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Title: *The Untapped Potential of IT Chargeback*

Author: Ross, Vitale, Beath

Date: November 1997

Pages: 31

Abstract: IT chargeback is generally regarded as a necessary evil through which central IT costs are, as accurately as possible, divided among the organizational units that benefit from them. In this study of IT chargeback practices at ten large U.S. firms, we examined the impacts of chargeback on three anticipated outcomes: (a) IT resource consumption, (b) business unit performance evaluations, and (c) business unit attitudes toward IT. We found that chargeback can and does result in reduced resource consumption when charges are based on usage. Nonetheless, we found that business unit managers sense they have no control over their IT charges. Although business managers believe this lack of control over IT charges has no significant impact on their performance evaluations, it does affect their attitudes toward the IT unit. Respondents at six of the ten firms felt that the IT unit was not doing as much as it could to control its own costs. At the other four firms, respondents believed that negotiations with the core IT unit led to more effective IT investments on the part of both IT and business units. At these firms, chargeback facilitated fruitful negotiations about IT costs, services, and use. Based on these findings, we offer recommendations as to how firms can design and use chargeback systems to generate positive attitudes and economic returns.

Title: *Texas Instruments: Service Level Agreements and Cultural Change*

Author: Ross

Date: September 1997

Pages: 22

Abstract: The Information Systems and Services (IS&S) unit at Texas Instruments had a reputation for providing high quality, state-of-the-art systems to the company's individual business units. IS&S found that its centralized structure contributed to a standardized and highly reliable global infrastructure but made it difficult to respond to the firm's increasingly dynamic market environment. In the late 1980s IS&S started distributing staff to the business units to increase communication and to enhance understanding of business requirements and IT capabilities. Global cost pressures and the need for an enabling infrastructure demanded even more proactive efforts to target IS&S products and services at strategic business needs. In this case study the firm is preparing to implement service level agreements for this purpose. The case study identifies design and implementation issues key to the success of its service level agreements.

Title: *Dow Corning Corporation: Business Processes and Information Technology*

Author: Ross

Date: April 1997

Pages: 27

Abstract: This case study, divided here into parts (A) and (B), describes one firm's experiences as it adopted a process perspective to managing its business, examined the implications for its information systems needs, decided to acquire SAP (an integrated, enterprise-wide software package) and embarked on the SAP implementation.

Dow Corning Corporation (A): Business Processes and Information Technology focuses on the business context and describes the role and structure of the information technology (IT) function at Dow Corning in late 1994. In the midst of a legal crisis that is draining financial resources, the firm must address global competition. The case poses the question of how should IT be organized and managed to meet current business challenges.

Dow Corning Corporation (B): Reengineering Global Processes is set in March 1997. The IT organization has been redesigned and reports to a member of the senior management team. The case focuses on Dow Corning's pilot implementation of SAP and its plans to reengineer global processes. Special attention is given to the IT unit's role in the reengineering and systems implementation processes.

Title: *Are We Moving Toward an Information SuperHighway or a Tower of Babel? The Challenge of Large-Scale Heterogeneity*

Author: Madnick

Date: February 1996

Pages: 9

Abstract: The popularity and growth of the "Information SuperHighway" have dramatically increased the number of information sources available for use. Unfortunately, there are significant challenges to overcome.

One particular problem is context interchange, whereby each source of information and potential receiver of that information may operate with a different context, leading to large-scale semantic heterogeneity. A context is the collection of implicit assumptions about the context definition (i.e., meaning) and context characteristics (i.e., quality) of the information. This paper describes various forms of context challenges and examples of potential context mediation services, such as data semantics acquisition, data quality attributes, and evolving semantics and quality, that can mitigate the problem.

Title: *JCPenny: Developing Seamless Operations in a Multi-Platform Environment*

Author: Ross

Date: November 1996

Pages: 19

Abstract: JCPenney must operate a highly reliable, flexible, and cost effective computing and networking environment in order to support the needs of its 1,250 retail stores and catalogue sales business. This case study describes the operations infrastructure that the firm has developed in order to address these requirements. JCPenney is attempting to develop a single network and systems management process for its mainframe and client-server environments. IT management has articulated a clear architecture for accomplishing a seamless operating environment that centralizes and automates as much of the operations work as possible. The case is intended to help readers understand the complexities of current network and systems management, and identify issues important to the development of reliable, cost effective, and secure computing operations.

This is one in a series of case studies developed for MIT's executive education course on "Managing the IT Network for Global Competitiveness." The case study and accompanying teaching note are intended to describe and analyze one company's experiences in building and managing its IT infrastructure.

Title: *Management by Maxim: Creating Business Driven Information Technology Infrastructures*

Author: Broadbent, Weill

Date: October 1996

Pages: 33

Abstract: Information technology (IT) infrastructure capabilities are critical to how firms compete in the marketplace. This is particularly the case for firms in industries going through dynamic change, for firms reengineering their business processes, and for those with extensive international or geographically dispersed operations. Yet infrastructure investments are fraught with difficulty as they often have to be made in advance of specific business strategies.

This paper explains how business driven IT infrastructures are created in successful firms and why this is important. Some firms make no investment in firm-wide infrastructure and this might be appropriate, while others invest up to 10% of their revenues in IT infrastructure, such as communication networks, databases, and expertise that is shared across multiple business units. Both approaches can be correct, provided they each match firm specific needs.

Creating business driven IT infrastructure involves a series of decision points based on a sound understanding of the firm's strategic context. This understanding is articulated and communicated through a series of business maxims. These strategic statements capture the essence of the future direction of the firm. Business maxims lead to the identification of IT maxims which express how information technology resources should be deployed and the ways in which information and data needs to be accessed and used. IT maxims provide a basis for decision making about how the firm should view IT infrastructure and the specific infrastructure services required. Developing successful infrastructures is the joint responsibility of executive and IT management and guidance is given on how this joint responsibility can be exercised.

Title: *The Illusory Diffusion of Innovation: An Examination of Assimilation Gaps*

Author: Fichman, Kemerer

Date: November 1995

Pages: 36

Abstract: Innovation researchers have known for some time that a new technology may be widely acquired, but then only sparsely deployed among acquiring firms. When this happens, the observed pattern of cumulative adoptions will vary depending on which event in the assimilation process (i.e., acquisition or deployment) is treated as the adoption event. Instead of mirroring one another, a widening gap—termed here an assimilation gap—will exist between the cumulative adoption curves associated with the alternatively conceived adoption events. When a pronounced assimilation gap exists, the common practice of using cumulative purchases or acquisitions as the basis for diffusion modeling presents an illusory picture of the diffusion process—leading to potentially erroneous judgments by vendors and prospective adopters about the robustness of the diffusion process already observed, and the technology's future prospects.

This study develops the assimilation gap concept, describes the circumstances under which assimilation gaps are most likely, proposes techniques for the measurement and analysis of assimilation gaps, and applies these techniques in a study of three innovations in software development process technology: relational database management systems (RDBs), general purpose fourth generation languages (4GLs), and computer aided software engineering tools (CASE). Analysis based on graphical techniques showed that, as expected, CASE had a pronounced assimilation gap, while RDBs and 4GLs had more moderate gaps. Further analysis based on survival analysis techniques revealed that the differences in the size of the gaps for the three technologies were statistically significant, and that each gap was large enough in absolute terms to be of practical interest. For researchers, these results suggest that, where the strong possibility of an assimilation gap exists, the time of deployment should be captured instead of, or in addition to, time of acquisition as the basis for diffusion modeling. For managers, the results suggest that they be guarded about concluding, based on impressive sales data, that an innovation is necessarily destined to become widely used.

Title: *Alternative Measures of Adopter Innovativeness: A Conceptual and Empirical Analysis*

Author: Fichman

Date: November 1995

Pages: 39

Abstract: Devising appropriate measures of adopter innovativeness is one of the more important tasks in the innovation diffusion field. Many measures have been proposed, including traditional measures, such as time of adoption, and newer measures, such as stage of assimilation. This study provides both a conceptual and an empirical analysis of six prominent measures of the adopter innovativeness concept: 1) Time of Adoption, 2) Dichotomous Adoption, 3) Aggregated Adoption, 4) Internal Diffusion, 5) Infusion, and 6) Assimilation Stage. The conceptual analysis describes the origins of each measure, identifies potential advantages and limitations, and provides guidance on when and how the measure is likely best applied. The empirical analysis uses data on the adoption of three software process innovations (object-oriented programming languages, relational database management systems, and CASE tools) to operationalize the six measures and to explore several issues raised in the conceptual review.

The conceptual analysis showed that each measure had a unique set of potential strengths and weaknesses, and that no measure dominated any of the others. The empirical analysis provided several additional insights. It was shown that: 1) even thin measures such as Time of Adoption and Dichotomous Adoption can have reasonable strong criterion validity; 2) contrary to the concern first raised by Downs and Mohr, there are positive relationships between the propensities to acquire many innovations, to acquire innovations early, and to implement innovations in depth; 3) the use of Aggregated Adoption has a strong positive effect on variance explained, and leads to a pattern of significant relationships identical to that predicted by theory, and 4) the Extent of Implementation measures (Internal Diffusion and Infusion) have very weak criterion validity, quite possibly due to restriction in the ranges of study variables.

Overall, it appears that, with the possible exceptions of Internal Diffusion and Infusion, the alternative innovativeness measures can be seen as valid indicators of a general notion of adopter innovativeness. As a result, researchers have the freedom to let their substantive interest in different classes of predictors drive the research design process, while still maintaining a strong link to the cumulative tradition of diffusion research.

Title: *The New IT Organization: Eight Imperatives*

Author: Rockart, Earl, Ross

Date: March 1996

Pages: 31

Abstract: Change has emerged as the trademark of the 1990s business environment, and changes in both business and in technology are prompting adaptation in the role and structure of the information technology (IT) function. This article explores some of the challenges IT units now face and defines eight "imperatives" for IT management trying to respond to those challenges. The imperatives are: (1) achieving two-way strategic alignment; (2) developing effective line partnerships; (3) delivering and implementing new systems; (4) building and managing infrastructure; (5) reskilling the IT organization; (6) managing vendor partnerships; (7) building high performance; and (8) redesigning and managing the "federal" IT organization. The article also discusses trends in the structure of the IT organization, and emphasizes the growing and crucial role of line managers in the effective use of IT.

Title: *Managing Models in a Multi-Site Environment*

Author: Hofman

Date: March 1996

Pages: 29

Abstract: Delivering quality software on time and within budget remains, for many organizations, a critical but elusive goal. Many organizations are increasingly turning to the use of commercial software packages, while others continue to custom build applications. A third alternative is the template approach. A template is a system which has been built with a CASE tool and reused, with modifications made at the design, or model level. Depending on the particular CASE tool, the code is then automatically generated from the changed design. Our prior research in this area suggested a number of benefits associated with the template approach. In addition, the companies we studied all found that working with models was far superior to working with program code. At the same time, however, working with models presents some unique challenges. In particular, managing the models across multiple sites and keeping them synchronized has proven to be an extremely complex process.

This paper describes the efforts of five companies who are implementing and managing templates internally across multiple divisions. It examines the issues they are encountering and the different ways in which they have addressed these issues. Key factors which influence the effective use of a template approach include the design of the template, a well-defined template management process for new releases, clear decision criteria for changes to the core template, and supportive model management tools. Given the degree and nature of change involved, particularly since it crosses organizational boundaries, senior management involvement and understanding is critical.

While the benefits and issues noted here are discussed specifically as they relate to templates, organizations striving to deploy common systems and packages globally will find themselves faced with a similar set of considerations.

Title: *Developing Long-Term Competitiveness through Information Technology Assets*

Author: Ross, Beath, Goodhue

Date: December 1995

Pages: 26

Abstract: Claims that information technology can be a source of competitive advantage, which populated business literature in the late 1980s, have been largely discredited. Nonetheless, business executives continue to look for ways to apply information technology strategically to their businesses. Reporting on a two-year study of IT management practices, the authors note that some firms do appear to generate competitive advantage from their IT, but the advantage results from their IT capabilities not from their IT applications. Specifically, a firm delivers value from IT by building and leveraging three assets: highly competent IT human resources, a reusable technology infrastructure, and a strong IT-business partner relationship. These three assets are interrelated in the sense that they tend to strengthen-or weaken-one another. Together, they allow a firm to apply information technology to strategic business needs faster and more cost effectively than the competition. This paper describes the characteristics of strong IT assets and offers strategies for developing them.

