faces a specific set of threats and opportunities.

As depicted in Figure 1, organizations possessing appropriate IT management competencies establish processes that support converting the resources into IT impacts valuable to the organization (Sambamurthy and Zmud 1994). Whether these are referred to as best practices (General Accounting Office 1994), imperatives (Rockart, Earl and Ross 1996), IT assets (Ross, Beath and Goodhue 1996) or core capabilities (Feeny and Willcocks 1998), the logic remains roughly the same. By establishing these practices, managers will greatly improve their chances of achieving success in employing information technology.

As an IT executive might hope, the IT management literature, at least at a macro

CONTRIBUTION

This paper contributes to research and practice within the domain of enterprise-level IT management. Despite the availability of extensive scholarly, business-oriented and policy-related publications on IT management and the concerted efforts of knowledgeable and diligent professionals, major IT initiatives fail with alarming regularity. The primary contribution of this paper is to provide a model that specifically conceptualizes the influence of IT management policies and prescriptions within the broader context of factors long-recognized as helping to lead to successful IT employment.

Furthermore, the paper enriches our understanding of IT management policies and prescriptions by: (1) concisely summarizing and synthesizing the bulk of academic- and practitioner-oriented IT management literature; (2) demonstrating potential conflicts inherent among commonly accepted IT management prescriptions; (3) illustrating the knowledge and judgment required for effective implementation of commonly accepted IT management prescriptions within a given organizational context.

The paper also makes a methodological contribution to IS research by applying Lee's (1991) model for integrating positivist and interpretivist research approaches in a disciplined fashion.

This research should be of specific interest to researchers investigating management models contributing to effective organizational IT use as well as to researchers more generally concerned with the study of all factors contributing to successful IT infusion. For practitioners willing to tolerate the methodological discussion and extensive use of citations, this paper provides a cautionary tale of problems likely to be encountered when IT and program managers confuse the ease with which policies can be understood with the ease of implementing programs adhering to those policies.

level, tends to identify a consistent set of prescribed practices. Certainly wording and nuances vary, but four common principles regularly occur in the prescriptive literature. These include the need to: (1) align IT strategy with the business vision; (2) establish effective working relationships among

business and IT managers; (3) develop an IT architecture capable of supporting current and future business strategies; and (4) improve the technical and business knowledge and skills of organizational members. Table 1 summarizes recommendations from several sources to illustrate this argument.

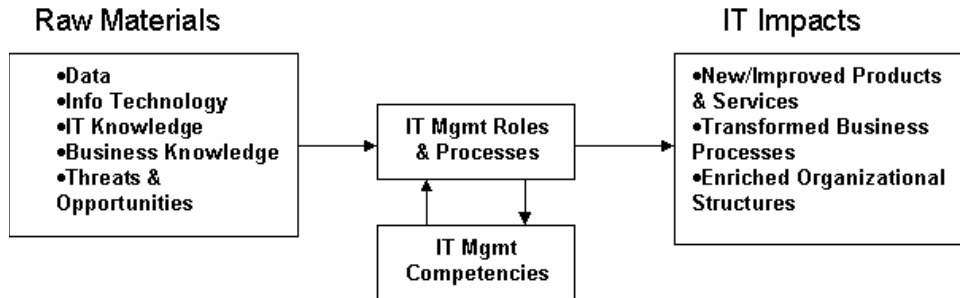


Figure 1. How IT/IS Management adds value (Adapted from Sambamurthy and Zmud 1994)

Table 1. IT Management Best Practices

	GAO 1994	Sambamurthy & Zmud 1994	Rockart, et al 1996	Ross, et al. 1996	Feeny & Willcocks 1998
IT/Business Strategy Alignment	Anchor strategic planning in customer needs and mission goals	Integrate business strategy and IT strategy planning	Achieve two-way strategic alignment	Note: The alignment principle is reflected under the technology asset	Integrating IS/IT effort with business purpose and activity
Build/maintain relationship among IT and business mgrs	Get line management involved and create ownership	Create line manager ownership of IT projects within their domains of business responsibility	Develop effective relationships with line management	Relationship Asset -- strong shared vision and relationship between business and IT leadership	Getting the business constructively engaged in IS/IT
Enabling architecture	Focus on process improvement in the context of an architecture	Create appropriate data, network and processor architectures	Build and manage infrastructure	Technology Asset -- defined technology plan based on strategic business principles	Creating the coherent blueprint for a technical platform
Build/maintain staff skills and knowledge	Upgrade skills and knowledge of line and information management professionals	Ensure adequacy of organization's IT skill base	Re-skill the IT organization	Human Resource Asset -- IT staff possesses strong business, technical and change management knowledge	Rapidly achieving technical progress -- by one means or another

The literature provides convincing evidence that these prescribed IT management practices do have value. Unfortunately, the emerging literature – whether conceptual or empirical – does little to shed light on the difficulties that managers inevitably face in attempting to establish these practices. This manuscript provides the results of a study intended to develop a better understanding of IT management practice and to provide insight into the challenges faced by practitioners in establishing recommended practices.

The following sections of this manuscript provide a selective overview of IT management literature, a discussion of the case study design, a distillation of data collected, the author's interpretation of that data, and a discussion of the potential implications of this research on current practice and future research.

AN OVERVIEW OF IT MANAGEMENT LITERATURE

IT management research consists of two distinct but interrelated streams. The first research stream concerns IT governance strategies and addresses questions concerning factors influencing decisions to adopt centralized, decentralized and, more recently, federal IT governance structures. Theoretical frameworks for predicting selection of IT governance style have become increasingly sophisticated (Ein-Dor and Segev 1982; King 1983; Zmud 1984; Tavakolian 1989; Boynton, Jacobs and Zmud 1992; Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999). For example, Sambamurthy and Zmud (1999) have suggested a multiple contingency model identifying factors jointly influencing the selection of governance arrangements employed to direct, control and coordinate three fundamental spheres of IT activities: IT infrastructure management, IT use management and project management. This stream of research has been valuable not only in its identification of contingencies influencing the selection of governance strategies, but also because it comprehensively identifies and categorizes the broad range of IT management activities. The IT governance research builds on a foundation of well

established contingency theory and has been rigorously formulated and conducted.