Title: *The Role and Worldview of Design Practitioners: A Multimethod Study of Information Systems Developers in the Public Sector*

Author: Epstein

Date: December 1995

Pages: 32

Abstract: Rational/scientific approaches are often espoused in normative models of design, yet descriptive research suggests that designers use methods that differ significantly from the prescribed model of technical rationality. This paper argues that the scientific approach represents one of two dialectical and complementary metatheories of design, both of which are required for effective design practice. Associated with each perspective are a multitude of attributes including designer ontology, epistemology, role, value system, and role characteristics. This paper draws upon research in practitioner epistemology, decision-making, and role theory to establish a model linking designer assumptions and designer role. The paper outlines two complementary worldviews that are brought to bear on the planning and design activity. The scientific worldview, characterized as objectivist, reductionist, and mechanistic, is contrasted with its complement, the humanistic worldview, characterized as subjectivist, holistic, and organic. For each worldview the model identifies a constellation of internally consistent and mutually reinforcing assumptions, as well as a designer role, value system, and role characteristics.

Four hypotheses are derived linking design metatheory with specific role characteristics including product/service orientation, task/relational orientation, tolerance for ambiguity, and orientation towards hierarchy. These were tested using secondary data from a sample of 64 information systems developers in the public sector. Differences were statistically significant for three of the four hypotheses, with the fourth marginally significant. Scientific designers were more product-oriented, task-oriented, intolerant of ambiguity, and hierarchically oriented than their humanistic counterparts. Findings were substantiated through a series of confirmatory interviews with several key informants.

By calling attention to the interlocking set of attributes associated with each perspective, the model allows designers and their clients to recognize their innate predispositions, to make conscious and informed choices regarding their roles in the design process, to diagnose imbalances, and to move fluidly and consciously between perspectives. Many of the classical planning and design dilemmas can be traced to an unbalanced emphasis on a single perspective. Resistance to change on the part of both practitioners and clients can be understood and accommodated when recognized as a clash of fundamental assumptions. Interventions can be made at any of the four levels in the model. Implications for the selection, education, socialization, and supervision of designers are discussed. These metatheories are best viewed as complementary perspectives, as both are required in appropriate balance for effective design. Design strategies which over-value either perspective at the expense of the other are likely to be less powerful and more highly at risk than those which incorporate both.

Title: *Realizing the Potential of Groupware Technologies: An Improvisational Strategy for Change Management*

Author: Orlikowski,

Date: November 1995

Pages: 26

Abstract: A particularly relevant and promising technology that is increasingly being used to support new organizational forms is groupware. However, the potential of groupware technologies to enable dramatic changes in organizational structures and processes seems to be hard to realize in practice. While there are numerous reasons for these difficulties, we believe that a major influence on the effective implementation and use of groupware technologies is the change strategy used to manage them.

Specifically, we believe that top-down, planned, strategies for implementing new information technologies—in which each step of the change is defined in advance and the organization then strives to implement these changes as planned in a specified period of time—are not particularly useful for the new class of open-ended and customizable technologies such as groupware. Instead, we propose an improvisational strategy around groupware technologies which accommodates and encourages ongoing organizational learning, experimentation and discovery with the new technology, and allows organizations to respond to and even leverage unanticipated outcomes. We illustrate the value of this strategy by describing the experiences of an organization which successfully managed changes in its customer service operations through the implementation and use of the Notes groupware technology. We conclude by considering some of the conditions under which an improvisational change strategy may be most effective.

Title: *A German View of Executive Support Systems*

Author: Rechkemmer

Date: September 1995

Pages: 21

Abstract: The German view of executive support systems (ESS) described in this paper has its roots in a board-level ESS project undertaken at Daimler-Benz AG. This project led the author to wonder how differences in US and German management approaches are reflected in top executives' need for, and use of, information. He surveyed IS executives in six large firms in Germany about their views of ESS. This paper presents the results of the survey, which was done in connection with the MIT International Center for Research on the Management of Technology (ICRMOT), and draws upon ESS research conducted by the MIT Center for Information Systems Research (CISR).

Title: *Schneider National Inc.: Building Networks to add Customer Value*

Author: Ross

Date: September 1995

Pages: 18

Abstract: Schneider National, Inc. is in the process of transforming itself from a trucking company to an asset-based logistics company. The change is a response to customer demands and offers tremendous potential for long-term growth, but it requires a very different information technology infrastructure than the company has developed for its traditional operations. This case study identifies the information technology requirements for a logistics company and how Schneider is going about developing them.

Title: *Gtech Corporation: Leveraging Networking Competencies*

Author: Ross

Date: September 1995

Pages: 12

Abstract: GTECH is the world's dominant lottery company. In the process of installing and administering lotteries, GTECH has developed expertise in developing highly efficient, reliable, low-cost transaction processing networks. As the lottery market becomes saturated, GTECH needs to find new business opportunities that will leverage its technology strengths. To that end, GTECH has won a contract in Texas to administer food stamps and other government benefits electronically. This case discusses how GTECH developed its unique competencies as well as the challenges of leveraging those competencies in new markets.

Title: *Johnson & Johnson: Building an Infrastructure to Support Global Operations*

Author: Ross

Date: September 1995

Pages: 21

Abstract: Johnson & Johnson, Inc. has over 100 years of experience operating in decentralized management practices, but its customers are increasingly demanding that J&J present “a single face.” This means that J&J must coordinate sales, distribution, financial, and marketing information across its 160 operating companies. This case reviews possible strategies for developing an information technology infrastructure that would enable J&J to be more responsive to its customers’ demands. The case cites both technical and organizational challenges inherent in implementing a more centralized infrastructure.

Title: *Travelers Insurance: Process Support Through Distributed Technologies*

Author: Ross

Date: September 1995

Pages: 33

Abstract: Travelers Insurance has undertaken a large scale systems project to effectively redesign the workers compensation claim process. The project team has agreed to use high-risk technologies in order to provide case managers with both the standardization and the flexibility they need to become highly productive and customer oriented. Travelers' information technology unit has strong technical skills but no experience with object oriented technologies, and Travelers is building an infrastructure to support client-server systems even as it pursues this project which will put servers in fifty-one offices around the country. This case examines the decision to pursue this high-risk development project. The addendum to this case, *Travelers Insurance: Centralized Support of Distributed Systems*, provides detail on the infrastructure the company developed to support the system. This addendum permits discussion of alternative architectures for managing distributed computing in large organizations.

Title: *The Assimilation of Software Process Innovations: An Organizational Learning Perspective*

Author: Fichman, Kemerer

Date: July 1995

Pages: 39

Abstract: Software process innovations (SPIs) impose a substantial burden on would-be adopters in terms of the know-how and technical knowledge needed to use them effectively. The burden of organizational learning surrounding these technologies—and complex organizational technologies in general—creates a “knowledge barrier” that inhibits diffusion (Attewell 1992). While Attewell’s model suggests that many organizations will defer adoption until knowledge barriers have been sufficiently lowered, it says little about which organizations should be more likely to innovate even in face of high knowledge barriers. This research proposes that organizations will have a greater propensity to successfully innovate in face of knowledge barriers when the burden of organizational learning is effectively lower, either because the organizations already possess much of the know-how and technical knowledge necessary to innovate, or because they can acquire such knowledge more easily or more economically. Specifically, it is hypothesized that information technology (IT) organizations will be more likely to initiate and sustain the assimilation of SPIs when they have a greater scale of activities over which learning costs can be spread (learning-related scale), more extensive existing knowledge in areas related to the focal innovation (related knowledge), and a greater diversity of technical knowledge and activities in general (diversity).

An empirical study was conducted using data on the assimilation of object oriented programming languages (OOPs) by the IT departments of 608 medium to large US firms. Data analysis, using partial least squares, strongly confirmed the importance of learning-related scale, related knowledge, and diversity in explaining the assimilation of OOPs. For researchers, these results support and extend Attewell’s reconceptualization of diffusion theory for the case of complex organizational technologies. The managerial significance of these results is in identifying the profile of a likely innovator. For vendors this profile provides a basis for more targeted marketing and promotion. For potential adopters this profile supports a critical self-evaluation: organizations that fit the profile should, in general, be more aggressive adopters of new technology; while those that do not should consider strategies that emphasize delay, or should consider adoption of a simpler technology variant.

Title: *Radical Change in the Systems Delivery Process: Object-Oriented Component Assembly*

Author: Hofman

Date: June 1995

Pages: 34

Abstract: Organizations today are looking for a systems delivery strategy that addresses their need for speed, cost containment and flexibility. One of the strategies we have been studying is object-oriented component assembly. In a component assembly delivery environment, systems are assembled from pre-existing, standardized parts rather than developed. Components could be built internally or purchased externally if available. Assembly might be performed by IS or, as the tools improve, by the business users themselves. Companies that are pursuing this strategy are aiming for massive reductions in cycle time, and the ability to handle unpredictable, ongoing business change.

This paper outlines the efforts of four companies in this area, examines the issues they are encountering, and compares the different ways in which they are handling these issues. This delivery strategy requires changes in the IS organization including structure, culture and process and is further complicated by the immaturity of the underlying technology. Changes in the business are also required, particularly with regard to ownership and funding of applications. While there are clearly risks in choosing this strategy, the potential benefits are correspondingly high.

Title: *Evolving with Notes: Organizational Change Around Groupware Technology*

Author: Orlikowski

Date: June 1995

Pages: 35

Abstract: This paper examines the use of a groupware technology—Lotus Development Corporation's Notes®—in the context of customer support to understand how the technology was used to enable organizational changes over time. Building on its successful implementation of the technology two years ago, the customer support department underwent a number of organizational changes that altered the nature and distribution of work, forms of collaboration, utilization and dissemination of knowledge, and coordination with internal and external units. These changes were enacted through a series of intended as well as opportunistic modifications to both the technology and the organization. The effectiveness of this change process suggests a strategy of implementing and using groupware technology that focuses first on enacting some initial planned organizational changes, and then builds on these to enact emergent changes in response to the opportunities and conditions occasioned by the planned changes. Because groupware technologies are largely open-ended and adaptable, this process of evolving organizationally with the technology over time may be a particularly useful way of implementing organizational change around groupware.

Title: *The Role of Information Technology Infrastructure in Business Process Redesign*

Author: Broadbent, Weill,

Date: May 1995

Pages: 31

Abstract: To gain business value from their investments in Information Technology (IT), firms need to carefully examine the links between their strategic context, the role and capabilities of their IT infrastructure, and the nature of their business processes. Recent experience in large firms indicates that the type of IT infrastructure in place at both corporate and business unit levels is an indicator of the firm's positioning to undertake significant and successful business process redesign. This paper explores the relationship between Business Process Redesign (BPR) and IT infrastructure, conceptually and empirically in four large firms. Of the four firms studied in detail, the two which had an extensive set of IT infrastructure services were more easily able to implement dramatic change to their business processes over a relatively shorter time frame.

We found that if a firm has a suitable IT infrastructure in place, it is well positioned to implement either Process Innovation or Process Simplification. Where services or components of that infrastructure are missing then the firm is more likely to be limited to Process Simplification. The implementation of Process Innovation will require further enhancements to the firm's IT infrastructure. The lack of IT infrastructure can be a barrier to successfully implementing Process Innovation. The readiness of firms to change both their business processes and their IT infrastructure depends partly on the view (i.e., utility, dependent, or enabling) which the firm takes of investments in IT infrastructure. The paper concludes by proposing a model linking IT infrastructure and BPR with strategic context.

Title: *The Information Systems Balancing Act: Building Partnerships and Infrastructure*

Author: Brown, Ross

Date: February 1995

Pages: 20

Abstract: Information systems (IS) units require organizational structures that both facilitate close partnerships with business unit clients and enable tight coordination of computing platforms to strengthen the technology infrastructure. For years, IS executives have recognized that the structure that best supports each objective is counterproductive for the other objective. Thus, they have periodically undertaken major restructuring, which has the effect of alternating between the objectives rather than addressing them simultaneously. We have observed that IS executives are increasingly attempting to achieve partnership and infrastructure development simultaneously. They are doing so through balancing mechanisms. These are structural overlays and process enhancements that leverage the strengths of an existing organizational structure while compensating for its limitations, thus enabling the IS function to work towards partnership and infrastructure development simultaneously. This paper describes some balancing mechanisms and offers a strategy for using these mechanisms to achieve IS management goals.

Title: *Assessing the “Health” of the Information Systems Applications Portfolio: A Case Study in Process Manufacturing*

Author: Weill

Date: December 1994

Pages: 33

Abstract: This paper presents a model of the health of the IS applications portfolio and illustrates how it can be assessed through a case example in process manufacturing. The health of the portfolio is defined as a value judgment by a senior manager of a business unit’s set of systems. The value judgment is based on five important attributes of the IS applications portfolio: system importance, investment, technical quality, use and management value.

Health Grids are introduced as a vehicle for representing the IS applications portfolio so that the assessment of health can be made by senior management. One of the purposes of the Health Grids is to make the assessment of the health of the portfolio explicit, transparent and open for discussion. Assessment of the health of the portfolio in the firm studied is aided by a statistical analysis of the relationship between the attributes of the portfolio.

In the firm studied, the health was generally assessed as in need of attention. For example, there was no evidence of any relationship between investment in a system and management value. System importance and investment were positively associated with use but only importance was positively related to management value. Technical quality was not a factor in explaining management value or use. In fact, there was a negative relationship between technical quality and use.

The paper concludes with a four step suggested approach to assessing the health of the IS applications portfolio: (1) Assess the state of health using the Health Grids. (2) Assess the underlying patterns in the firm using the statistical analysis. (3) Assess how the firm got this way. (4) Determine what to do about it.

Title: *Shaping Electronic Communication: The Metastructuring of Technology in Use*

Author: Orlikowski, Yates, Okamura, Fujimoto

Date: October 1994

Pages: 49

Abstract: In this paper we suggest that the use of computer-mediated communication technologies to support more flexible and dynamic ways of organizing can be facilitated by explicit and ongoing adaptation of those technologies to changing contexts of use. In an exploratory study on the use of a computer conferencing system in an R&D setting, we found that use of the new medium was significantly influenced by the intervention of a few individuals who took on a role we label technology-use mediation. These mediators shaped everyday use of the conferencing technology, modifying the technology as well as the context of use to facilitate more effective electronic communication. Drawing on the insights of this empirical study, we develop a theoretical framework that views technology-use mediation as influencing how users structure their communication technologies, and hence as one form of metastructuring. We believe that the role of technology-use mediation may serve as a valuable mechanism for providing the ongoing attention and resources needed to contextualize what are often generic computer-mediated communication technologies to the shifting conditions of dynamic organizational forms.

Title: *The Information SuperHighway and Electronic Commerce: Effects of Electronic Markets*

Author: Benjamin, Wigand

Date: August 1994

Pages: 30

Abstract: This paper examines how electronic markets may affect the evolution of the emerging national information infrastructure, popularly described as the information superhighway. Although not specifically discussed the conclusions reached seem applicable to the emerging global information infrastructure as well, albeit its development may be somewhat slower. IT anticipates a rapid expansion of electronic market activity, as the national information infrastructure (NII) is connected to where the consumer lives, the home. When this happens (most likely over a ten year transition) significant changes in the economics of marketing channels, patterns of physical distribution, and the structure of distributor companies may also take place. Central to this evolution will be the way in which the "market choice box," the consumer's interface between the many electronic devices in the home (television, telephone, and computers), the information superhighway, and the vast variety of market choices, will be implemented.

Electronic markets, augmented by the capabilities of the market choice box, may profoundly affect those industry value chains that terminate with the consumer. The analysis presented here draws on previous writing on transaction costs and electronic markets and suggests that: 1) all intermediaries between the manufacturer and the consumer may be threatened, as the NII reaches out to the consumer; 2) profit margins may be substantially lowered and redistributed; 3) the consumer will thus have access to a broad choice of lower priced goods; and 4) there will be many opportunities to restrict market access to the potentially vast amount of commerce that will flow to the consumer. Although many of these potential areas of restricted access are being debated in public policy arenas, the market choice box, a technology component, may become a critical component of free access and thus needs public policy scrutiny.

Title: *Computers and Economic Growth: Firm-Level Evidence*

Author: Brynjolfsson, Hitt

Date: August 1994

Pages: 45

Abstract: In advanced economies, computers are a promising source of output growth. This paper assesses the value added by computer equipment and information systems labor by estimating several production functions that also include ordinary capital, ordinary labor and R&D capital. Our study employs recent firm-level data for 367 large firms which generated approximately \$1.8 trillion dollars in output per year for the period 1988 to 1992.

We find evidence that computers are correlated with significantly higher output at the firm level, although simultaneity makes it difficult to prove a causal relationship. Considering the rapid growth of computer capital stock, our estimates imply that computers were associated with more output growth in the sample period than all other types of capital combined, despite the fact that they accounted for less than 2% of the total capital stock.

Title: *Implementing Radical Change: Gradual Versus Rapid Pace*

Author: Gallivan, Hofman, Orlikowski

Date: August 1994

Pages: 34

Abstract: This paper explores the question of how radical changes are implemented in organizations. The literature either does not directly address this issue or implies that radical change can only be implemented rapidly. In fact, to speak of the gradual implementation of radical change may at first glance appear paradoxical: how can radical change be implemented slowly? We examine the assumptions underlying various notions of radical change, and suggest that it may be useful for both conceptual and managerial reasons to distinguish, at least analytically, between the nature or degree of organizational change (radical or incremental) and the pace or speed of its implementation (rapid or gradual). Drawing on the findings of a field study that investigated the implementation of radical change in systems development, we show that the gradual implementation of radical change may not only be feasible, but also effective in some situations. Specifically, we identify characteristics of the organizational context and the technological innovation that can indicate the conditions under which gradual implementation of radical changes may be appropriate.

Title: *Application Templates: Faster, Better, and Cheaper Systems*

Author: Hofman, Rockart

Date: July 1994

Pages: 32

Abstract: Organizations today are undergoing massive transformations in the way they are structured, managed, and operated. The ability to develop and change their information systems quickly and often is increasingly important. Two primary approaches to systems development have existed to date: build or buy. Our research over the past two years suggests that a third alternative is emerging which can enable organizations to both develop and change systems faster. This is a “template” approach which combines most of the best aspects of the other two. Templates are existing systems built with the aid of “CASE” tools which are being changed at the design level, and thereby customized for a new organization's use.

This paper discusses the use of the template approach by three companies, as well as the rapidly growing template marketplace. All three organizations cited significant reductions in the time and cost of delivering their system, as well as improvements in IS-business relationships and the ability to learn new business methods and technologies. At the same time, there are some issues in pursuing a template approach today, including supply, CASE tool acceptance, and competition from other approaches. The template market is currently in its infancy, but is becoming increasingly active as software package vendors, tool vendors, and custom software consultants begin offering templates or announce plans to do so. From what we have seen, the template alternative clearly warrants attention today.

Title: *Generating Value from Infrastructure Investments: An Examination of Client–Server and Teams*

Author: Ross, Beath, Goodhue

Date: March 1994

Pages: 26

Abstract: As one way to increase IS's contribution to their firms' business value, IS executives are introducing IT infrastructure changes in their organizations. Because the impact of these changes is difficult to measure, it is unclear whether specific initiatives do, in fact, generate value. Furthermore, the conditions that must exist in order for them to result in anticipated benefits are unknown. This study examines two infrastructure initiatives—the implementation of client-server architectures and the adoption of team-based management structures in IS—in order to determine how these changes might result in increased business value. Findings from twelve case studies suggest that firms must attend to partnership, technology architecture and IS skill factors in order to achieve the benefits and avoid the risks of these management initiatives.

Title: *I/T Value and the Role of I/T Infrastructure Investments*

Author: Weill, Broadbent, St. Clair

Date: March 1994

Pages: 26

Abstract: Successful exploitation of I/T by a firm and its business units stems from the alignment between the strategic context of the firm and its I/T portfolio. All I/T investment is not alike, and the I/T-related capability that is the largest contributor to long-term business advantage is I/T infrastructure.

Firms invest in information technology to achieve four fundamentally different management objectives: strategic, informational, transactional and infrastructure. I/T infrastructure is the base foundation of I/T capability, shared throughout the firm and usually provided by the information systems function in the form of reliable services. I/T infrastructure investments are typically large, long-term in nature and underpin the future competitiveness of firms. The direct business benefits of I/T infrastructure are difficult to specify and an analogy can be drawn with investments in public infrastructure at national and regional levels.

What firms expect to get from their I/T infrastructure investments depends on their view of the role of I/T infrastructure. Drawing on recent research in large firms, this chapter identifies and describes three different views of infrastructure in firms: UTILITY, DEPENDENT and ENABLING. The investment, benefit expectations, and value of I/T infrastructure is determined to a great extent by the way a firm views I/T infrastructure, and is linked to the ability of firms to achieve their strategic intent and implement their vision. This is illustrated by examples of these views in three firms.

Title: *Context Interchange: Overcoming the Challenges of Large-Scale Interoperable Database Systems in a Dynamic Environment*

Author: Goh, Madnick, Siegel

Date: February 1994

Pages: 26

Abstract: Research in database interoperability has primarily focused on circumventing schematic and semantic incompatibility arising from autonomy of the underlying databases. We argue that, while existing integration strategies might provide satisfactory support for small or static systems, their inadequacies rapidly become evident in large-scale interoperable database systems operating in a dynamic environment. The frequent entry and exit of heterogeneous interoperating agents renders “frozen” interfaces (e.g., shared schemas) impractical and places an ever increasing burden on the system to accord more flexibility to heterogeneous users. User heterogeneity mandates that disparate users’ conceptual models and preferences must be accommodated, and the emergence of large-scale networks suggests that the integration strategy must be scaleable and capable of dealing with evolving semantics.

As an alternative to the integration approaches presented in the literature, we propose a strategy based on the notion of context interchange. In the context interchange framework, assumptions underlying the interpretations attributed to data are explicitly represented in the form of data contexts with respect to a shared ontology. Data exchange in this framework is accompanied by context mediation whereby data originating from multiple source contexts is automatically transformed to comply with the receiver context. The focus on data contexts giving rise to data heterogeneity (as opposed to focusing on data conflicts exclusively) has a number of advantages over classical integration approaches, providing interoperating agents with greater flexibility as well as a framework for graceful evolution and efficient implementation of large-scale interoperable database systems.

Title: *Reinventing the IS Organization: Evolution and Revolution in IT Management Practices*

Author: Ross, Beath, Goodhue

Date: February 1994

Pages: 25

Abstract: Competitive environments and sophisticated technologies are presenting IS executives with new opportunities and pressures, encouraging many to consider new IS management practices. This paper describes a study of fifty executives' new management practices and the reasons they were implemented. The findings suggest that IS executives are most concerned with delivering business value, but they believe that delivering business value requires attention to five other concerns: the technical infrastructure, the staff infrastructure, productivity, cycle time, and partnership. Executives are making both evolutionary and revolutionary changes in their management practices as they attempt to address multiple objectives simultaneously. The executives' concerns are summarized in a proposed model of IT management that demonstrates the complex interrelationships between objectives and practices.

Title: *Network Externalities in Microcomputer Software: An Econometric Analysis of the Spreadsheet Market*

Author: Brynjolfsson, Kemerer

Date: June 1993

Pages: 38

Abstract: As an economic good, software has a number of interesting properties. In addition to the value of intrinsic features, the creation of or conformance to industry standards may be critical to the success of a product. This research builds and evaluates econometric models to determine which product features are important in the purchase and pricing decisions for microcomputer software. A special emphasis is to identify the effects of standards and network externalities.

Four main results were found for the microcomputer spreadsheet market for the time period 1987–1992. Hedonic regression techniques can provide sensible estimates of the value users place on intrinsic features such as the ability to sort the data or to embed charts. Network externalities measurably influence the value of products. Each one percent increase in a product's installed base enables the product to command an additional \$3.94 in price. Purchasers place significant value on adherence to standards. Products compatible with the Lotus menu tree interface earned a premium of approximately 30% of the average price in the sample. Shifts in technology platforms substantially change vendor premiums. Products manufactured by Lotus Development Corporation commanded a premium of \$272 on the DOS platform but only \$65 on non-DOS platforms.

The results of this research and the general model proposed can be used to estimate the relative values of software package features, adherence to standards, and increased market share. It also quantifies the opportunities created by changes in technology architecture. Finally, the results offer guidance into current public policy issues such as the value of intellectual property embodied in software.

Title: *Technological Frames: Making Sense of Information Technology in Organizations*

Author: Orlikowski, Gash

Date: October 1993

Pages: 47

Abstract: In this paper, we build a theoretical framework to extend research into users' and designers' cognitions and values by proposing a systematic approach to examining the underlying assumptions, expectations, and knowledge that people have about technology. Such interpretations of technology (which we label technological frames) are central to understanding technological development, use, and change in organization as they critically influence the way people act around technology. We suggest that where the technological frames of key groups in organizations—such as managers, technologists, and users—are significantly different, difficulties and conflict around the development, use, and change of technology may result. We use the findings of an empirical study to illustrate how the nature, value, and use of a groupware technology were interpreted differently by various organizational stakeholders, resulting in outcomes that deviated from those expected. We argue that technological frames offer an interesting and useful analytic perspective for explaining and anticipating actions and meanings around information technology that are not easily obtained with other theoretical lenses.