The second research stream identifies IT management processes and competencies associated with successful IT implementation and use. Much of this research is empirically based, practitioner-oriented and prescriptive in nature (Rockart, Earl and Ross 1996; Ross, Beath and Goodhue 1996; Broadbent and Weill 1997; Feeny and Willcocks 1998; Weill and Ross 2004). A problem with this literature, at least for researchers, is that it is predominantly published in practitioner-oriented journals. Such publications, while commendable, make it more difficult for academic researchers to assess the theoretical approach and methodological rigor underlying reported findings.

A smaller set of publications within this second research stream reflects a more traditional academic publishing style. King and Kraemer (1985) introduced a theoretical framework for studying IT management issues but did not develop or test the framework. Zmud, Boynton and Jacobs (1989) initiated research examining managerial strategies for increasing IT use in organizations. This research focused on the influence of management processes and IT-related managerial interactions on IT penetration. The study provided evidence that IT-related managerial interactions more strongly influenced IT penetration than did the extent to which organizations had effectively implemented recognized IT management processes.

These data were later re-analyzed employing a model based upon the theory of absorptive capacity (Boynton, Zmud and Jacobs 1994). Absorptive capacity refers to the knowledge structures existing within an organization that enable it to exploit new technologies or other innovations successfully (Cohen and Levinthal 1990). With respect to information technology use, the researchers conceptualized a firm's absorptive capacity as "representing the conjunction of IT-related and business-related knowledge possessed and exchanged among IT managers and business unit or line managers, and... the formal routines and procedures used by organizations to foster appropriate IT use" (Boynton, Zmud

and Jacobs 1994, 300). This analysis reconfirmed the previous finding regarding the relationship between managerial and IT knowledge and organizational IT use. As in the first study, support for the hypothesis that effective IT management processes would also contribute to IT use was weak, prompting the researchers to opine that “an organization... might best err in favor of emphasizing the development of managerial IT knowledge rather than an effective set of IT management processes” (314).

Sambamurthy and Zmud (1992) extended the examination of IT-related organizational competencies and IT management processes in research conducted under the auspices of the Financial Executives Research Foundation. Their first study identified 32 core competencies and four control strategies for assessing organizational progress toward developing such competencies. In a follow-up study, Sambamurthy and Zmud (1994) conceptualized the role of IT management in translating organizational resources into IT impacts and ultimately into business value. This second project was intended to refine further core competencies identified in the previously cited study, validate their contribution in creating business value, and create a tool that could be used by organizations to assess their capabilities regarding these competencies.

Knowledge of these prescriptions by management does not appear sufficient to reliably improve organizational performance in implementing and operating information technology. That is, even if one agrees that adhering to commonly accepted IT management prescriptions will contribute to an organization's achieving more effective IT implementation and use, a richer understanding of the processes involved is required to help organizations improve their implementation of recommended practices.

CASE RESEARCH METHODOLOGY

The IT management literature provided convincing evidence concerning the value of IT management prescriptions but little insight into barriers organizations might face in attempting to develop these competencies. The study, then, needed to develop a deeper

understanding of how organizations establish recommended practices.

The study employed a single-site research design based on a multi-paradigmatic approach suggested by Lee (1991). The design attempted not just to combine qualitative and quantitative data collection and analysis methods, but also to respect disparate views associated with constructivist and neo-positivist research paradigms. Theoretical insights drawn from Giddens' theory of structuration (Giddens 1984; Orlikowski and Robey 1991; Orlikowski 1992; DeSanctis and Poole 1994) suggest the desirability of employing a multi-paradigmatic research approach. Beachboard (2004) provides a comprehensive explanation of the author's philosophical and methodological approach to this study.

While this paper is not intended as a methods paper *per se*, a degree of explanation is required to place the reported findings in the proper context of the research design. Lee's framework integrates interpretivist and positivist approaches by positing the existence of three levels of understanding (Lee 1991, 351):

- **Understanding at the first level** (subjective understanding) belongs to the observed human subjects. This understanding consists of the everyday sense and everyday meanings with which human subjects see themselves and which give rise to the behaviour that they manifest in socially constructed settings.
- **Understanding at the second level** (interpretive understanding) belongs to the observing organizational researcher. This understanding is the researcher's reading or interpretation of the first-level, common-sense understanding.
- **Understanding at the third level** (positivist understanding) also belongs to the organizational researcher. This understanding is the one the researcher creates and tests in order to explain the empirical reality being investigated.

Lee suggests that methodologies (e.g., phenomenological sociology, hermeneutics, ethnography) associated with interpretive

research can be used to develop the second level of understanding. Lee then suggests that this second-level, interpretive understanding can inform the development of a third-level, positivist-like understanding that can be subjected to more traditional positivist-oriented research approaches. Obtaining an interpretive understanding required what Stake (1994, 241) referred to as knowledge in the particular: "The reader of such research comes to know some things told, as if he or she had experienced them." Acquiring that level knowledge can justify the selection of a single-site research methodology. Given a primary interest in U.S. Government IT management practices, the author negotiated access at the Department of Interior's Bureau of Land Management (BLM).

While not required by Lee's multi-paradigmatic approach, quantitative survey data were collected in the first phase of this research. The collection of survey data served several purposes. The general staff survey included questions concerning IT use, IT satisfaction and IT service quality. These data provided IT managers an indication of IT performance management throughout the BLM and constituted a near-term contribution that the researcher could make to the study organization. The surveys offered an opportunity for a wide range of BLM staff to provide non-structured comments as well as structured responses, greatly enriching the qualitative data set.

A total of 28 BLM managers returned surveys; 19 managers agreed to follow-on interviews. Given the wide geographic dispersion of BLM managers, the researcher conducted face-to-face, telephonic and email interviews. Each of the 19 managers was contacted at least once; several were contacted multiple times. The researcher employed an "active interview" approach (Holstein and Gubrium 1994), permitting the participants to lead the discussion in directions that addressed their insights and concerns regarding the bureau's IT management and use.

Participants permitted taping of the interviews. The researcher transcribed these interviews and added comments submitted in the surveys and participant comments noted during informal discussions to the qualitative

data set. The researcher parsed the data set into approximately 900 statements and went through multiple iterations of coding. Based on this analysis, six core narratives or themes emerged. Representative statements illustrating these narratives are provided in Table 2. These narratives represent conversations that were to some extent already occurring within the bureau and served as the basis for constructing the researcher's second-level understanding of IT management practices within the BLM.