Title: *Exploiting Opportunities for Technological Improvement in Organizations*

Author: Tyre, Orlikowski

Date: May 1993

Pages: 35

Abstract: In recent years, managers have learned through hard experience that in order to exploit the advantages of new process technologies, they must adapt those technologies and their ways of using them to fit the organization and its strategy. But exactly how and when organizations actually make those changes is not well understood. In this paper the authors argue that technological improvement is seldom a steady process. Instead, users of new process technologies tend to alternate between short episodes of intensive change activity and longer periods of more routine use. Data from European and US firms show that adaptation to new technologies often occurs in a lumpy or episodic pattern. In these settings, the pattern appears to be a natural out-growth of potent organizational forces that make it difficult to devote attention and energy to adaptation for long periods of time. Examination of several leading Japanese organizations reveals a similar pattern with one important difference: managers in these operations actively exploit the episodic pattern of adaptation around a given technology. Drawing on these observations, the authors suggest that managing an uneven pace of adaptation can yield important benefits to firms pursuing both efficiency and change.

Title: *Electronic Integration and Business Network Redesign: A Roles-Linkage Perspective*

Author: Kambil, Short

Date: July 1993

Pages: 32

Abstract: This paper develops a preliminary theory of the effects of electronic integration (EI) at the level of the business network. Electronic integration refers to strategic choices made by firms to exploit electronic data interchange (EDI) and interorganizational systems (IOS) to transform business processes and relationships, the business network or the firm's business scope. The business network is defined as the structure of interdependent relationships between the activities of a given firm and those of other firms in its competitive environment which influence each others' strategies.

Building from a critical review of prior research on IT-enabled, electronic integration, we develop a model of network roles and linkages between roles and suggest the roles-linkage model provides a useful conceptual schema with which to study electronic integration. We elaborate our model in a case drawn from the tax return preparation industry. Based on our analysis, we suggest guidelines for theory development and case-based research. We conclude by discussing key advantages and disadvantages of our preliminary model and suggest research extensions of the approach to facilitate further studies of networked organizations.

Title: *From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer–Supplier Relationships*

Author: Bakos, Brynjolfsson

Date: June 1993

Pages: 33

Abstract: As search costs and other coordination costs decline, theory predicts that firms should optimally increase the number of suppliers with which they do business. Despite recent declines in these costs due to information technology, there is little evidence of an increase in the number of suppliers used. On the contrary, in many industries firms are working with fewer suppliers. This suggests that other forces must be accounted for in a more complete model of buyer-supplier relationships.

This paper uses the theory of incomplete contracts to illustrate that incentive considerations can motivate a buyer to limit the number of employed suppliers. To induce suppliers to make investments that cannot be specified and enforced in a satisfactory manner via a contractual mechanism, the buyer must commit not to expropriate the ex post surplus from such investments. Under reasonable bargaining mechanisms, such a commitment will be more credible if the buyer can choose from fewer alternative suppliers. Information technology increases the importance of non-contractible investments by suppliers, such as quality, responsiveness and innovation; it is shown that when such investments are particularly important, firms will employ fewer suppliers, and this will be true even when search and transaction costs are very low.

Title: *Evidence on Economies of Scale in Software Development*

Author: Banker, Chang, Kemerer

Date: July 1993

Pages: 20

Abstract: Researchers and practitioners have found it useful for cost estimation and productivity evaluation purposes to think of software development as an economic production process; whereby inputs—most notably the effort of systems development professionals—are converted into outputs (systems deliverables), often measured as the size of the delivered system. One central issue in developing such models is how to describe the production relationship between the inputs and outputs. In particular, there has been much discussion about the existence of either increasing or decreasing returns to scale. The presence or absence of scale economies at a given size are important to commercial practice in that they influence productivity. A project manager can use this knowledge to scale future projects so as to maximize the productivity of software development effort.

The question of whether the software development production process should be modeled with a nonlinear model is the subject of some recent controversy. This paper examines the issue of nonlinearities through the analysis of eleven datasets using, in addition to standard parametric tests, a new statistical test with the nonparametric Data Envelopment Analysis (DEA) methodology. Results of this analysis support the hypothesis of significant nonlinearities, and the existence of both economies and diseconomies of scale in software development.

Title: *An Exploratory Study of Joint Application Design (JAD) in Information Systems Delivery*

Author: Davidson

Date: June 1993

Pages: 22

Abstract: Joint Application Design (JAD) methods are commonly used in information systems delivery to gather business requirements for systems development projects. Although these methods are popular and their use is widely advocated, there have been no theoretical analyses of their effects on ISD processes and no systematic empirical evaluation of their use and potential organizational outcomes. This paper reports on an exploratory field study into the adoption and use of JAD methods at three research sites. The major empirical finding was that espoused JAD methods were incorporated into practices and used in ways that were highly consistent with the existing ISD process at the research sites. Without changing the ISD process in ways prescribed by JAD methods, the extent to which use of JAD methods result in expected benefits is questionable. This result can be explained by drawing on institutional theory. Implications for managers are discussed and additional research areas are identified.

Title: *Transformation of the IS Organization: From “Technical Portfolio” to “Relationship Portfolio”*

Author: Venkatraman, Loh

Date: May 1993

Pages: 16

Abstract: The traditional information systems (IS) organization is analogous to a “technical portfolio” that is characterized by: (1) the acquisition of IS-based competencies from internal arrangements (e.g., line management obtaining services from the corporate IS department); and (2) the concentration of decision rights on the use of IS within the central IS division (e.g., end-users having to conform to IS policies that invariably originate from the IS division).

In this paper, we argue that the emergent IS organization is more appropriately referred to as a “relationship portfolio.” By this, we mean that IS-based competencies are now sourced from inter-organizational arrangements, where vendors might play a critical role in providing the necessary capabilities. Further, IS decision rights are now distributed to line management where the users have a greater autonomy in leveraging the systems and applications for maximal benefits. We provide a set of prescriptions for managers in positioning the IS organization within the context of our framework.

Title: *CASE Tools as Organization Change: Investigating Incremental and Radical Changes in Systems Development*

Author: Orlikowski

Date: May 1993

Pages: 50

Abstract: This paper presents the findings of an empirical study into two organizations' experiences with the adoption and use of CASE tools over time. Using a grounded theory research approach, the study characterizes the organizations' experiences in terms of processes of incremental or radical organizational change. These findings are used to develop a theoretical framework for conceptualizing the organizational issues around the adoption and use of these tools—issues that have been largely missing from contemporary discussions of CASE tools. The paper thus has important implications for research and practice. Specifically, the framework and findings suggest that in order to account for the experiences and outcomes associated with CASE tools, researchers should consider the social context of systems development, the intentions and actions of key players, and the implementation process followed by the organization. Similarly, the paper suggests that practitioners will be better able to manage their organizations' experiences with CASE tools, if they understand that such implementations involve a process of organizational change over time, and not merely the installation of a new technology.

Title: *Managing Information Technology Enabled Change*

Author: Benjamin, Levinson

Date: April 1993

Pages: 29

Abstract: The purpose of this article is to provide managers with several key models to help them understand information technology enabled change, and a set of principles that can be used in managing technology introduction. The change models include: a time-based process model that describes the tasks necessary at each stage of the change process; an equilibrium model that describes the relationships of technology, organization, and work processes; and a stakeholder model that analyzes change from the perspective of the stakeholders. The change management principles apply the models and link them to issues of implementation, resistance, management and scope of change.

Title: *Computerized Loan Origination Systems: A Case Study of the Electronic Markets Hypothesis*

Author: Hess, Kemerer

Date: March 1993

Pages: 38

Abstract: Much has been written in recent years about the changes in corporate strategies and industry structures associated with electronic coordination of market activities. This paper considers the advent of electronic market coordination in the home mortgage industry, focusing on Computerized Loan Origination systems (CLOs). Initially developed over a decade ago, CLOs give home buyers an automated means to compare, select, apply for and close mortgage loans. CLO terminals, sometimes found in real estate agencies, provide mortgage information and application services from several lenders at the point of sale of the property to be mortgaged.

Case studies of five CLOs (First Boston's Sherlternet, Planning Research Corporation's LoanExpress American Financial Network's Rennie Mae, Prudential's CLOS, and Citicorp's Mortgage Power Plus) reveal a range of system functionalities. A three-level categorization, from "Loan Listing Service" to "Transformed Market" is proposed, and the five case studies are mapped to this categorization.

Predictions from the Electronic Markets Hypothesis (EMH) are tested against the empirical results of the five case studies. The results were that, as suggested by the EMH, coordination technology has reduced the time and effort required to select and secure a mortgage. In addition, financial intermediaries have been threatened by the introduction of CLOs, and in some cases opposition has been mounted against the systems.

On the other hand, despite the availability of the technology and mortgages' favorable characteristics as an electronically-mediated market product, the industry has not yet been fundamentally changed by the introduction of these systems. Of the two case studies that could be characterized as electronic markets, neither continues to exist in that form today. And the system with the current largest dollar volume of mortgages is best characterized as a pure electronic hierarchy.

These results suggest that either the results predicted by the EMH require a longer gestation period, or that the underlying model will require some augmentation in order to fully explain the results in the home mortgage market. Some possible barriers to the advent of full electronic markets in the home mortgage industry are suggested as possible directions for future research to explore in continuing the validation of the EMH.

Title: *Corporate Governance and Strategic Resource Allocation: The Case of Information Technology Investments*

Author: Venkatraman, Loh

Date: February 1993

Pages: 31

Abstract: The impact of corporate governance on strategic decisions is emerging as a key concern in contemporary businesses. In particular, governance mechanisms such as stock ownership structure and takeover defenses have major influences on strategic resource allocation in firms. In this paper, we empirically examined a set of relationships between corporate governance and information technology (IT) investments. Using data from a sample of major US corporations, we established a negative relationship between IT investments and two constructs of corporate governance, namely: (1) stock ownership structure (that includes large or insider shareholders); and (2) presence of takeover defenses. These results respectively provide support for: (1) the “monitoring hypothesis” of risky investments which purports that stock ownership could align the interests of managers with those of shareholders, and (2) the “managerial entrenchment hypothesis” of risky investments which posits that takeover defenses allow managers to pursue suboptimal decisions. In addition, consistent with existing empirical evidence, we observed a negative relationship between stock ownership structure and takeover defense adoption.

Title: *Strategic Issues in Information Technology Sourcing: Patterns, Perspectives, and Prescriptions*

Author: Venkatraman, Loh

Date: February 1993

Pages: 20

Abstract: The conventional wisdom in the information systems (IS) profession and the general business community appears to view information technology (IT) as an important component of corporate strategies. Extensive writings in professional journals and trade periodicals have consistently suggested that aligning IT strategy with business strategy is an important lever for success in the competitive marketplace. To move beyond casual observations, we at the MIT Sloan School of Management conducted a research study to examine the state of corporate IT strategy, with a particular focus on IT outsourcing that is a current topic of considerable importance.

This report is a summary of the research conducted on IT sourcing strategy at Sloan over the last year. It integrates the results drawn from our surveys of Fortune 500 corporations with other studies we conducted using secondary data sources. Further, it incorporates some of the insightful observations provided by speakers and audience during the symposium.

The report is divided into three major sections-patterns, perspectives and prescriptions. In the first section, we highlight the key patterns of changes relevant to IT strategy that we observed during the study. Using these patterns as a backdrop, in section two, we delineate several central perspectives on IT outsourcing. These perspectives highlight the major considerations that should guide outsourcing decisions and actions. The third section develops a set of prescriptions for viewing IT outsourcing as an important component of IT strategy. We conclude with our view of IT governance as a broader way of considering IT outsourcing decisions. This, we believe, would constitute the logic for managing the IT function in the 1990s and beyond.

Title: *The Emerging Use of Application Templates*

Author: Rockart, Hofman

Date: December 1992

Pages: 21

Abstract: The process by which systems are delivered today has not kept pace with the demands of the business environment. While there have been advances in speeding up the existing process, systems still take too long to build, cost more than expected, often do not meet the business need once they are delivered, and cannot be easily changed to meet continual change in the business. Further, for many organizations, significant resources are still tied up in maintenance rather than in the development of the new systems that are needed. We believe that the use of application templates—where a “template” is a system that has been built with a CASE tool and reused—represents a very significant attempt to address these issues. This paper describes our definition of templates, as well as the trends we see in the emerging template market. The majority of use to date has involved one company purchasing a CASE-built system from another company and customizing it to its own needs. The concept of reusing models, however, can also be applied within multi-divisional companies and across companies within an industry. While the market for templates is currently in its infancy, we believe that this is a major trend and that templates are the software packages of the future. Further, effective use of a template approach has major implications for the systems development process and offers opportunities for changes in managing the business.

Title: *A Metrics Suite for Object Oriented Design*

Author: Chidamber, Kemerer

Date: December 1992

Pages: 39

Abstract: Given the central role that software development plays in the delivery and application of information technology, managers are increasingly focusing on process improvement in the software development area. This demand has spurred the provision of a number of new and/or improved approaches to software development, with perhaps the most prominent being object-orientation (OO). In addition, the focus on process improvement has increased the demand for software measures or metrics with which to manage the process. The need for such metrics is particularly acute when an organ-organization is adopting a new technology for which established practices have yet to be developed. This research addresses these needs through the development and implementation of a new suite of metrics for OO design. Metrics developed in previous research, while contributing to the field's understanding of software development processes, have generally been subject to serious criticisms, including the lack of a theoretical base. Following Wand and Weber, the theoretical base chosen for the metrics was the ontology of Bunge. Six design metrics are developed and then analytically evaluated against Weyuker's proposed set of measurement principles. An automated data collection tool was then developed and implemented to collect an empirical sample of these metrics at two field sites in order to demonstrate their feasibility and suggest ways in which managers may use these metrics for process improvement.

Title: *Determinants of Electronic Integration in the Insurance Industry: An Empirical Test*

Author: Zaheer, Venkatraman

Date: December 1992

Pages: 44

Abstract: Electronic integration—a form of vertical quasi-integration achieved through the deployment of dedicated computers and communication systems between relevant actors in the adjacent stages of the value-chain—is an important concept to researchers in the information systems field since it focuses on the role of information technology in restructuring vertical relationships. Drawing on theoretical and empirical research on transaction costs, we develop and test a model of the determinants of the degree of electronic integration in the commercial segment of the property and casualty (P&C) industry. Based on a sample of 120 independent agencies operating under dedicated information technology-mediated conditions, we provide empirical support for three hypotheses on the determinants of electronic integration. Implications and research extensions are identified to guide further research in this important area.

Title: *Making Sense of IT: Strategic Alignment and Organizational Context*

Author: Henderson, Thomas

Date: October 1992

Pages: 54

Abstract: This paper examines the relationship between top managers' understanding of the strategic alignment between the business and information technology (IT) domains and the organizational context in which that understanding is manifested. Using responses from a nationwide survey of 393 top executives in the health care industry, we tested a series of hypotheses regarding the context-strategic alignment relationship. We also examined the impact of two contingency variables: structure of the top management team and perceived environmental uncertainty. Overall, the findings indicate systematic linkages between the information-processing activities (e.g., planning efforts) of top managers and their understanding of the critical relationships that define strategic alignment. The specific relationships and contingencies found suggest that managers must manage the context in which they strive to make sense of their ambiguous environments as well as the specific business and IT issues they are forced to confront if they are to be successful in utilizing IT as a source of competitive advantage.

Title: *Stock Market Reaction to Information Technology Outsourcing: An Event Study*

Author: Loh, Venkatraman

Date: November 1992

Pages: 43

Abstract: Despite the abundant anecdotal evidence on the benefits of information technology (IT) outsourcing, whether the stock market reacts favorably to such a governance choice remains a puzzle. In line with the recent emphasis on a value-based approach to evaluating firms, we adopt an event study method to examine the market-impacting effects of IT outsourcing. Our analysis, based on a sample of 58 IT outsourcing announcements obtained from a systematic search of on-line databases, indicates that this governance decision contributes positively and significantly to stock returns. The finding is robust across both service and industrial sectors. Further, we demonstrate that the stock market reacts favorably to IT outsourcing decisions by firms with a high business cost structure and low business performance. We discuss the results pertaining to stock market reaction in the context of corporate performance assessment and offer avenues for research extensions.

Title: *Diffusion of Information Technology Outsourcing: Influence Sources and the Kodak Effect*

Author: Loh, Venkatraman

Date: October 1992

Pages: 40

Abstract: The governance of an organizational information technology (IT) infrastructure is steadily shifting away from pure hierarchical and market mechanisms toward hybrid and partnership modes that involve outside vendors. In particular, IT outsourcing has recently emerged as a significant administrative innovation in an organization's IT strategy. This paper seeks to explore the sources of influence in the adoption of this innovation. For this purpose, we generated a comprehensive sample of outsourcing contracts in the US using an electronic bibliometric search process. Using diffusion modeling, our empirical analysis shows that the adoption of IT outsourcing is motivated more by internal influence (or imitative behavior) within the community of user organizations than by external influence from outside the community. Subsequently, we considered the widely-publicized Eastman Kodak's outsourcing decision as a critical event to assess whether this internal influence is more pronounced after the Kodak contract than before the Kodak contract. Our results show that internal influence is dominant in the post-Kodak time period but not in the pre-Kodak time period. Implications and directions for future research are discussed.

Title: *When Managers Use Computer-Based Data: A Qualitative Analysis of Marketing Product Managers*

Author: Goldstein, Cho

Date: October 1992

Pages: 37

Abstract: How are managers using computer-based data in their day-to-day work? When are they more likely to use these data? We addressed these questions through a qualitative study of the use of computer-based data and analytic tools by marketing product managers focusing on sixteen product management work units at five grocery manufacturers. Our results indicate that these managers made extensive use of computer-based data to make sense of their environment and how it was changing. Further, we found that the factors that most greatly influenced use were characteristics of the product managers' environment. Through an inductive analysis we developed a set of propositions that relate four environmental characteristics—complexity, dynamism, uncertainty and analyzability—to the degree to which managers use computer-based data. Finally, we will describe three configurations or groupings of these characteristics and of the marketing mix employed by these managers that further explained some of the variation in use of data among managers.

Title: *Performance Evaluation Metrics for Information Systems Development: A Principal-Agent Model*

Author: Banker, Kemerer

Date: July 1992

Pages: 34

Abstract: The information systems (IS) development activity in large organizations is a source of increasing cost and concern to management. IS development projects are often over-budget, late, costly to maintain and not done to the satisfaction of the requesting user. These problems exist, in part, due to the organization of the IS development process, where information systems development is typically assigned by the user (principal) to a systems developer (agent). These two parties do not have perfectly congruent goals, and therefore a contract is developed to specify their relationship. An inability to directly monitor the agent requires the use of performance measures or metrics to represent the agent's actions to the principal. The use of multiple measures is necessary given the multi-dimensional nature of successful systems development. In practice such contracts are difficult to develop satisfactorily, due in part to an inability to specify appropriate metrics.

This paper develops a principal-agent model that provides a set of decision criteria for the principal to use to develop an incentive compatible contract for the agent. These criteria include the precision and the sensitivity of the performance metric. After presenting the formal model, some current software development metrics are discussed to illustrate how the model can be used to provide a theoretical foundation and a formal vocabulary for performance metric analysis. The model is also used in a positive (descriptive) manner to explain why current practice emphasizes metrics that possess relatively high levels of sensitivity and precision. Finally, some suggestions are made for the improvement of current metrics based upon these criteria.

Title: *Adoption of Software Engineering Process Innovations: The Case of Object–Orientation*

Author: Fichman, Kemerer

Date: June 1992

Pages: 27

Abstract: Software development is critical to the effective use of Information Technology but is currently poorly understood and managed. Numerous software engineering process innovations have been proposed to improve practice in this area the latest of which is object-orientation (OO). How can information systems managers tell whether they should invest today in new software engineering process technologies such as OO? This paper proposes a general two-dimensional framework based on diffusion of innovations theory and the economics of standards theory for guiding management decisions regarding software engineering innovations. This framework is shown to accurately predict the current fate of three previous innovations (fourth generation languages, relational databases and structured methods). When applied to OO, this framework suggests that OO is not likely to be quickly adopted by most IS groups—a controversial position given that the current press on this innovation has been overwhelmingly positive.

Title: *Learning from Notes: Organizational Issues in Groupware Implementation*

Author: Orlikowski

Date: May 1992

Pages: 23

Abstract: This paper explores the introduction of a groupware technology—Lotus Corporation's Notes®—into one office of a large organization to understand the changes in work practices and social interaction facilitated by the technology. The results reveal that a number of organizational elements such as mental models (which affect how people understand and appropriate groupware) and structural properties (reward systems and workplace norms) significantly influence how groupware technology is implemented and used. Specifically, the findings suggest that in the absence of mental models that appreciate the collaborative nature of groupware such technologies will be interpreted in terms of more familiar personal and stand-alone technologies such as spreadsheets. Further, in competitive and individualistic organizational cultures—where there are few incentives or norms for cooperating or sharing expertise—groupware on its own is unlikely to engender collaboration. Such products will be interpreted as counter-cultural, and, to the extent that they are used, they will promote individual not group aims. Recognizing the significant influence of these organizational elements appears critical to both researchers and practitioners of groupware technologies.

Title: *The Role and Value of Information Technology Infrastructure: Some Empirical Observations*

Author: Weill

Date: May 1992

Pages: 35

Abstract: Information technology (IT) infrastructure is a critical component of the IT portfolio. The role and value of IT infrastructure is not well understood. This paper explores these issues via the IT and public infrastructure literatures as well as observations in five large organizations. The provision of IT infrastructure appears to be a strategy companies have adopted to find an economically sensible compromise between complete centralization and complete decentralization of IT. Specifically, three questions are addressed: 1. What is a clear definition of IT infrastructure? 2. What benefits do firms expect to get from IT infrastructure investments? 3. How are IT infrastructure investments identified and justified? The result is a model of the role and business value of IT infrastructure. Two types of infrastructure are identified: firm-wide and business unit IT infrastructure. The model also distinguishes between different roles firms identify for IT infrastructure and suggests different benefits profiles will result. A number of propositions and implications for management policy are derived from the model.

Title: *The Relationship Between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector*

Author: Weill

Date: May 1992

Pages: 53

Abstract: Large amounts of resources have been and continue to be invested in information technology (IT). Much of this investment is made on the basis of faith that returns will occur. This study presents the results of an empirical test of the performance effects of IT investment in the manufacturing sector. Six years of historical data on IT investment and performance was collected for 33 valve manufacturing firms from the CEO, the controller and the production manager in each firm. Investment was perceptually categorized by management objective (i.e.: into strategic, informational and transactional) and tested against four measures of performance (sales growth, return on assets and two measures of labour productivity). Heavy use of transactional IT investment was found to be significantly and consistently associated with strong firm performance over the six years studied. Heavy use of strategic IT was found to be neutral in the long term and associated only with relatively poor performing firms in the short term. This study suggests that early adopters of strategic IT could have spectacular success but once the technology becomes common the competitive advantage is lost. In addition, the context of the firm was included in the analysis. Conversion effectiveness, which measures the quality of the firm-wide management and commitment to IT, was found to be a significant moderator between strategic IT investment and firm performance.

Title: *The Economics of Information Technology: Explaining the Productivity Paradox*

Author: Brooke

Date: April 1992

Pages: 21

Abstract: The past 40 years have seen dramatic advances in the technology of information processing, and its widespread adoption bears testimony to the advent of the “information society.” However, the economic implications of this transition remain to some degree obscure, since there is little evidence that the new technology has led to clear improvements in productive efficiency. Indeed, during the past 20 years the United States’ economy has suffered from a declining rate of productivity growth despite sharply accelerating investment in computer-based systems.

Several attempts have been made to resolve this “productivity paradox,” yet none has proved entirely satisfactory. In this work, we propose a new explanation of the paradox and present economic evidence in its support. The central argument is that information technology has altered the economies of production in favor of differentiated output, and that our methods of productivity measurement tend to discount the benefits of greater product variety. The validity of this reasoning is demonstrated by an empirical study of the United States’ private economy covering the forty-year period from 1950 to 1989. Despite these results, however, we conclude that declining productivity growth is not merely an accounting fiction, since our current economic system is relatively ill-suited to differentiated production.

Title: *Empirical Research on Software Maintenance: 1981–1990*

Author: Kemerer, Ream

Date: May 1992

Pages: 42

Abstract: Despite its economic importance, the activity of software maintenance is relatively under-studied by researchers. This comprehensive survey documents that only tow percent of all articles appearing in three leading journals and two refereed conferences over the past decade were devoted to empirical studies of software maintenance. The primary purpose of this paper is to document “what is known” from this research and to suggest future avenues of research. The sixty-one articles surveyed are conveniently summarized as to major differences and similarities in a set of detailed tables. The text is used to highlight major findings and differences. Although the emphasis of the paper is on the subject matter, a section discussing appropriate research methodologies is included as a guide to researchers new to area.