BLM Background and Program to Automate Land Management

Although the BLM has officially existed only since 1946, its roots go back more than 200 years to the time when the new republic of the United States was establishing policies for surveying and settling new territories. Today, the bureau manages approximately 264 million acres of public land in 28 states, about one-eighth of the land in the United States. It also manages the mineral estates underlying another 300 million acres of lands administered by other government agencies or owned by private interests and supports fire suppression on an additional 388 million acres.

To support this mission, the BLM manages more than one billion paper documents, including land surveys and surveyor notes, tract books, land patents, mining claims, oil and gas leases, and land and mineral case files. Many of the land titles and much of the survey data date back to the birth of the nation. With the automation of mining claim data in 1978 and of oil and gas leases in 1982, the bureau began to employ information technology to improve its core business processes. However, the BLM found that it was still unable to handle its case-processing workload and associated information requests.

In the mid-1980s, the bureau began planning to develop an automated land and mineral records system. After several false starts, in 1993 the BLM agreed on the scope and functionality of a modernization project that came to be called the Automated Land and Mineral Resources System/Modernization Program. This program was to have three major components: infrastructure development,

development of the ALMRS application and upgrading of IT infrastructure to support the implementation of the ALMRS application and establishment of a geographic coordinate database. The bureau awarded a development contract to Computer Sciences Corporation (CSC). The contract provided for computer technology, commercial software, telecommunications technology, customized software and IT services support.

The BLM began the ALMRS/Modernization implementation, planning to proceed in phases. Over a period of four years, the bureau fielded UNIX-based desktop workstations and servers, commercial office automation software, local area networks, wide area network connectivity and electronic mail. By 1998, more than 6,000 workstations were installed and 8,000 employees trained. The bureau also successfully migrated 11 legacy COBOL database applications to

operate under the Informix database management system acquired under the ALMRS contract. Simultaneously, work was proceeding on the development of the ALMRS application.

The bureau experienced a series of delays and cost overruns developing the ALMRS application. When the contractor finally delivered ALMRS Release 1, the bureau determined that the ALMRS software was too slow and cumbersome to use and failed to meet the needs of its intended users. In April 1999, after 15 years of effort and the expenditure of more than \$400 million on the project, the bureau lost confidence in the contractor's ability to deliver an acceptably performing product and cancelled the ALMRS/Modernization Project. (The GAO reported \$67.5 million had gone into development of the failed software and another

Table 2. Example of Coding Scheme

Narrative	Sample Quotes
IT drivers	<ul style="list-style-type: none"> • Technology is forcing us... to work together, to have standard policies and procedures to follow. • Where local IRM folks have their own [mini-computers] and their own applications, as we implement modernization that will have to go away because we will not be able to maintain a national network. • IRM needs to quit dictating what kind of computers we have. Standardization does not work. It only adds resentment and lack of local control...
Resource constraints	<ul style="list-style-type: none"> • There is no problem that you could not use more resources on. But the money has to come from somewhere. • Money and time: even if you have the money, it is difficult to find the time and training to comply with the policies.
IT management knowledge	<ul style="list-style-type: none"> • Non-IT managers are quick to criticize high cost and lack of solutions to business problems, but they fail to accept technical realities and complications inherent to building bureau-wide solutions; eyes are going to glaze over during an upcoming discussion of linking technology to business needs. • There is an issue of getting into management and losing the day-to-day involvement and use of the applications. So management can be good, but I am seeing problems with folks who are making the decisions that do not really know the day-to-day stuff.
BLM culture	<ul style="list-style-type: none"> • The BLM's state IRM organizations function as 12 different companies... this reflects BLM culture. • Attitudes are hard to change, I'm not sure if you can change it; just wait until they all die off.
IT governance	<ul style="list-style-type: none"> • The psychology has been against centralized control; the programs have a lot of independence. • IT management works best when it is part of the management team, not sitting in a dictatorial or <i>control</i> mode.
BLM's Modernization Program	<ul style="list-style-type: none"> • I am not being negative; I thought this whole thing [the program] was thought- and planned-out great, it still is great and will serve the purpose. • Modernization is a fiasco. • ALMRS is an 800-pound gorilla.

Table 3. ALMRS/Modernization Program Major Components

Major Component	Explanation
Infrastructure Modernization	Selection, purchase and installation of enterprise-wide IT infrastructure, including: desktop workstations and office automation applications, servers, printers, groupware applications, local- and wide-area networking, and conversion of 11 legacy COBOL applications to the newly adopted standard DBMS.
ALMRS Development	Design and implementation of corporate data architecture, enterprise-wide database management system (DBMS), geographic information system capabilities and multiple applications designed to automate critical bureau business processes.
Geographic Coordinate Data Base (GCDB) Project	A geographic database that would contain coordinates of legal boundaries and other survey characteristics of public lands that would be linked to the ALMRS databases and hosted on the modernization infrastructure.

\$74.6 million into project management expenses. A teaching case based on this study provides additional background information and additional detail (Beachboard 2003).

IT Management at BLM: Researcher Interpretation of Insider Perspectives

Primary data collection was accomplished in the year just preceding the cancellation of the ALMRS/ Modernization Project. At that time, the bureau had already faced many difficulties, cost overruns and project delays, but was still confident that its contractor would deliver an acceptable ALMRS application.

Six primary narratives, or themes, emerged during the analysis of the qualitative data and responses to open-ended questions included on the surveys: information technology, resource constraints, IT/IT-management knowledge, BLM culture, IT governance and the ALMRS/Modernization Project. These narratives reflect IT management issues of primary concern to BLM managers. They form the basis for the author's "second-level" understanding of IT management as specifically enacted within the BLM and are briefly summarized as follows:

The BLM increasingly recognized that **information technology** had become essential. Evolving IT systems and capabilities were driving the recognition that bureau-wide IT standards and management were increasingly needed. The pace of technology change was driving the need for technology upgrades that the BLM required but did not really desire. Hardware, operating systems and application software upgrades stressed the bureau's

technology and training budget, forcing resource reprioritization and creating friction within the bureau. Rapid IT change also increased perishability of technical knowledge.

BLM IT managers, and to a lesser extent BLM staff, perceived **resource constraints** as limiting the quality of IT support. IT managers also perceived resource constraints as limiting their ability to comply with IT management policies and perceived the competition for resources within the bureau as undermining their relationships with functional area managers.

IT managers perceived functional area managers as having limited **IT management knowledge**, while functional area managers felt that senior IT managers did not adequately understand the bureau's operational requirements for IT. Regional-level IT managers also expressed concerns regarding the technical and operational knowledge of senior IT managers.

Study participants viewed the bureau's management culture as being open to new technology but perceived **BLM's culture** of regional autonomy as a critical factor undermining establishment of strong central IT management.

Despite the establishment of a CIO, national IRM center and advisory councils, senior IT managers felt that bureau-wide consensus regarding **IT governance**, i.e., where specific IT management functions or decision rights should reside in the organization had not been achieved.

The **ALMRS/Modernization Program** complied with applicable federal IT

policies. It consisted of a strategic bureau-wide application based on a standards-compliant information architecture intended to contribute to mission performance. Yet, the considerable investment in ALMRS/Modernization diverted resources from other important IT projects. Furthermore, users were dissatisfied with systems and office-automation applications fielded under the modernization project. Despite extensive external oversight by Department of Interior, Office of Management and Budget, GAO and Congress, serious problems persisted, ultimately resulting in the project's cancellation.

These brief summaries of participant narratives attempt to report accurately the issues that were identified by the study participants as being most relevant to the issue of IT management within the BLM. These summaries provided the primary basis for conceptualizing the influence of IT management prescriptions on organizational practices.

What Went Wrong: Multiple Perspectives

The previous overview of the ALMRS/Modernization Program provided some insight into the thinking of bureau IT and non-IT managers regarding the general impact of information technology on the bureau's mission and organization and the ALMRS/Modernization Program prior to its cancellation. This section presents internal and external perspectives regarding causes of the program's demise.

The ALMRS/Modernization Program received considerable management oversight by department-level IT managers, Office of Management and Budget (OMB), GAO and Congress. The GAO oversight provided an opportunity to compare the documented observations of external personnel with those of bureau IT managers.

In an interview granted to *Federal Computer Weekly*, the GAO concluded that over the course of a lengthy planning and implementation process, project requirements had gone stale and that the BLM was "using technology that had really been eclipsed by the Windows technology of today" (Tillett 1999). That article also quoted a Department of

Interior employee as stating that bureau managers "should have recognized the problems five years ago."

GAO testified before Congress that the lack of system architecture was a "key reason why ALMRS' initial operational capability did not meet the bureau's business needs" (General Accounting Office 1999). The GAO also reported on several other program deficiencies that it deemed to have substantially contributed to the ALMRS failure. According to GAO, the BLM had not developed a system architecture, formulated a concept of operations or a credible schedule with reliable milestones. Additionally, the GAO determined that BLM had faced "serious risks" throughout the ALMRS/Modernization Program because the BLM had not:

- Established a robust configuration management program
- Established a security plan or security architecture
- Established transition plans
- Established operation and maintenance plans
- Planned a complete stress test

Not surprisingly, senior BLM IT managers expressed a somewhat different perspective on the failure of their program. After the decision to cancel was made, key IT managers identified the primary cause of the program's cancellation to be the prime contractor's failure to provide applications that met usability and performance requirements although they did confess that the contract did not adequately specify required user-system interactions or systems performance. BLM managers acknowledged that the failure to include performance specifications likely contributed to the contractor's failure to deliver an acceptable product.

The IT managers also expressed disappointment with the services obtained from the independent verification and validation (IVV) contractor. Under the direction of Congress, the BLM obtained assistance in managing its primary contractor. The BLM hired Mitre Technical Services Corporation (Mitretek) to assist in the contract

management function. In analyzing the program failure, the IT management staff concluded that the IVV contractor had taken a legalistic approach in determining whether recommended development processes were being followed. That is, the contractor was able to verify whether processes existed but failed to reveal how well the processes were being executed. In retrospect, senior IT managers felt that Mitretek had employed “management folks” on the project instead of engineers and systems designers capable of reviewing the appropriateness of the technical solutions offered by the prime contractor.

BLM IT managers also argued that external direction and policy-driven guidance were, at least in some cases, detrimental. For example, Department of Interior officials had directed that the bureau’s deputy director be placed in charge of the ALMRS Program. As a result of this decision, the director whose unit would be the primary beneficiary of the ALMRS application was not active in managing that aspect of the program. Senior BLM IT managers felt that the director’s lack of involvement may have resulted in poorer user participation in the development process.

Furthermore, in the IT managers’ view, the strong management support of the program within the bureau and the Department of Interior probably contributed to continuing the program for so long. The bureau documented more than 200 high-priority deficiencies with the application design and seriously considered cancelling or refocusing the program in 1996. According to the BLM managers, Department of Interior personnel strongly urged the bureau to “stay the course.” The group felt that the basis for this decision may have been the Department of Interior’s unwillingness to admit to Congress the full extent of the program’s problems.

Unfortunately, given the serious political and contractual issues surrounding this program, the researcher could not interview GAO and contractor representatives.

Conceptualizing IT Management Effectiveness

The BLM experience suggests that determined but ineffective efforts to comply with accepted IT management practices may

prove detrimental to the interests of the organization. Analysis of data collected during the BLM case study provided strong evidence that bureau managers were cognizant of and attempting to comply with the four fundamental IT management prescriptions presented in the introduction of this paper.

The bureau had identified the ALMRS/Modernization Program as a key element in its strategic plan. The program was clearly aligned with the bureau’s mission and included the fielding of a standards-based bureau-wide IT infrastructure. Recognizing that the new infrastructure and applications would require a different mix of technical skills, the bureau invested significant resources in training technical staff and system users although later funding shortfalls did require some cutbacks in training. Furthermore, the bureau sought contractor assistance to manage its primary contractor more effectively. Despite these efforts and extensive project oversight provided by the U.S. Department of Interior and the U.S. General Accounting Office, the program clearly failed.