Title: *Changing Frames: Understanding Technological Change in Organizations*

Author: Orlikowski, Gash

Date: April 1992

Pages: 33

Abstract: In this paper we propose a theoretical approach to the study of technological change that is based on the premise that people act on the basis of their interpretations of the world, and in doing so they enact particular social realities and endow them with meaning. Our interest in this approach is motivated by a belief that the existing studies of technological change have often overlooked the underlying assumptions, meanings and expectations that people have about information technology. We believe that these interpretations of information technology are critical to an understanding of technological use and change as they significantly influence the way actors in the social world of computing respond to it. Further, we posit that patterns of organizational change occasioned by different types of technological interventions can be investigated through changes in interpretations over time. This framework allows for the diagnosis and understanding of intended and unintended changes around the development and use of information technology in organizations.

Title: *Determinants of Information Technology Outsourcing: A Cross-Sectional Analysis*

Author: Loh, Venkatraman

Date: February 1992

Pages: 30

Abstract: This paper develops and tests a model of the determinants of information technology (IT) outsourcing by integrating both business and IT perspectives. Specifically, we attempt to explain the degree of IT outsourcing using business and IT competencies as represented by their cost structures and economic performances. Additionally, we posit that outsourcing is dependent on business governance particularly financial leverage. Based on factor analyses and multiple regressions using data from 55 major US corporations, we observed that the degree of IT outsourcing is positively related to both business and IT cost structures. We also established that the degree of IT outsourcing is negatively related to IT performance. Finally, we conclude with implications and future research directions.

Title: *Computer-Based Data and Organizational Learning: The Importance of Managers' Stories*

Author: Goldstein

Date: April 1992

Pages: 23

Abstract: While many organizations are investing large amounts of money to provide computer-based data to their manager, little is known about how or even whether managers use these data to learn about the business environment. This issue is explored by examining how grocery product managers use supermarket scanner data to learn about changes in the marketing environment. Managers' stories play a central role in the four step process used by one product management organization as it learns from analyzing computer-based data. First, a manager examines the data and looks for unexpected results—findings that contradict one or more of their stories about the marketing environment. If a surprise is found, the manager carries out a relatively unstructured, multi-stage process to make sense out of the unexpected result. This process can be viewed as a dialogue between the result and a set of tools at the manager's disposal (including analyses of computer-based data). Next, the manager tells the story to share her insights with peers and superiors developing a common understanding. Finally, the manager creates an official story that is used to "sell" new marketing approaches to people outside the product manager organization—the sales force and supermarket buyers.

Title: *The Information Technology Function in the Year 2000: A Descriptive Vision*

Author: Benjamin, Blunt

Date: March 1992

Pages: 37

Abstract: This paper provides a descriptive scenario of the Information Technology (IT) function in the year 2000. Starting with fundamental technology drivers, it examines how application characteristics, application development, the economics of the IT function and IT organizations may change. It then examines critical issues the IT executive will have to address to arrive at a satisfactory year 2000 future state.

Title: *Computers, Networks, and the Corporation*

Author: Malone, Rockart

Date: August 1991

Pages: 14

Abstract: This article, written for a general audience, discusses the effects that information technologies are likely to have on corporate structure and management approaches. By dramatically reducing the costs of coordination and increasing its speed and quality, these new technologies will enable people to coordinate more effectively, to do much more coordination, and to form new, coordination-intensive business structures.

Title: *Learning Curve Models for Integrated CASE Tool Management*

Author: Kemerer

Date: November 1991

Pages: 21

Abstract: It is taken as an article of faith among software development professionals that Integrated Computer-Aided Software Engineering (I-CASE) tools are an appropriate response to the problems that plague the profession. However, when I-CASE is observed in practice what is generally seen is (a) limited adoption, and (b) significant amounts of abandonment of the technology after adoption. A number of academic and practitioner authors have suggested the presence of a “learning curve” as a partial explanation of this phenomenon. These suggestions may be seen as the first, or problem identification stage of research.

The purpose of this paper is to go beyond these suggestions and begin the second stage of research, model development, in order that a formal approach can be used to determine appropriate I-CASE investment evaluations. This paper will explain the learning curve concept within the context of I-CASE and will propose a set of three models that may be employed.

While not proceeding to the third or model validation stage, this paper will suggest some difficulties, both theoretical and practical, in making further progress in this area and will offer some suggestions as to how these might be overcome. Finally, some concluding remarks which place the research in a broader management context are provided.

Title: *Object-Oriented and Conventional Analysis and Design Methodologies: Comparison and Critique*

Author: Fichman, Kemerer

Date: November 1991

Pages: 40

Abstract: Object-orientation principles form the basis of a number of emerging analysis and design methodologies. A vigorous debate surrounds the question of whether these methodologies represent an incremental change over conventional development methodologies, and hence may be adopted by organizations schooled in conventional methodologies with relative ease, or whether object-oriented methodologies are a radical change that will involve a far more risky and problematic transition period.

A detailed comparison of leading conventional and object-oriented analysis and design methodologies reveals that object-oriented analysis methodologies do represent a radical change over some conventional methodologies (process-oriented methodologies such as classic Structured Analysis) but not over others (data-oriented methodologies such as Information Engineering). With regard to design, object-oriented methodologies appear to be a radical change over conventional design methodologies both process- and data-oriented.

In addition, the object-oriented methodologies were criticized to undercover areas where further development is needed. Based on this analysis, three areas emerged as especially strong candidates for further research: (1) rigorous procedures for large scale model partitioning, (2) tools for end-to-end process modeling, and (3) detailed procedures for identifying, evaluating and merging reusable components.

Title: *Improving the Reliability of Function Point Measurement: An Empirical Study*

Author: Kemerer, Porter

Date: October 1991

Pages: 46

Abstract: Information Systems development has operated for virtually its entire history without the quantitative measurement capability of other business functional areas such as marketing or manufacturing. Today, managers of Information Systems organizations are increasingly taken to task to measure and report, in quantitative terms, the effectiveness and efficiency of their internal operations. In addition, measurement of information systems development products is also an issue of increasing importance due to the growing costs associated with information systems development and maintenance.

One measure of the size and complexity of information systems that is growing in acceptance and adoption is Function Points, a user-oriented non-source line of code metric of the product of systems development. Recent previous research has documented the degree of reliability of Function Points as a metric. This research extends that work by (a) identifying the major sources of variation through a survey of current practice, and (b) estimating the magnitude of the effect of these sources of variation using detailed case study data from actual commercial systems.

The results of the research show that a relatively small number of factors have the greatest potential for affecting reliability, and recommendations are made for using these results to improve the reliability of Function Point counting in organizations.

Title: *Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations*

Author: Tyre, Orlikowski

Date: July 1991

Pages: 46

Abstract: This paper examines the introduction and adaptation of technologies that support productive operations. The authors argue that the process of technological adaptation is not gradual and continuous, as often argued in the innovation literature, but is instead highly discontinuous. Evidence from three manufacturing and service organizations indicates that there exists a relatively brief window of opportunity to explore and modify new process technology following initial implementation. Afterwards, modification of new process technologies by users is limited by the increasing routinization that occurs with experience. Thus, the technology and its context of use tend to congeal, often embedding unresolved problems into organizational practice. Subsequent changes appear to occur in an episodic manner, triggered either by discrepant events or by new discoveries on the part of users. These findings have important implications for theories of technological change.

Title: *The Information Technology Function of the 1990s: A Unique Hybrid*

Author: Rockart, Benjamin

Date: June 1991

Pages: 23

Abstract: The role of the information technology (IT) function and its relationship to other business functions is under constant and growing examination. While centralization of some IT resources is occurring in a number of organizations today, in many there is a very perceptible and much publicized decentralization of IT resources and responsibilities to line divisions and functions. In this paper we attempt to provide a conceptual understanding of the IT function—a generalization which may be useful to managers and educators who must deal with these difficult issues. Our view is that the function will be long-lived and that it will evolve into a hybrid type of organization with line responsibility for the management of technology, and staff responsibility for a number of other critical roles. The paper describes IT in terms of its staff and line responsibilities with emphasis on the nature of the IT infrastructure, which is significantly different than the infrastructures that support other staff functions of the firm. We also present the essential elements of the technology infrastructure and develop some principles for deciding which aspects of information technology should be managed centrally versus which should be managed in a decentralized manner. To summarize our view that the IT role is unique, we present a model of the function and then discuss two key emergent IT staff roles. Finally, the paper provides some prescriptive conclusions that will hopefully be of value to senior management, IT executives, and IT educators.

Title: *A Perspective on Information Technology in the Process-Oriented Organization*

Author: Rockart

Date: January 1991

Pages: 14

Abstract: This is a brief, non-academic article written as a “white paper” for the management of a major business organization. The paper points out that we are moving toward customer-oriented organizations whose sub-units are increasingly interdependent. A major key to success in this environment will be the use of information technology to link far-flung sub-units and the organization as a whole with suppliers and customers. To achieve success, companies must focus their efforts on three key business processes and three major managerial processes. All will require significant changes in current ways of doing business, leaders who empower other members of the organization to achieve the vision, and major improvements in information technology infrastructure.

Title: *Improving Systems Delivery: A Managerial Perspective*

Author: Rockart, Hofman

Date: June 1991

Pages: 26

Abstract: In order to improve their capability to deliver information systems more quickly, inexpensively, and effectively, many organizations today are considering major investments in new systems development tools, methods, and techniques. Many are struggling with the decision of whether to invest in CASE tools, other types of tools and methods, software packages or nothing at all. The decision, however, is not an easy one. Based on conversations with senior managers in twelve companies, a framework emerges which can be used to address the many issues which are involved. Rethinking and investing in a redesigned systems development process is critical and must be anchored in the business context. The associated issues are major, strategic in nature, and require significant senior management attention.

Title: *Strategic Management of Information Technology Investments: An Options Perspective*

Author: Kambil, Henderson, Mohsenzade

Date: March 1991

Pages: 19

Abstract: In this paper we adopt financial options theory to guide decision making in the management of information technology investments. Information systems investment opportunities can provide firms with real options that can allow firms to exercise strategies for future growth or cost savings. These options, like call options on securities, represent real value to the firm and must be considered in the ex ante evaluation and justification of IT investment opportunities.

We illustrate the value of real IS investment options using an illustrative case example and develop implications of an options perspective on the strategic management process needed to realize value from information technology investments. This permits managers to better align the business, information technology and financial strategies of the firm.

Title: *Information Technology and the Structuring of Organizations*

Author: Orlikowski, Robey

Date: March 1991

Pages: 37

Abstract: The purpose of this paper is to propose a theoretical basis for research into the interaction of organizations and information technology. Recent work in social theory departs from prior traditions in proposing that social phenomena can be understood as comprising both subjective and objective elements. We apply this premise of duality to understanding the relationship between information technology and organizations. We construct a theoretical framework in which the development and deployment of information technology in organizations is a social phenomenon, and in which the organizational consequences of technology are products of both material and social dimension. The framework is based on Giddens' theory of structuration, and it allows us to progress beyond several of the false dichotomies (subjective vs. objective, socially constructed vs. material, macro vs. micro, and qualitative vs. quantitative) that persist in investigations of the interaction between organizations and information technology. The framework can be used to guide studies in two main areas of information systems—development and the organizational consequences of using information technology.

Title: *The Duality of Technology: Rethinking the Concept of Technology in Organizations*

Author: Orlikowski

Date: January 1991

Pages: 42

Abstract: This paper develops a new theoretical model with which to examine the interaction between technology and organizations. Early research studies assumed technology to be an objective, external force that would have deterministic impacts on organizational properties such as structure. Later researchers focused on the human aspect of technology seeing it as the outcome of strategic choice and social action. This paper suggests that either view is incomplete and proposes a reconceptualization of technology that takes both perspectives into account. A theoretical model—the structurational model of technology—is built on the basis of this new conceptualization, and its workings explored through discussion of a field study of information technology. The paper suggests that the reformulation of the technology concept and the structurational model of technology allow a deeper and more dialectical understanding of the interaction between technology and organizations. This understanding provides insight into the limits and opportunities of human choice, technology development and use, and organizational design. Implications for future research of the new concept of technology and structurational model of technology are discussed.

Title: *Cyclomatic Complexity Metrics Revisited: An Empirical Study of Software Development and Maintenance*

Author: Gill, Kemerer

Date: October 1990

Pages: 24

Abstract: While the need for software metrics to aid in the assessment of software complexity for both development and maintenance has been widely argued, little agreement has been reached on the appropriateness and value of any single metric. McCabe's cyclomatic complexity metric, a measure of the maximum number of linearly independent circuits in a program control graph, has been widely used in research. However, despite the widespread interest and popularity of this metric, it has not been without criticism—both analytical (the Myers and Hansen variants) and empirical (the high correlation of cyclomatic complexity with size measures). The current research tested both types of critiques on a newly collected dataset of real world software development and maintenance projects. The analytical research questions were tested on a set of 834 software modules from a number of existing real-time systems. Neither the Myers nor Hansen variants were found to be significantly different from the original value as computed by McCabe. Therefore, these particular theoretical criticism seem to have little or no practical impact, as represented by the data collected in this study. In regard to the empirical research questions, previous concerns were validated on this new dataset. However, the current research proposes a simple transformation of the metric whereby the cyclomatic complexity is divided by the size of system in source statements, thereby determining a “complexity density” ratio. This complexity density ratio is demonstrated to be a useful predictor of software maintenance productivity on a small pilot sample of actual maintenance projects.

Title: *Strategic Alignment: A Model for Organizational Transformation via Information Technology*

Author: Henderson, Venkatraman

Date: November 1990

Pages: 35

Abstract: This paper develops a model for research and practice of strategic management of information technology. The model, termed the Strategic Alignment Model, is defined in terms of four domains of strategic choice: business strategy; information technology strategy; organization infrastructure and processes; and information technology infrastructure and processes—each with its constituent dimensions. The model is conceptualized in terms of two fundamental characteristics of strategic management: strategic fit (i.e., the interrelationships between external and internal domains) and functional integration (i.e., integration between business and functional domains). A set of propositions is developed based on this model with implications for research and management practice.

Title: *Strategic Data Planning: Lessons from the Field*

Author: Goodhue, Kirsch

Date: October 1990

Pages: 43

Abstract: Many large organizations today are finding that even if they can access data from multiple functions the lack of logical data integration (common data definitions and codes) across information systems makes it difficult or impossible to answer cross-functional or cross-divisional questions. This reduces their ability to take advantage of potential opportunities or respond to business problems. Strategic Data Planning (SDP) is one methodology which can address such problems within the general umbrella of information engineering. Resting on the assumption that a relatively stable group of data entities lies at the center of an organization's information processing needs, SDP is a formalized, top-down, data-centered planning approach that builds a model of the enterprise, its functions, and its underlying data as a basis for identifying and implementing an integrated set of information systems.

In spite of strong conceptual arguments for the value of the SDP approach and its use in many organizations, empirical research has found more evidence of problems than of success. This raises the question of whether the approach is universally appropriate. If success is somewhat problematic, are there lessons that can be drawn from actual organizational experience? In this paper, four detailed case studies of SDP efforts are described along with summaries of five previously reported efforts. These cases suggest fifteen propositions about SDP that can guide practitioners in deciding when to use it, and guide researchers as they begin the process of rethinking and modifying it to be more effective.

Title: *The New Industrial Engineering: Information Technology and Business Process Redesign*

Author: Davenport, Short

Date: June 1990

Pages: 32

Abstract: Those aspiring to improve the way work is done must begin to apply the capabilities of information technology to redesign business processes. Business process design and information technology are natural partners; yet industrial engineers have never fully exploited their relationship. The authors argue, in fact, that it has barely been exploited at all. But the organizations that have used IT to redesign boundary-crossing, customer-driven processes have benefited enormously. This article explains why.

Title: *Does Information Technology Lead to Smaller Firms?*

Author: Brynjolfsson, Malone, Gurbaxani

Date: November 2089

Pages: 31

Abstract: We examine the relationship between information technology capital and firm size using industry data for the entire U.S. economy. The results indicate that increased stocks of information technology are associated with significant decreases in firm size as measured by the number of employees. One explanation for this observation is that information technology enables reduced levels of vertical integration and our analysis of data for the U.S. manufacturing sector supports this explanation. We also find that the effects of information technology on organizations are most pronounced after a lag of two years. While the correlations we find cannot, of course, prove causality, the evidence is consistent with the hypothesis that information technology reduces transaction costs and coordination costs, enabling a shift from hierarchies to markets as a means of coordinating economic activity.

Title: *Strategies for Electronic Integration: From Order-Entry to Value-Added Partnerships*

Author: Venkatraman, Short

Date: June 1990

Pages: 37

Abstract: We examine the relationship between information technology capital and firm size using industry data for the entire U.S. economy. The results indicate that increased stocks of information technology are associated with significant decreases in firm size as measured by the number of employees. One explanation for this observation is that information technology enables reduced levels of vertical integration and our analysis of data for the U.S. manufacturing sector supports this explanation. We also find that the effects of information technology on organizations are most pronounced after a lag of two years. While the correlations we find cannot, of course, prove causality, the evidence is consistent with the hypothesis that information technology reduces transaction costs and coordination costs enabling a shift from hierarchies to markets as a means of coordinating economic activity.

Title: *Strategies for Electronic Integration: Lessons From Electronic Filing of Tax Returns*

Author: Venkatraman, Kambil

Date: May 1990

Pages: 22

Abstract: In 1990, taxpayers nationwide had access for the first time to a service that could electronically transmit their tax returns to the IRS, provide a receipt, and thus reduce the wait for refund checks by three to four weeks. This electronic integration initiative has not only changed the procedure for sending tax returns, it has also changed the entire basis of competition in the tax preparation marketplace. In this paper, Venkatraman and Kambil define the players and their roles before and after electronic integration, and suggest ways to exploit opportunities in the new marketplace. They provide a useful analysis for managers in any of the number of industries that are or will be affected by electronic integration.

Title: *Software Complexity and Software Maintenance Costs*

Author: Banker, Datar,

Date: April 1990

Pages: 34

Abstract: In an empirical analysis of sixty-five software maintenance projects in a large IBM/COBOL transaction processing environment, the impacts of correctable software complexity upon project costs were estimated. Module size, procedure size, and the use of complex branching were all found to significantly affect software maintenance costs. It was estimated that projects involving maintenance of systems with greater underlying code complexity cost approximately 25% more than otherwise identical projects dealing with less complex code. These costs are estimated to amount to several million dollars at this data site suggesting that the aggregate cost across the industry may be extremely large. A generalizable model is provided to allow researchers and managers in other environments to estimate and reduce these costs.

Title: *Legal Protection of Information*

Author: Meldman

Date: May 1990

Pages: 17

Abstract: As we have become more aware of the importance of information and more dependent on information technologies, we have begun to think more explicitly about using the law to help protect information. This paper presents an overview of how the legal means for protecting both personal privacy and computer software have developed from a multitude of more traditional legal protections. The survey of the development of American privacy law concludes with a look at statutes directed primarily at privacy threats associated with computer and communications technology. With respect to the legal protection of software, the paper first reviews the major forms of intellectual property protection, and then explores how these legal mechanisms can be useful for protecting computer software.

Title: *Groupware in Practice: An Interpretation of Work Experience*

Author: Bullen, Bennett

Date: March 1990

Pages: 52

Abstract: Observers have identified a potential for major improvements in organizational productivity made possible through the use of personal computers serving as a means to link people into task-oriented teams. The study we conducted, given in overview form here, offers an early examination of how people are using personal computers for such electronic exchanges via networking. Our interviews of 223 people who were using several “groupware” systems in a sample of 25 enterprises indicate how they employ these software tools to support their group work.

We conclude that complex interactions of social and technical factors affect the use of groupware systems in organizations. We outline issues which both the developers of systems and the managers implementing groupware systems must understand in order to facilitate the design, introduction, and use of these systems.

Title: *CISL: Composing Answers from Disparate Information Systems*

Author: Madnick, Wang

Date: September 1989

Pages: 15

Abstract: This paper presents the problems we experienced and solutions developed in the composite information systems laboratory (CISL) research project for composing answers from disparate information systems. A fundamental CISL assumption is that organizations must deal with pre-existing information systems which have been developed and administered independently and are likely to remain so. A primary CISL focus is logical connectivity which is concerned with the ability to know where and how data are stored, to decompose a user query into sub-queries that can be executed by local systems, to accumulate the results from all the sub-queries, to reconcile differences among the results accumulated, and to formulate composite answers for the user. In particular, we are interested in (1) semantic reconciliation which deals with the integration of data semantics among disparate information systems, and (2) dynamic query composition where new information is inferred and composed based on the underlying data in a heterogeneous distributed environment. An example is presented in the paper to help illustrate both the problems to be solved and approaches used in CISL.

Title: *Lithonia Lighting*

Author: Hofman, Rockart

Date: December 2089

Pages: 54

Abstract: The use of information technology in the 1980s has evolved from the traditional transaction-based systems built in the 1960s and 70s toward more innovative and far-reaching applications. As the industry matures, studies have been undertaken to better understand the impact of information technology on organizations. Results of a recent study, by the Center for Information Systems Research at the MIT Sloan School of Management, suggest that information technology has joined the arsenal of traditional tools used by an organization to manage the multi-dimensional interdependence of its subunits (Rockart and Short, 1988).

Lithonia lighting provides an interesting example of this trend. As the number one player in the \$4+ billion lighting and related products market, Lithonia has recently emerged from a seven-year process of implementing a series of systems to electronically link the entities in its marketplace. This effort was spearheaded by the company's visionary Chief Information Officer and Senior Vice President, Charles Darnell. This document will discuss the implementation of this process and its impact on the lighting marketplace and on the organization within the context of "the management of interdependence" (Rockart and Short, 1988). The information presented here is the result of discussions with Darnell and other members of the Lithonia team and of a reading of a number of documents provided by them.

Title: *IT and the Networked Organization: Towards More Effective Management of Interdependence*

Author: Rockart, Short

Date: December 2089

Pages: 55

Abstract: This paper discusses one form of organizational innovation, the networked firm, and the role of information technology (IT) in making the many networks operating within the firm more effective. A major premise is that IT-enabled networks allow us to more effectively manage organizational interdependence or the firm's ability to achieve concurrence of effort along multiple dimensions of the organization.

Sixteen companies were interviewed over a 14-month study period. Six organizational contexts in which IT supported more effective management of interdependence were identified: Integration across the firm's value-added chain; Integration within functions; IT-enabled teams; New planning and control processes; Partnerships between line business and technology managers; and Inter-organizational integration (integration between firms).

Seven implications for senior management were identified: increased role complexity brought on by continuous changes in products, markets, processes and organization; increased skill requirements at all levels of the organization; more work performed by teams; changing measurement systems to reflect the high degree of cooperative work; changing accountability and authority relationships among peers and hierarchies in the firm; changing planning processes, reflecting the need for "real-time," stimulus-driven planning; and changes in the technology infrastructure reflecting increased emphasis on organization-spanning networks and applications.

Finally, the authors identify several implications of their view of "networks" which they define as one part of the firm's overall system of interrelationships to accomplish work: networks can be thought of as capabilities for organizational functioning; networks do not automatically mean that the organization is flat, flexible or responsive; networks do not automatically mean that all or most employees are networked (conversely, any daily work routines do not require complex, cross-organizational work activity); there are many networks (e.g., There are many types of work tasks to be accomplished); networks are sensitive to organizational complexity (e.g., if the firm's products and services are complex, then the networks supporting them tend to be complex.)

Title: *A Multi-Dimensional Approach to Performance Evaluation for I/S Development*

Author: Coopriider, Henderson

Date: December 2089

Pages: 29

Abstract: Information systems are a major force in today's organization. Unfortunately, the development of information systems remains very labor-intensive and quite difficult to manage. It is not surprising that IS management is searching for improved methods for evaluating the performance of IS developers. This paper makes an initial step in the evaluation of the IS function by presenting an approach for evaluating the performance of IS development units and describing its use in a large international technology manufacturing firm.

We first present a diagnostic, behavior-based model for measuring software development from a management perspective. This model proposes measures of development processes and products from the task, social, and organizational levels of analysis. We then describe the application of this model in a large international technology manufacturing firm. Data envelopment analysis (DEA) is used as a technique for applying the model to the firm's performance data. The results of the DEA analysis is then used to investigate the performance impacts of various management policies. This evaluation approach provides a systematic method for evaluating development performance. It highlights the importance of using a range of behavior-based measures for evaluating performance, and it illustrates a methodology for examining performance based on such measures.

Title: *Building and Sustaining Partnership Between Line and I/S Managers*

Author: Henderson

Date: September 2089

Pages: 29

Abstract: Given the increasing complexity of the technological infrastructure, there is a critical need to build effective working relationships between line managers and information systems managers. This paper explores the concept of building partnerships as a management strategy. Using interviews with executives, the author focuses both on external partnerships (relationships between managers in separate organizations) and on internal partnerships (relationships between line managers and information systems managers in the same organization) to create a descriptive model.