Consistent with Lee’s (1991) multi-paradigmatic research design, the author used his interpretation of the users’ perspectives regarding BLM IT management to develop the descriptive model depicted in Figure 2. The proposed model represents the third level of understanding, briefly described in the methodology section, and is intended to enrich rather than replace the conceptual understanding depicted in Figure 1. Lee conceptualizes the first level understanding as belonging to the study participants. The second level understanding is the researcher’s interpretation of the participant understanding, which in this case is reflected in the six core narratives. The descriptive model represented in Figure 2 represents a third level of understanding that can be used to develop propositions that can be tested in other settings.

The models depicted in Figures 1 and 2 depict inputs that are transformed into IT impacts. The newly proposed model varies from Figure 1 in several significant respects summarized below:

- Figure 2 includes resources (both financial and staff) as a key input that was not

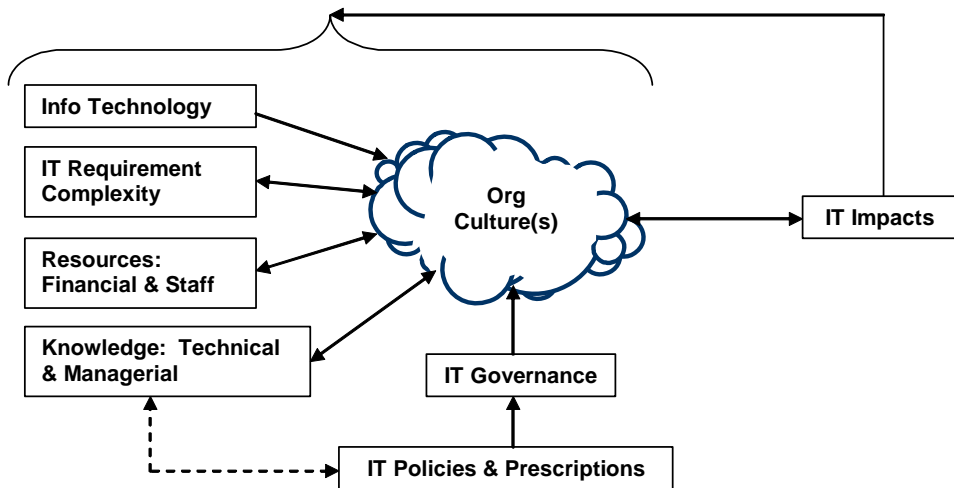


Figure 2. Reconceptualizing IT Governance and Practice

identified in Figure 1. This reflects the study participants' overarching concern with the lack of adequate money and staff.

- Figure 2 also includes an input labelled "requirement complexity." This input can be viewed as a distillation of the "threats and opportunities" input identified in Figure 1 but more faithfully represents concerns expressed by the study participants.
- Figure 2 explicitly recognizes that a recursive relationship exists between identified organizational inputs and the transformation **processes** identified. This reflects the observation, for example, that not only does knowledge influence the conduct of organizational processes, but that organizational processes and culture may well influence the recruitment and retention of its knowledge workers.
- Figure 2 includes a feedback loop connecting IT impacts back to the organization's input to reflect the observation that an organization's history of IT success and failures inevitably influences resource allocations, the quality of personnel it is able to recruit and retain, as well as the types of projects that it is willing to attempt.

- Figure 2 de-centers the IT management roles and processes of Figure 1 and establishes organizational culture as the key intervening factor governing an organization's ability to transform identified inputs into desirable IT impacts. As is further discussed below, this modification more faithfully represents participant observations governing the quality of IT management practice at BLM.
- Figure 2 identifies IT management policies and practices as substantive recommendations to be implemented by the organization. IT governance refers to the mechanisms that an organization employs to enact those recommendations (Weill and Ross 2004). The dashed arrows connecting IT policies and practices to the knowledge input reflect that the understanding of widely prescribed IT management policies and practices represents a particular domain of knowledge.

Again, the proposed model in Figure 2 represents an elaboration rather than refutation of the Sambamurthy and Zmud (1994) model in Figure 1. The notion of organizational culture is implicit in many of the competencies identified in their study.

The value of the proposed descriptive model lies in its more explicit acknowledgement of the messiness and complexity of IT management; the arrows do not all point in one direction. There is recursion and interaction among the various elements. IT management policies and practices such as represented by the 34 core IT management processes identified by Sambamurthy and Zmud reflect an explicit type of IT management knowledge that, while useful, is insufficient to ensure IT success.

In acknowledging possible interaction effects among its various components, the expanded model attempts to emphasize the implicit knowledge or judgment required of IT managers. There can be no simple checklist for IT managers to follow. Establishment of conforming IT management practices requires insight into an organization's particular history, culture and context.

IMPLICATIONS

The author confesses a bias toward conducting research relevant to practice but has sought to apply interpretive methods of data collection and analysis (Klein and Myers 1999; Altheide and Johnson 1994; Miles and Huberman 1994). This study is but one step within a proposed research stream wherein some of the interpretive findings may be subjected to validation using more positivist-oriented research methods. However, as the author hopes to demonstrate below, interpretivist research methods, rigorously applied, can produce knowledge relevant to practitioners.

Implications for Practice

While inferences drawn from a single case do not constitute the type of generalizable knowledge derived from more traditional research methods, such inferences may still prove to be useful outside of the original context in which they were drawn. Dalcher (2004) argues that historical methods are uniquely suited for the production of knowledge with respect to understanding IT failures. Traditional research has tended to employ simplistic "causal pairings" to explain the IT failures, "...thereby ignoring the role of

the participants, their assumptions, and the overall environment" (Dalcher 2004, 311).

A close examination of BLM experience generally and the cancellation of the ALMRS/Modernization Program specifically should prove useful for the practitioner community. The proximate cause of the program's cancellation was the failed software release. Yet had the release proved acceptable, the schedule delays, cost overruns, and widespread user dissatisfaction would still represent serious problems.

Neither recognizing the failed software release as the direct cause of the program's cancellation, or acknowledging BLM's failure to manage its contractor's performance adequately is terribly useful. One must try to understand what factors most likely contributed to BLM's arrival at that point. An analysis of the case history suggests the following as significant contributing factors:

- **Program Scope.** The ALMRS/Modernization Program was clearly intended to align with and support BLM strategy. Rather than building stovepipe solutions to provide capabilities for distinct functional areas, (e.g., one database to support mineral leasing and a completely separate database to support wildlife management) the program was designed to establish a technical foundation on which all the bureau's operational processes could be built. However, the larger and more complex the program, the greater the chances for failure became (Ferrat and Starke 1995; Goodhue, et al. 1992; Brooks 1995).
- **Program Ownership.** The bureau's powerful deputy director became the primary owner and champion of the program. Some interviewees felt that this decision led to more limited participation by the chief of the directorate, whose processing requirements formed the primary basis for the program's justification. While no sabotage was implied, the feeling did exist that this decision diminished the quality of user participation in the development of the baseline ALMRS application.

- **Technical Standards.** The bureau developed and implemented a standards-based, enterprise-wide IT infrastructure that was as consistent with government standards as could be achieved at that time. However, the selection of UNIX workstations as the bureau's desktop and server standard significantly increased hardware and software acquisition as well as maintenance costs and technical and user training costs. Numerous users complained that the new systems were incompatible with external agencies, impeding their ability to complete work at home, and generally lacked functionality that they had come to expect using Windows-based desktop applications.
- **Skill and Knowledge Deficit.** While such a conclusion may be too simple, the case provides evidence that BLM lacked the requisite level of technical knowledge and managerial expertise to manage the ALMRS/Modernization Program.

While certainly not a comprehensive list of underlying problems that contributed to the ALMRS/Modernization Program cancellation, the four issues identified neatly coincide with the four IT management practices identified in Table 1. This correspondence provides a unique opportunity to explore the strength and limitations of prescribed IT management practice.

Consistent with the practices identified above, BLM had attempted to align its IT strategy with its business strategy. At least formally, the program was placed under the direction of an executive-level non-IT manager. This could be seen as an attempt to demonstrate top-level management support and encourage line manager participation. BLM sought to implement a standards-based enterprise-wide IT infrastructure. The BLM did provide significant amounts of in-house training, and additionally sought to supplement its management capabilities with contractor support. Ironically, the bureau's attempt to adopt recommended IT management practices contributed, at least in part, to the ALMRS/Modernization Program's cancellation and failure. This represents something of a paradox, the investigation of which should prove useful for IT practitioners.

Perhaps the paradox is best explained by contrasting theory and practice, or more accurately, contrasting *explicit* with *implicit* or *tacit* knowledge. Table 1 represents explicit knowledge derived primarily from successful IT executives. Table 1 represents "best practices." What Table 1 does not and likely cannot include, however, is the practical judgment (tacit knowledge) required to implement these practices effectively. Embedded in these practices are potential conflicts or contradictions.

Enterprise-wide strategic alignment virtually necessitates optimization of business processes and data standardization across organizational activities before automation can occur. Consequently, project size, scope and complexity are necessarily increased because of the additional actors involved in identifying requirements and negotiating capabilities. To the extent that negotiation and compromise occur, feelings of ownership at the operational levels are likely to erode.

The desire for standardized enterprise infrastructure engenders similar issues. Now that most, if not all, the enterprise's processing and networking needs are to be satisfied by a common infrastructure, the technical complexity of the project increases. It is also likely that some elements of the infrastructure will be over-engineered relative to the needs of some activities and under-engineered relative to the needs of others. Again, the need for negotiation and compromise can undermine line manager ownership and support.

The fourth recommended practice concerns the need to upgrade the IT skills and knowledge of the organization's staff and management. Barring large and unforeseeable external factors, an IT failure necessarily represents insufficient technical and/or managerial knowledge. One can hardly imagine a circumstance where increasing skill and knowledge would be inappropriate.

However, some implications related to developing organizational knowledge bear scrutiny. First, we must recognize that adherence to the practices of achieving strategic IT alignment and developing standardized IT infrastructure necessarily implies that the organization must possess

relatively high levels of managerial and technical sophistication. The dilemma that practitioners face is how to develop required expertise. Analysis of the BLM experience suggests the observed problems can more likely be attributed to a lack of tacit knowledge or judgment than a lack of understanding of accepted IT management practices. This tacit knowledge is not knowledge readily gained through formal educational and training; it is associated with experience.

Thus, if an organization lacks personnel with relevant experience, its options are somewhat limited. In addition to providing training and education opportunities, the organization can recruit new personnel or contract for the expertise. However, as demonstrated by BLM's experience with its prime and IVV contractors, assuring performance is problematic if those supervising the effort lack required expertise. In short, the process of bootstrapping an organization's level of IT management sophistication is problematic. This leaves the organization with essentially two options. It can scale back on the complexity of its IT initiatives and hope to gradually build required expertise and experience over time. Alternatively, the organization can gamble that it will be successful in hiring or contracting the required expertise.

This brief analysis should not be read as a denunciation of identified IT management best practices. On the contrary, research and experience suggest that these practices are valuable. Paradoxically, the chief implication of this study, the fact that implementing these practices is fraught with difficulties, is simultaneously trivial and significant. Practicing managers recognize that successfully implementing these practices is not easy. Certainly a finding that IT management is difficult cannot be a significant insight. Yet the BLM experience is revelatory in at least two respects. First, the case analysis demonstrates that recommended practices can engender conflict or competing aims (e.g., the tension between instilling line manager ownership while implementing enterprise-wide systems). To the extent that managers recognize that these tensions can exist, they should be better able to adjust their initiatives

to reflect their organization's culture and capabilities.

But perhaps more importantly, the case demonstrates how a legalistic focus on instantiating best practices can prove detrimental to the organization. When, as is the case within the U.S. Federal Government, best practices are reflected in formal policies and regulations, there can be a tendency to follow "the letter of the law" rather than the "spirit of the law." Policies can become checklists where ascertaining performance of prescribed activities is easier than determining their quality. This legalistic approach to policy was not only reflected in the actions of BLM management but in the analysis of the program's external auditor, GAO.

Much of the prescriptive literature cited above can be viewed as encouraging a "checklist" mentality and inadequately describing the tensions and limitations inherent in its prescriptions. The chief implication for practice is not to fall into that trap.

Implications for Future Research

In addition to the immediate implications that can be drawn from this study, the descriptive model suggested by this research can serve as a foundation for a variety of future research. Since the development of the proposed model is based on the in-depth analysis of a single entity, further research is required to see how relevant that model proves to other organizations. Furthermore, the model as it currently stands is subject to the same type of criticism that is levied here against much of the existing IT management literature. While it provides a richer conceptualization of how IT management processes can contribute to effective IT use, it still falls short in providing useful guidance with respect to establishing effective IT management practices. Accordingly, three potential areas for future research are described below.

Assessing the Proposed Model

As outlined in the methods section, one of the objectives of this research was to apply interpretive methods in the development of an understanding or model of IT management that

could be assessed using more traditional positivist-oriented research methods. While the author does not believe that the proposed model as formulated above is directly amenable to statistical analysis, it should be possible to design studies that test derived propositions and more deeply explore the interaction among identified constructs.

Exploring IT Management Knowledge

As reflected in the analysis in the preceding section, research in the IT management arena needs to explore and describe tension or conflict inherent in recommended practices. The BLM case provides an indication that more research is needed to understand the interaction of technical and managerial knowledge. While the ALMRS/Modernization Program failure represents a management failure, one could argue that the bureau's lack of technical expertise led to an inability to monitor its contractor's software development and perhaps led to undesirable decisions on the selection of infrastructure standards as well.

Exploring Organizational Culture

IS researchers have long recognized that organizational culture plays a significant role in determining the overall effectiveness of initiatives (Ein-Dor and Segev 1978; Keen 1981; King 1983; Brown and Magill 1994; Sambamurthy and Zmud 1994). In terms of practical application, Markus and Benjamin (1997) specifically address the implications of organizational culture that must be considered in fostering IT-enabled organizational change. More recently, Chan's (2002) discussion of informal organizational processes with respect to achieving IT alignment with business evokes an image of the important role played by organizational culture.

Yet, to some degree, the treatment of organizational culture within the IT management literature remains fuzzy. Researchers recognize the importance of organizational culture yet have difficulty in deriving actionable findings from their research. Further research is needed to explore organizational culture and its implications for the selection and effectiveness of IT governance structures, recruitment and retention of personnel possessing required IT

technical and managerial skills, and organizational commitment to faithfully complying with IT management policies and prescriptions.

CONCLUSION

An extensive IT management literature has been briefly outlined above. However, in reviewing the literature from a practitioner's perspective, the author found much of it to be unsatisfying. The fundamental problem is that while it identifies what needs to be done, it offers minimal insights regarding how IT managers can overcome barriers to implementing the prescriptions. Recommendations to align business and IT strategies, improve technical and managerial knowledge, and establish strong business-line manager relationships are commonly understood by IT managers, who are likely to consider such prescriptions as platitudinous. Improved understanding is required to develop effective strategies for implementing these prescriptions.

Existing IT management prescriptions can be viewed as proverbial "double-edged swords"; they cut both ways. Double-edged swords are effective but their value ultimately lies in the skill and ability of the individuals wielding them. Recent publication of research concerning organization IT capabilities from a resource-based perspective provides insight into the difficulties encountered in building such IT management competencies (Bharadwaj 2000). His research conclusions acknowledge time and experience are needed to achieve such competencies. Yet, academicians should not be satisfied with concluding that such abilities can be developed only through long experience and practice – although there certainly is some truth to the statement. The challenge is to help make explicit that knowledge which is currently implicit.

The proposed model introduced above suggests that technology, knowledge, resources and requirements largely determine the limits of what can be expected from information technology. But more importantly, the model emphasizes the critical role that an organization's culture plays in the efficacy with which the identified resources are

transformed into desired IT outcomes. Effective managers intuitively weigh and balance these constraints in formulating courses of action. Existing IT management prescriptions represent the obvious elements of IT managerial knowledge but minimally address the tacit dimensions of understanding required to initiate action within particular organizational contexts.

There are no "silver bullet" solutions to the difficult issues facing IT managers, no simple management prescriptions or organizational arrangements that can guarantee

success. Even future research conducted along the lines suggested above will not provide formulaic instructions for successfully exploiting information technology. Effectively aligning IT and business strategies and efficiently providing required services depend upon the knowledge of the organization's particular mission, history and environment. Yet, through the study of and reflection on the experiences of unique organizations, we may gain generalized insights that will assist IT managers in their daunting tasks.

REFERENCES

- Altheide, D.L. and J.M. Johnson, "Criteria for assessing interpretive validity in qualitative research," In N.K. Denzin and Y.S. Lincoln (eds.), *Handbook of Qualitative Research*, Thousand Oaks: Sage, 1994, pp. 485-499.
- Beachboard, J.C., "U.S. Bureau of Land Management: The Perils of Implementing Strategic Information Technology," *Communications of the AIS*, 2003, 11:35, pp. 678-94.
- Beachboard, J.C., "Rigor, relevance and research paradigms: A practitioner's perspective," In M.E. Whitman and A.B. Woszczynski (eds.), *The Handbook of Information Systems Research*, Hershey, PA: Idea Group Publishing, 2004, pp. 79-102.
- Bharadwaj, A.S., "A resource-based perspective on information technology capability and firm performance: An empirical investigation," *MIS Quarterly*, 2000, 24:1, pp. 169-196.
- Boynton, A.C., J.C. Jacobs, and R.W. Zmud, "Whose responsibility is IT management?" *Sloan Management Review*, 1992, 33:4, pp. 32-38.
- Boynton, A.C., R.W. Zmud, and G.C. Jacobs, "The influence of IT management practice on IT use in large organizations," *MIS Quarterly*, 1994, 18:3, pp. 299-318.
- Broadbent M. and P. Weill, "Management by maxim: How business and IT managers can create IT infrastructures," *Sloan Management Review*, 1997, 38:3, pp. 77-92.
- Brooks, F.P., *The Mythical Man-month: Essays on Software Engineering*, Reading, MA: Addison-Wesley, 1995.
- Brown, C.V., "Examining the emergence of hybrid IS governance solutions: Evidence from a single case site," *Information Systems Research*, 1997, 8:1, pp. 69-94.
- Brown, C.V. and S.L. Magill, "Alignment of the IS Functions within the Enterprise: Toward a Model of Antecedents," *MIS Quarterly*, 1994, 18:4, pp. 371-394.
- Chan, Y.E., "Why haven't we mastered alignment? The importance of informal organizational structure," *MIS Quarterly Executive*, 2002, 1:2, June, pp. 97-112.
- Cohen, W.M. and D.A. Levinthal, "Absorptive capacity: A new perspective on learning and innovation," *Administrative Science Quarterly*, 1990, 35, pp. 128-152.
- Cohen, Senator W.S., "Computer Chaos: Billions Wasted Buying Federal Computer Systems," 12 October, 1994.
- DeSanctis, G. and M.S. Poole, "Capturing the complexity in advanced technology use: Adaptive structuration theory," *Organization Science*, 1994, 5:2, pp. 121-147.
- Ein-Dor, P. and E. Segev, "Organizational context and the success of management information systems," *Management Science*, 1978, 24:10, pp. 1064-1071.
- Ein-Dor, P. and E. Segev, "Organizational context and MIS structure: Some empirical evidence," *MIS Quarterly*, 1982, 6:3, pp. 55-68.

- Endoso, J., "Procurement reform ignores mismanagement history," *Washington Technology*, December 7, 1995, pp. 20, 24.
- Feeny, D.F. and L. Willcocks, "Core IS capabilities for exploiting information technology," *Sloan Management Review*, 1998, 39:3, pp. 9-21.
- Ferrat, F.A. and Starke, T.W., "Eight lessons: Coordinating multiple organizations in developing IS," *Journal of Systems Management*, 1995, 46:1, pp. 36-40.
- General Accounting Office: *Executive guide: Improving Mission Performance through Strategic Information Management and Technology*, GAO/AIMD-94-115, Washington, DC: GAO, 1994.
- General Accounting Office: *Land Management Systems: Major Software Development does not meet BLM's Business Needs*, GAO/AIMD-99-135, Washington, DC: GAO, 1999.
- Giddens A.: *The Constitution of Society*, Berkeley, CA: University of California Press, 1984.
- Goodhue, D.L., L.J. Kirsch, J.A. Quillard, and M.D. Wybo, "Strategic data planning: Lessons from the field," *MIS Quarterly*, 1992, 16:3, pp. 11-34.
- Holstein, J.A. and J.F. Gubrium, "Phenomenology, ethnomethodology, and interpretive practice," In N.K. Denzin and Y.S. Lincoln (eds.), *Handbook of Qualitative Research*, Thousand Oaks: Sage, 1994, pp. 262-272.
- Keen, P.G.W., "Information systems and organizational change," *Communications of the ACM*, 1981, 24:1, pp. 24-33.
- King, J.L., "Centralized versus decentralized computing: Organizational considerations and management options," *Computing Surveys*, 1983, 15:4, pp. 319-349.
- King, J.L. and K.L. Kraemer, *The Dynamics of Computing*, New York: Columbia University Press, 1985.
- Klein, H.K. and M.D. Myers, "A set of principles for conducting and evaluating interpretive field studies in information systems," *MIS Quarterly*, 1999, 23:1, pp. 67-93.
- Lee, A.S., "Integrating positivist and interpretive approaches to organizational research," *Organizational Science*, 1991, 2:4, pp. 342-365.
- Lewis, B., *IS Survival Guide: Changing CIO from "Career is Over" to "Change is Outstanding"*, Indianapolis, IN: SAMS, 1999.
- Luftman, J.N., *Managing the Information Technology Resource: Leadership in the Information Age*, Upper Saddle River, NJ: Pearson Prentice Hall, 2004.
- Markus, M.L. and R.I. Benjamin, "The IT magic bullet theory in IT-enabled transformation," *Sloan Management Review*, 1997, 38:2, pp. 55-68.
- Miles, M.B. and A.M. Huberman, *Qualitative Data Analysis: An Expanded Sourcebook*, Thousand Oaks, CA: Sage, 1994.
- Orlikowski, W.J., "The duality of technology: Rethinking the concepts of technology in organizations," *Organization Science*, 1992, 3:3, pp. 398-427.
- Orlikowski, W.J. and D. Robey, "Information technology and the structuring of organizations," *Information Systems Research*, 1991, 2:2, pp. 143-169.
- Rockart, J.F., M.J. Earl, and J.W. Ross, "Eight imperatives for the new IT organization," *Sloan Management Review*, 1996, 37:1, pp. 43-55.
- Ross, J.W., C.M. Beath, and D.L. Goodhue, "Develop long-term competitiveness through IT assets," *Sloan Management Review*, 1996, 38:1, pp. 31-42.
- Sambamurthy, V. and R.W. Zmud, "Arrangements for information technology governance: A theory of multiple contingencies," *MIS Quarterly*, 1999, 23:2, pp. 261-290.
- Sambamurthy, V. and R.W. Zmud: *IT Management Competency Assessment: A Tool for Creating Business Value through IT*, Morristown, NJ: Financial Executives Research Foundation, 1994.
- Stake, R.E., "Case Studies." In N.K. Denzin and Y.S. Lincoln (eds.), *Handbook of Qualitative Research*, Thousand Oaks: Sage, 1994, pp. 236-247.
- Stanglin, D. and J. Chetwynd, "Technology wasteland: Washington's failure to harness computers is costing the taxpayers billions," *U.S. News & World Report*, 1996, 120:2, pp. 45-47.

John C. Beachboard

- Strassmann, P.A., *The Politics of Information Management: Policy Guidelines*, New Canaan, CT: The Information Economics Press, 1995.
- Tavakolian, H., "Linking the information technology structure with organizational competitive strategy: A survey," *MIS Quarterly*, 1989, 13:3, pp. 309-317.
- Tillett, L.S., "Interior kills ALMRS," *Federal Computer Week*, 1999, 13:10, pp. 1, 36.
- Van Schaik, E.A., *A Management System for the Information Business*, Englewood Cliffs, NJ: Prentice-Hall, 1985.
- Weill, P. and J.W. Ross, *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*, Harvard Business School Press, Boston, MA, 2004.
- Zmud, R.W., "An examination of 'push-pull' theory applied to process innovation in knowledge work," *Management Science*, 1984, 30, pp. 727-738.
- Zmud, R.W., A.C. Boynton and G.C. Jacobs, "An examination of managerial strategies for increasing information technology penetration in organizations," In J.I. DeGross, J.C. Henderson, and R. Konsynski (eds.), *Proceedings of the Ninth International Conference on Information Systems*, Boston, MA, 1989, pp. 24-44.

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