Title: *Division Among the Ranks: The Social Implications of CASE Tools for System Developers*

Author: Orlikowski

Date: July 2089

Pages: 28

Abstract: This paper explores how the introduction of case tools in systems development changes the social relations among project team members. An investigation into the role of case tools in projects found structural changes due to modification of the systems development division of labor and shifts in patterns of dependency among project team coalitions. These changes triggered a polarization among the system developers which was evinced in acts of coercion and rebellion, the display of territorialism, resentment, and stereotyping, as well as the enactment of subcultures. These findings are interpreted within a broader social theoretic framework, and their implications for research and practice are discussed.

Title: *A Quantitative Analysis of US and Japanese Software-Engineering Practice and Performance*

Author: Cusumano, Kemerer

Date: July 2089

Pages: 45

Abstract: Since the early 1980s, there has been a mounting debate in industry literature and in U.S. government-sponsored reports over the relative performance of software developers in Japan versus those in the United States. This literature is divided between assertions of Japanese or U.S. superiority in this technology. However, both sides of the debate have offered evidence that, to date, has been primarily qualitative or based on one or two cases.

This paper contributes to the debate in two ways. First, it offers a comprehensive literature review that analyzes existing comparisons of Japanese and U.S. firms in software development and summarizes the major proposed differences in performance. Second, it presents the first set of quantitative data collected from a statistically comparable sample of 24 U.S. and 16 Japanese software-development projects and uses these data to test propositions from the literature. The analyses indicate that Japanese programmers perform at least as well as their U.S. counterparts in basic measures of productivity, quality(defects), and reuse of software code. The data also make it possible to offer models that explain some of the differences in productivity and quality.

Title: *Critical Success Factors: An Annotated Bibliography*

Author: Forster, Rockart

Date: June 2089

Pages: 107

Abstract: Keeping pace with the growing usage of the critical success factor method is the number of articles that continue to be published on the subject. In this paper we have attempted to make more accessible this wealth of information in the form of an annotated bibliography. To assist in further research we have also included tables of significant articles categorized by the major subject to which each pertains.

Title: *Strategic Alignment: A Framework for Strategic IT Management*

Author: Henderson, Venkatraman

Date: May 2089

Pages: 46

Abstract: This paper develops a framework for strategic information technology management termed the strategic alignment model. This model is defined in terms of four domains—business strategy, information technology strategy, organizational infrastructure and processes, and information systems infrastructure and processes—each with their constituent components. This model is developed using two fundamental dimensions—strategic integration and functional integration—and the cross-domain alignment across the two dimensions. A theoretical perspective of strategic alignment is developed using four concepts—(1) consistency in cross-domain analysis, (2) completeness of the analysis, (3) validity of the process, and (4) comprehensiveness of the process. These concepts are used to develop a set of research propositions with important implications for the management of strategic is planning processes.

Title: *Object Lens: "Spreadsheet" for Cooperative Work*

Author: Lai, Malone, Yu

Date: September 2088

Pages: 38

Abstract: Object lens allows unsophisticated computer users to create their own cooperative work applications using a set of simple but powerful building blocks. By defining and modifying templates for various semistructured objects, users can represent information about people, tasks, products, messages, and many other kinds of information in a form that can be processed intelligently by both people and their computers. By collecting these objects in customizable folders, users can create their own displays that summarize selected information from the objects in table or tree formats. Finally, by creating semiautonomous agents, users can specify rules for automatically processing this information in different ways at different times.

The combination of these primitives provides a single consistent interface that integrates facilities for object-oriented databases, hypertext, electronic messaging, and rule-based intelligent agents. To illustrate the power of this combined approach, we describe several simple examples of applications (such as task tracking, intelligent message routing, and database retrieval) that we have developed in this framework.

Title: *Lessons Learned from Modeling the Dynamics of Software Development*

Author: Abdel-Hamid, Madnick

Date: August 2088

Pages: 22

Abstract: The development of software systems has been marked by cost overruns, late deliveries, poor reliability, and users' dissatisfaction. The problems persist in spite of significant advances in the software engineering field to tackle the technological hurdles of software production. In recent years, the managerial aspects of software development have been gaining increased recognition as being at the core of both the problem and the solution.

The objective of this paper is twofold. First, we present a paradigm for the study of software project management that is grounded in the feedback systems principles of system dynamics. Feedback processes are universal in social systems in general, and we show how, when applied to software project management, they do provide a powerful lens to view and understand software project behavior.

Secondly, we summarize the stream of research findings obtained to date and the lessons learned regarding the dynamic implications of an array of managerial policies and procedures pertaining to software development.

This paper is a companion to Working Paper No. 163, "Modeling the Dynamics of Software Project Management." Whereas No. 163 discusses the model itself in some detail, this paper focuses on the managerial lessons to be learned from the simulation model.

Title: *What is Coordination Theory?*

Author: Malone

Date: February 2088

Pages: 30

Abstract: No abstract available.

Title: *Dimensions of I/S Planning and Design Technology*

Author: Henderson, Coopridner

Date: September 2088

Pages: 49

Abstract: Information technology is playing an increasingly integral role in the competitive strategies of many organizations. As this trend continues, it is not surprising that there is growing emphasis on the ability of organizations to plan, design, and implement critical information systems. A major strategy to improve the effectiveness of these processes is the use of computer-based planning and design aids. However, there is little empirical evidence that using this technology provides a significant performance impact.

One factor limiting research on the impact of technology on planning and design is the manner in which this technology has been conceptualized for measuring usage behavior. This research develops a functional model of IS planning and design support technology that distinguishes three general functional dimensions: production technology, coordination technology, and organizational technology. An empirical analysis is used to test the robustness of the proposed model and its ability to discriminate between current design aids in a meaningful way. Implications for the use of this model in the study of IS planning and design processes are discussed.

Title: *Information Technology and the New Organization: Towards More Effective Management of Interdependence*

Author: Rockart, Short

Date: September 2088

Pages: 42

Abstract: No abstract available.

Title: *Groupware: A Key to Managing Business Teams?*

Author: Bullen, Johansen

Date: May 2088

Pages: 40

Abstract: This paper focuses on the increasingly important role of business teams in today's organizations and on the emergence of "groupware" as a class of information technology tools to support team work. The authors discuss managerial issues involved in organizing and running teams and describe the needs of teams for support in various communication and collaboration activities.

The paper presents a framework (that has since been frequently cited) for looking at team activities and groupware capabilities in two dimensions: "same time/different time" and "same place/different places." This two-by-two matrix is very helpful in anticipating the needs of teamwork and directions for groupware. The paper also discusses the potential benefits and pitfalls to consider when providing groupware support to business teams.

Title: *Modeling the Dynamics of Software Project Management*

Author: Abdel-Hamid, Madnick

Date: October 2087

Pages: 24

Abstract: The development of software systems has been marked by cost overruns, late deliveries, poor reliability, and users' dissatisfaction. The problems persist in spite of significant advances in the software engineering field to tackle the technological hurdles of software production. In recent years, the managerial aspects of software development have been gaining increased recognition as being at the core of both the problem and the solution.

The objective of this paper is twofold. First, we present a research paradigm for the study of software project management that is grounded in the feedback systems principles of system dynamics. Feedback processes are universal in social systems in general. We show how, when applied to software project management, they do provide a powerful lens to view and understand software project behavior.

Second, we summarize the stream of research findings obtained to date. A system dynamics model of software project management has been developed and is being used to study and predict the dynamic implications of an array of managerial policies and procedures pertaining to the management of software development.

Title: *Dependent Variables for the Study of Firm and Industry–Level Impacts of Information Technology*

Author: Bakos

Date: August 2087

Pages: 27

Abstract: Macro-level impacts of information technology (those at the level of entire organizations, industries, or the society as a whole) have not been studied in the depth accorded to impacts at the individual user level. Furthermore, there is a lack of studies that can claim to have successfully demonstrated specific impacts at this level. We believe that a well-defined and instrumented set of dependent variables at this level would make a significant contribution in this area. This paper addresses the issue of identifying the appropriate dependent variables for research on the impacts of information technology at the firm and industry levels. The role of different organizational perspectives is examined, and some implications for the design of empirical studies are discussed.

Title: *The Line Takes the Leadership*

Author: Rockart

Date: August 2087

Pages: 21

Abstract: The deployment of information technology is too important to be left solely to information technologists. Advances in technology have opened up opportunities that call for line management leadership in system conception and implementation. The role of IS managers must also grow. Based on a study of fifteen companies where line managers have been proactive in the use of information technology, this paper examines the reasons for and implications of these important role changes.

Title: *Managing the Data Resource: A Contingency Perspective*

Author: Goodhue, Quillard, Rockart

Date: January 2087

Pages: 45

Abstract: Today, corporations are placing increasing emphasis on the management of data. To learn more about effective approaches to “managing the data resource,” we conducted case studies of 31 data management efforts in 20 diverse firms. Our major finding is that there is no single, dominant approach to improving the management of data. Rather, firms have adopted multiple approaches which appear to be very diverse in (1) business objective, (2) organizational scope, (3) planning method, and (4) “product,” i.e., deliverable produced. The dominant business objective for successful action was improved managerial information; most data management efforts were “targeted” without a formal data planning process; and the dominant product was “information databases.” In addition, several key organizational issues were identified which must be addressed when undertaking any data management effort.

Title: *The Value Added of Strategic IS Planning: Understanding Consistency, Validity, and IS Markets*

Author: Henderson, Sifonis

Date: November 2086

Pages: 32

Abstract:

Title: *Electronic Markets and Electronic Hierarchies*

Author: Malone, Yates, Benjamin

Date: April 2086

Pages: 31

Abstract:

Title: *Managing End-User Computing in the Information Era*

Author: Gerrity, Rockart

Date: October 2084

Pages: 32

Abstract:

Title: *A Planning Methodology for Integrating Management Support Systems*

Author: Henderson, Rockart, Sifonis

Date: September 2084

Pages: 38

Abstract:

Title: *Engaging Top Management in Information Systems Planning and Development: A Case Study*

Author: Rockart, Crescenzi

Date: July 2084

Pages: 39

Abstract:

Title: *Managing End User Computing*

Author: Henderson, Treacy

Date: May 2084

Pages: 29

Abstract:

Title: *The Management of End User Computing: A Research Perspective*

Author: Rockart, Flannery

Date: February 2083

Pages: 31

Abstract:

Title: *Implications of Changes an Information Technology for Corporate Strategy*

Author: Scott Morton, Rockart

Date: January 2083

Pages: 30

Abstract:

Title: *The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective*

Author: Rockart

Date: April 2082

Pages: 46

Abstract:

Title: *A Primer on Critical Success Factors*

Author: Bullen, Rockart

Date: June 2081

Pages: 60

Abstract: The critical success factor (CSF) concept has become a widely used approach to determining the information needs of managers and to conduct strategic planning for the information systems (IS) function. The method has also been used successfully to aid executive teams in establishing and prioritizing their shared strategic agenda. The CSF concept was first introduced in a Harvard Business Review article entitled: "Chief Executives Define Their Own Data Needs," and this paper provides additional background on the method. Most particularly, it is written as a primer for those who would like to carry out CSF interviews.

Critical success factors are the few key areas of activity in which favorable results are absolutely necessary for a particular manager to meet their goals. Because these areas of activity are critical, the manager should have the appropriate information to allow them to determine whether events are proceeding sufficiently well in each area. The CSF interview method is designed to provide a structured technique which can be used by an interviewer to assist managers to zero in on their critical success factors—and to determine the resulting information needs.

This paper describes the interview procedure, emphasizes appropriate techniques for the interviewer to use in helping interviewees to think about and identify their CSFs, and discusses methods of analyzing the data.

Title: *The CEO Goes On-Line*

Author: Rockart, Treacy

Date: April 2081

Pages: 23

Abstract:

Title: *Value Analysis: Justifying Decision Support Systems*

Author: Keen

Date: October 2080

Pages: 44

Abstract:

Title: *MIS Research: Reference Disciplines and a Cumulative Tradition*

Author: Keen

Date: October 2080

Pages: 36

Abstract:

CISR Working Paper No. 59

Title: *Power, Politics and MIS Implementation*

Author: Markus

Date: October 2080

Pages: 54

Abstract:

Title: *Building a Decision Support System: The Mythical Man-Month Revisited*

Author: Keen, Gambino

Date: May 2080

Pages: 93

Abstract:

Title: *Information Systems and Organizational Change*

Author: Keen

Date: May 2080

Pages: 41

Abstract: