Generating Value from Infrastructure Investments:
An Examination of Client-Server and Teams

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.

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Generating Value from Infrastructure Investments:
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INTRODUCTION
Stalked by visions of outsourcing and downsizing, IS executives are encountering increased pressure to justify the business value of information technology (IT) investments. Although recent studies across firms indicate that investments in IT have a positive impact on productivity and business value (Brynjolfsson and Hitt, 1993; Weill, 1992), top managers at individual organizations often question the return on their IT dollar (Wilder, 1992). Thus, the challenge facing information systems (IS) executives is to manage IT to generate real value and to make that value apparent throughout the firm.

IT can contribute value to organizations by enabling streamlined operations, increasing responsiveness to changing market conditions, and allowing executives to identify strategic opportunities faster. This demands fast, easy access to data as well as timely delivery of new business applications. These capabilities are dependent upon solid IT infrastructures (Niederman, Brancheau and Wetherbe, 1991; Weill, Broadbent and St. Clair, 1994). We define IT infrastructure as those IT assets that are leverageable, or reusable, by more than a single implementation. These include hardware, systems software, development environments, shared data bases, and common applications as well as the human expertise, skills and methodologies that, as they develop, become strategic assets.

IS executives are taking a number of approaches to building IT infrastructures (Ross, Beath and Goodhue, 1994). Some of these efforts focus specifically on the technology, such as the implementation of client-server architectures and development of standards and common applications. Others focus specifically on the development of staff skills and expertise, such as the adoption of team structures, new recruiting and training techniques, and the recentralization of IS staff in order to facilitate communication and enforcement of standards. IS executives also manage infrastructure concerns through total quality management initiatives and IS planning processes that are linked to business unit plans.
It is not clear whether IS executives’ efforts to build IT infrastructures are having the intended, or other unintended, impacts. Do management initiatives intended to build technical and staff IT infrastructures lead to increased business value, and if so, under what circumstances? This paper describes a study of twelve IS executives’ new infrastructure-related management initiatives and the factors influencing their impacts on IT management and business value. The next section of the paper provides some background on IT research on infrastructure changes. The third section describes the research questions and methodology. The subsequent two sections specifically examine two different management initiatives intended to build infrastructure: the implementation of client-server architectures and the adoption of team-based management structures. The Discussion and Summary sections identify the common experiences between the two types of initiative and describe a model for understanding the outcomes from investments in the IT infrastructure.

BACKGROUND
In spite of some pessimistic reports (Loveman, 1988; Roach, 1987), several studies suggest that IT investments can lead to added business value. For example, Weill (1992) found that investments in transaction processing systems at valve manufacturing companies were correlated with successful firm performance. Similarly, Brynjolfsson and Hitt (1993) found correlations between IT investments and firm ROI in 380 large firms. However, not every firm in either sample experienced success. Brynjolfsson and Hitt’s study revealed wide variations in the returns that individual firms earned on their investments. Weill’s study suggests that the relationship between IT investment and firm performance is moderated by the firm’s effectiveness in converting IT into productive outputs. While these studies suggest that IT can have a positive impact on business value, they highlight that mere investment in IT does not ensure better performance. Thus, it is important to understand the key catalysts that lead to success.

Where organizational processes are complex and not well understood, positivist approaches to research, such as surveys measuring predefined constructs, provide only limited insights. In such cases, Markus and Robey (1988) favor process theories and interpretive approaches such as case studies, for identifying key circumstances that increase the likelihood of a given outcome. In-depth case studies have proved useful for revealing the sequence of events and combinations of variables that resulted in a specific IT application generating value for a firm. For example, Clemons and
Row (1988) describe how Foremost McKesson's interorganizational system, Economost, required internal process changes, such as the redesign of the warehouse and more frequent product delivery, as well as changes in inventory management at client sites. Sviokla (1990) describes how the benefits of XCON, an expert system developed at Digital Equipment Corporation, derived not just from the software, but from a combination of the expert system, redefined roles, elimination of processes, and a new focus on updating the knowledge base. These cases are useful in highlighting how individual applications of IT and concomitant organizational processes in one firm contributed business value to that firm, but these are not necessarily generalizable. Like all single-site case studies, the analyses are context-specific, providing after-the-fact explanations rather than readily generalizable findings. Nonetheless, case studies of specific IT applications suggest that it is not the simple existence of one or more factors, but rather the interplay among several factors, that leads to business value.

This interplay among variables is central to organizational change models (Chandler, 1962; Leavitt, 1965), which suggest that the impacts of new technologies are both dependent upon, and likely to reverberate among, a set of interacting variables. These models argue the need for a fit between organizational strategy, firm structure, and individual roles. Rockart and Scott Morton (1984) adapted Leavitt's organizational change model to account for IT-initiated changes. They suggest that IT impacts corporate strategy, organization structure, corporate culture, and management processes, and they note that individual roles must change as new technologies are introduced and strategies based on those technologies are reconsidered.

These models, surveys, and case studies all suggest that generating business value through information technology is not a simple matter of changing a technology. As IS executives look to the IT infrastructure as a possible source of business value, they need to identify the accompanying factors that can help transform IT infrastructure initiatives into business value. Organizational change models provide some general ideas as to the kinds of factors that will prove to be important. This paper seeks to identify specific constructs that enable IT infrastructure initiatives to deliver value to organizations.
METHODOLOGY

Because we did not have predefined constructs of the key factors that interact with IT infrastructure in delivering business value, we adopted an interpretive research design for studying the impacts of new infrastructure initiatives. We chose to develop multiple case studies, in order to generate generalizable theory (Eisenhardt, 1989). To identify the similarities and differences between strategies for managing the IT infrastructure, we decided to investigate multiple sites implementing one of two different kinds of initiatives -- changes to the technical infrastructure and changes to the IS staff infrastructure.

In a prior study, we had identified key new management practices of 50 respected IS executives (Ross, Beath and Goodhue, 1994). Among these new management practices, client-server architectures emerged as the most dramatic change targeted at changing the technical infrastructure, and team-based management emerged as the most revolutionary approach to changing the IS staff infrastructure. We contacted IS executives who indicated that they were introducing one of these changes and assembled a research sample of twelve companies, six that were implementing client-server architectures and six that were adopting team-based management structures.¹ Table One provides descriptions of the twelve firms.

We asked contacts at each site to identify IS staff and key clients who could provide general descriptions of the organizational context and first-hand descriptions of a specific client-server project or IS team. Between April and July, 1993, each author visited four of the twelve sites and conducted between five and nine interviews at each one.

We developed three different sets of interview questions for each initiative: one for top IS executives, one for project/team members and leaders, and a third for key clients and champions. Client-server interview questions sought both IS and client perspectives on the following:

- business reasons for using client-server architectures, and the anticipated benefits
- description of a specific application, the methods used to develop the system, and client roles in development

¹In total eighteen IS executives had identified either client-server or teams as a major new management initiative. We contacted fourteen of these executives and twelve agreed to participate.
Table 1
PROFILE OF RESEARCH SITES

<table>
<thead>
<tr>
<th>FIRM</th>
<th>INDUSTRY</th>
<th># OF EMPLOYEES</th>
<th>IS STAFF</th>
<th>IS STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>MANUFACTURING</td>
<td>30,000</td>
<td>800</td>
<td>DECENTRALIZED</td>
</tr>
<tr>
<td>B</td>
<td>FINANCIAL SERVICES</td>
<td>32,000</td>
<td>3,200</td>
<td>DISTRIBUTED</td>
</tr>
<tr>
<td>C</td>
<td>FINANCIAL SERVICES</td>
<td>2,500</td>
<td>225</td>
<td>CENTRALIZED</td>
</tr>
<tr>
<td>D</td>
<td>MANUFACTURING</td>
<td>63,000</td>
<td>2,200</td>
<td>CENTRALIZED</td>
</tr>
<tr>
<td>E</td>
<td>MANUFACTURING</td>
<td>2,800(^1)</td>
<td>325</td>
<td>DECENTRALIZED</td>
</tr>
<tr>
<td>F</td>
<td>MANUFACTURING</td>
<td>58,000</td>
<td>1,250</td>
<td>DISTRIBUTED</td>
</tr>
<tr>
<td>G</td>
<td>MANUFACTURING</td>
<td>2,000</td>
<td>90</td>
<td>CENTRALIZED</td>
</tr>
<tr>
<td>H</td>
<td>TRANSPORTATION</td>
<td>71,000</td>
<td>3,000</td>
<td>DISTRIBUTED</td>
</tr>
<tr>
<td>I</td>
<td>MANUFACTURING</td>
<td>25,000(^2)</td>
<td>200</td>
<td>CENTRALIZED</td>
</tr>
<tr>
<td>J</td>
<td>MANUFACTURING</td>
<td>8,000</td>
<td>75</td>
<td>CENTRALIZED</td>
</tr>
<tr>
<td>K</td>
<td>MANUFACTURING</td>
<td>133,000</td>
<td>5,000</td>
<td>DISTRIBUTED</td>
</tr>
<tr>
<td>L</td>
<td>FINANCIAL SERVICES</td>
<td>53,000</td>
<td>3,200</td>
<td>DISTRIBUTED</td>
</tr>
</tbody>
</table>

\(^1\)Represents one division of a manufacturing firm with 28,000 employees (1000 in IS).

\(^2\)Represents one division of a manufacturing firm with 284,000 employees.
critical success factors and problems or barriers to success in developing the application and supporting client-server architectures

Team interview questions sought both IS and client perspectives on the following:

- reasons for using teams and anticipated benefits
- description of one team's role and interactions with clients
- critical success factors and problems or barriers to success of the team in achieving its goals

The interviews were typically an hour in length, and we taped and transcribed nearly all of them. As appropriate, we also gathered archival data, including annual reports, extracts of presentations, architecture guidelines, statements of policy, organization charts and system requirements. In this study we used participants' descriptions of the anticipated benefits of each initiative as an operationalization of business value.

To analyze the results the researchers met and shared the stories of each site. We divided the sample by initiative (client-server and team) and reported first on the general context of the new initiative, such as the goals of top IS executives and the reasons the change was made. We then described specific teams/projects that we had studied, identifying the goals, outcomes, and related changes in management processes. Finally, we summarized the critical success factors and obstacles to success that IS and clients had reported to us. Researchers queried one another intensively and wrote notes to highlight key points about each site. When all six sites for an initiative had been discussed, we searched together for consistencies and inconsistencies among them. We then iteratively analyzed our findings, moving between within-case and across-case analysis, until we agreed on the defining dimensions, impacts and critical success factors that are described below. Later, we analyzed similarities and dissimilarities across the two initiatives, trying to identify, in particular, the accompanying changes that had been introduced to ensure success as well as the factors that were identified as potential obstacles or as critical to the success of an initiative.

**FINDINGS ON CLIENT-SERVER IMPLEMENTATIONS**

IS executives at the six sites defined client-server as an architecture that relies on distributed processing, that is, more than one processor is used to accomplish a single task. Of the eight
application projects we studied at the six sites, only one was fully operational at the time of the study. The firms varied in their length of experience with client-server architectures and the number of client-server systems they had implemented. Table 2 summarizes our findings on the firms' client-server experiences and the applications we studied.

**Impacts of Client-Server**

The client-server systems we studied capitalized on two key features of distributed computing: graphical user interfaces and improved data access. IS executives noted that the ability to provide easy access to data in a user-friendly format offers real potential for redesigning organizational processes and knowledge worker jobs, and it is through process and job redesign that client-server architectures can deliver business value. Because most of these systems were still under development, the most notable outcomes at the time were user ownership and enthusiasm for the systems under development. A summary of findings on client-server impacts is shown in Table 3.

Much of the user enthusiasm appeared to result from the use of system development methodologies that elicited more user participation than they had expected. Client-server technologies enable fast prototyping, and IS project leaders were taking advantage of those capabilities to generate alternatives and solicit regular feedback from users. Additionally, teams of IS and user personnel at Firms A, B and D were working closely together to define requirements, specify and manage project tasks, make technology choices and communicate those choices to other stakeholders. Users in these development efforts felt they were part of the team. They understood, and could describe, the risks of the technologies being implemented, and they shared responsibility for taking those risks. Clients at Firms B and D weathered delays and budget increases with patience and tolerance, confident that the final product would be worth the pain.

In Firms C, E and F users have accepted leadership roles in system development by hiring consultants, developing their own routines to access legacy data, or assuming responsibility for project management. Users at these companies were enthusiastic about their systems and confident that they would address critical business needs. They were relying on IS for technical expertise rather than for project leadership, but they expected IS to take responsibility for managing their networks once the applications became operational.
<table>
<thead>
<tr>
<th>FIRM</th>
<th>YEAR COMMITTED TO C-S</th>
<th>NUMBER OF C-S APPLICATIONS</th>
<th>APPLICATION DESCRIPTION</th>
<th>APPLICATION SCOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1992</td>
<td>3</td>
<td>Human resource information system; implementation of packaged software</td>
<td>Integrates human resources applications of 13 facilities</td>
</tr>
<tr>
<td>B</td>
<td>1985</td>
<td>10-20</td>
<td>Workers compensation workstation developed in C++ (00)</td>
<td>Redesigns job of 800 case-workers in 67 facilities</td>
</tr>
<tr>
<td>C</td>
<td>1992</td>
<td>none</td>
<td>Business acquisition system; customized vendor development</td>
<td>Major cross-functional reengineering effort linking 60 field locations</td>
</tr>
<tr>
<td>D</td>
<td>late 1980s</td>
<td>20-30</td>
<td>1) Purchasing workstation 2) Integrated factory system developed in Smalltalk (00)</td>
<td>1) Global with supplier links 2) Cross-divisional throughout factory</td>
</tr>
<tr>
<td>E</td>
<td>1990</td>
<td>24</td>
<td>1) Sales analysis system 2) Financial analysis system</td>
<td>1) Facilitates data access for 100 analysts 2) Facilitates data access for 100 analysts in 5 offices</td>
</tr>
<tr>
<td>F</td>
<td>1991</td>
<td>6-8</td>
<td>Contract management system in mock client-server environment</td>
<td>Integrates cross-functional data for about 20 contract administrators</td>
</tr>
</tbody>
</table>
At the time of the study, neither users nor IS had observed many negative outcomes of their client-server implementation efforts. The most frequently identified negative outcome was that systems were taking longer to develop than anticipated. This was most often due to complexities associated with relying on immature technologies. Nevertheless, some users perceived that systems development was much faster than in more traditional environments. One user enthusiastically stated that the kind of system under development at his organization would have taken four years under traditional methodologies. In fact, from start to finish, the user knew that the project would take about four years on client-server, but the heavy use of prototyping enabled users to see progress during development.

**Keys to Successful Client-Server Implementation**

At our sites, generating business value seemed to depend on the ability to redesign jobs and get data into the hands of decision makers while at the same time minimizing the costs and risks of moving to complex, immature technologies. Our participants defined three critical success factors (CSFs) for achieving this delicate balance: (1) taking advantage of prototyping to enable joint management and ownership of the implementation process, (2) appropriate technical architectures, and (3) relevant IS staff expertise. Table 3 lists specific CSFs mentioned by our interviewees.

As with any system development effort, maximizing the benefits of client-server requires staying focused on the business need. Firms in this study found user ownership of the implementation process important to maintaining that focus. To achieve user ownership five firms took advantage of prototyping tools to help users conceptualize and shape system functionality and operation. Committed users set priorities and made key decisions, such as those involving tradeoffs between functionality and delivery dates. Other techniques for building user ownership included regular meetings for joint application design, joint project management, and user project managers. Many participants emphasized the importance of constant IS-user communications.

To define an appropriate technical architecture most of the firms in the sample were focusing on choosing standards for operating systems, networks, programming languages, database management systems, and development tools. Although standards reduce options for users, they also facilitate system integration and promise to reduce the cost and complexity of supporting incompatible systems. Some firms were also filling holes in their distributed systems management capabilities by
<table>
<thead>
<tr>
<th>FIRM</th>
<th>IS OBJECTIVES FOR C-S</th>
<th>OBSERVED OUTCOMES (POSITIVE)</th>
<th>OBSERVED OUTCOMES (NEGATIVE)</th>
<th>CRITICAL SUCCESS FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Provide technology that enables cross-functional process redesign</td>
<td>User enthusiasm, managers thinking in terms of strategic IT applications, building new IT skills</td>
<td>Unexpected complexities in building controls; implementation slower than expected; users must do more operations work</td>
<td>Joint project management, extensive testing by users, both sides staff with best people</td>
</tr>
<tr>
<td>B</td>
<td>Increase employee productivity by making needed data readily available; provide flexible infrastructure</td>
<td>Ability to apply state-of-the-art technologies to improve business processes, user enthusiasm and patience with delays, building new IT skills</td>
<td>Development slower and more expensive than expected due to immature technologies</td>
<td>Extensive prototyping and user testing, regular joint application design meetings, staff with best people; build centralized performance monitoring system</td>
</tr>
<tr>
<td>C</td>
<td>In conjunction with bpr: save money, improve quality, and make workers more productive</td>
<td>Users taking more responsibility for system design and development</td>
<td>Inadequate IS skills; concerns about security/reliability</td>
<td>Joint project management; user development of quick hits; build developer’s workbench</td>
</tr>
<tr>
<td>D</td>
<td>Provide intuitive access to legacy data; use IT to improve business processes</td>
<td>Ability to apply state-of-the-art technologies, user enthusiasm and patience with delays; external sales of systems</td>
<td>Delays due to immature technology; tension over diversity in distributed components; concerns about security/reliability</td>
<td>Extensive prototyping; teamwork between IS &amp; users; use of object-oriented tools; developing data management tools</td>
</tr>
<tr>
<td>E</td>
<td>Provide access to data while maintaining control over it</td>
<td>User ownership, user satisfaction with systems</td>
<td>Configuration management concerns; concerns about IS &amp; user skills</td>
<td>Prototyping, co-location of development staff; simple tools; reliable legacy data</td>
</tr>
<tr>
<td>F</td>
<td>Provide new technological infrastructure; better user access to data</td>
<td>Users taking more responsibility for system design and development; user satisfaction</td>
<td>Delays in system delivery</td>
<td>Careful selling to all levels of management; daily involvement of 2 users; prototyping; limiting number of new technologies</td>
</tr>
</tbody>
</table>
developing tools and processes for ensuring system security, performance monitoring, data base management and operations support. IS staff explained that these measures are necessary to enable effective and efficient support of client-server architectures. Firm B, for example, was building a performance monitoring and control infrastructure that should enable one person to support 30 servers, as compared with the one person per two servers typical in the industry.

A final critical success factor is the development of IS staff skills. The new development methodologies and complex technologies associated with client-server require new IS skills. IS managers were confronting their skill shortages by hiring experienced vendors to work with their staffs during development, by assigning eager learners and self-teachers to client-server projects, and by implementing simple and mock client-server systems as a way to gradually build expertise.

Summary Observations of Client-Server Implementations
An IS executive at Firm D commented that IS must move to client-server because "if we don't, users will." Our small sample suggests that this is true. Users want access to data and user-friendly systems. If IS does not deliver these systems, it appears that users will either develop or contract for client-server systems themselves. While respondents felt that user ownership of systems was valuable for defining business needs and keeping development efforts focused on those needs, several IS respondents cautioned that user championship in moving to client-server can reduce IS's window of opportunity for defining a coherent technical architecture or acquiring needed expertise.

Figure 1 summarizes the key factors we saw as being associated with a move to client-server. Constant communication, prototyping, and user-led design are the kinds of conditions that our firms were developing to create user ownership of the implementation process. Applying these ownership processes to client-server implementations appeared to provide confidence that the expected benefits of process redesign would be forthcoming. Tempering the ebullience for the potential benefits of client-server, however, were concerns about the infrastructure--both the technical architecture and the technical skills inventory based in IS. These infrastructure components can be viewed as enabling factors in the success of IT. IS staff who are competent with client-server technologies and who work well with business partners appear to be prerequisite for building and maintaining the client-server architecture. Similarly, a well-designed, coherent technical infrastructure enables fast
Figure 1

User-Driven Design Process

Frequent IS-User Contact

Prototyping

User Ownership of Implementation

Technology Architecture & Infrastructure

Implemented Client/Server Applications

Better Business Processes

Overwhelming Support Demands

Technical Skill Inventory

Figure 2

Empowerment

Team-based Incentive Systems

Team Process Training

IS Teams

Technical Skill Inventory

Direct Team-user Communications

Technology Architecture & Infrastructure

IS Productivity

Responsiveness to Business Unit Needs

Suboptimal Solutions

LEGEND:
(Both figures)

Organizational Conditions

Technological Conditions

Partnership Points

Potentially Problematic Outcomes
cycle time and integratable components. Conversely, weak staff and technical infrastructures can lead to overwhelming support demands from client-server systems.

**Findings on Team-Based Management Structures**

Executives at the team sites did not share a common definition for teams, but they all indicated that, relative to traditional hierarchical structures, teams involved (1) relatively flat organizations and (2) shared responsibility for the accomplishment of fairly broadly-defined goals, as opposed to individual responsibility for narrowly-defined tasks. Teams were usually comprised of empowered IS professionals who took on managerial decision-making tasks. Having been trained in interpersonal skills, teams adopted group processes that encouraged creative problem solving, rewarded team achievements, or fostered cross-training and mutual support.

Firms in our sample varied in the length of time they had employed team structures and the percentage of IS staff on teams. Teams differed on a number of key dimensions: the permanence of the teams, user membership, the extent to which team members are empowered, and the role of a team leader. Table 4 displays the defining characteristics for each firm’s teams.

Structurally, the teams we saw could be divided into two categories: permanent and temporary. *Permanent teams* are groups of individuals who are permanently assigned to work with a particular segment of a business or a group of applications. In contrast, *temporary teams* draw their members from a pool of IS professionals and exist only for the life of a project. Permanent teams may, or may not, have a team leader. Where leaders are part of the team structure their role tends to be one of mentor and coordinator. The leaders of temporary teams had more traditional supervisory roles, but their reporting relationships were transitory.

*Impacts of Team Implementations*

In our sample of firms there was a variety of objectives for implementing teams that centered around developing a high-quality work force and streamlining communication paths between IS and users. Ultimately, business value was expected to flow from responsiveness to user demands and high IS staff productivity. Table 5 displays the objectives and observed outcomes identified by IS executives...
## TABLE 4
### TEAM DESCRIPTIONS

<table>
<thead>
<tr>
<th>FIRM</th>
<th>YEAR STARTED MOVING TO TEAMS</th>
<th>PERCENTAGE I/S EMPLOYEES INVOLVED</th>
<th>TEAM DESCRIPTION</th>
<th>MEMBER EMPOWERMENT</th>
<th>TEAM LEADER ROLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>1991</td>
<td>100%</td>
<td>Project teams formed from labor pool, part-time user members</td>
<td>Some self supervision and peer review</td>
<td>Supervisory, also have mentors separate from teams</td>
</tr>
<tr>
<td>H</td>
<td>1992</td>
<td>60%</td>
<td>Project teams formed from labor pool</td>
<td>Not an emphasis</td>
<td>Supervisory, team members also have full-time mentor or &quot;homeroom&quot; manager</td>
</tr>
<tr>
<td>I</td>
<td>1992</td>
<td>100%</td>
<td>Intact, team high-performance</td>
<td>A key focus, includes peer review</td>
<td>Consultant</td>
</tr>
<tr>
<td>J</td>
<td>1988</td>
<td>100%</td>
<td>Intact, team self-managed</td>
<td>A key focus, includes peer review</td>
<td>None</td>
</tr>
<tr>
<td>K</td>
<td>1992</td>
<td>2%</td>
<td>Intact, team experimenting with various team structures</td>
<td>Varies by team; some self-supervision</td>
<td>Some supervisory responsibility</td>
</tr>
<tr>
<td>L</td>
<td>1988</td>
<td>70%</td>
<td>Intact, team experimenting with various team structures</td>
<td>Yes, amount varies by group</td>
<td>Consultant</td>
</tr>
<tr>
<td>FIRM</td>
<td>IS OBJECTIVES FOR TEAMS</td>
<td>OBSERVED OUTCOMES (POSITIVE)</td>
<td>OBSERVED OUTCOMES (NEGATIVE)</td>
<td>CRITICAL SUCCESS FACTORS</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------</td>
<td>------------------------------</td>
<td>------------------------------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Increase responsiveness to business unit needs</td>
<td>Users feel project teams make good decisions for them, better systems in some cases</td>
<td>IS staff have less sense of belonging</td>
<td>Users involved on IS teams, constant communication; top mgmt team w/ project leaders set strategic direction</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Get more business value from IS resources</td>
<td>Higher level of user ownership, better applications, more consistent focus on targets, better user understanding of projects</td>
<td>Insufficient resources; client attempt to subvert pooling; rising compensation expectations among team members</td>
<td>Hybrid managers on both client and IS side; detailed business cases</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Increase productivity, do high-quality work</td>
<td>Higher productivity; strong team spirit</td>
<td>Some users are dissatisfied -- they've lost the control over IS they had from co-location or through managerial hierarchy</td>
<td>Recentralization of IS staff for coordination; empowerment training; open facility</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Improve quality and productivity</td>
<td>Growth in IS budget, IS has positive sense about the relationship; IS championing teams for corporation</td>
<td>Need to determine how to manage cross-team technology and strategy needs; lack of career path concerns some staff; much time spent in meetings</td>
<td>IS spends time in field; open facility; IS budget tied to services requested</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Find leveraged solutions, reduce IS costs; better performance in a technical organization</td>
<td>Better design decisions, better understanding of why some needs can't be met; working towards shared perceptions</td>
<td>Need for cross-team coordination mechanisms for self-managed teams</td>
<td>Open facility; virtual teams coordinate visions</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>More creative solutions, increased focus on organizational goals</td>
<td>Much more flexible organization, more strategic focus for IT applications</td>
<td>Much time and effort devoted to process rather than results; greater difficulty enforcing technology standards; confusion about leader roles; uncertainty as to fair compensation and incentives</td>
<td>Constant communication, IS spends time in field; empowerment training; increasing use of ad hoc teams</td>
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at the sample companies. Participants reported impacts on team member satisfaction, user relationships, and management control.

At a personal level, most permanent team members reported that they were learning, growing, and enjoying an increased sense of control. At the same time, some team members reported concerns about compensation, career tracks, and professional development. In traditional management structures they knew what they were responsible for, they did it, and then they got credit for it. On teams they shared responsibility, accountability, and credit, which made individual effort seem less worthwhile. In addition, many team members were conflicted as to how much supervision they wanted. They were positive about empowerment, but said they missed the efficiency with which a leader can solve a problem or do paperwork.

With the exception of Firm I, where the implementation of teams accompanied a physical recentralization of IS staff, users generally felt good about IS. Users observed that their IS teams proposed good designs, identified effective solutions, developed systems quickly, or effectively applied team skills, such as negotiation and problem solving, to their user interactions\(^2\). In one case, however, users cited a lack of accountability as a drawback to their experiences with IS teams.

Team structures also had implications for IS management control. Some IS executives felt that delegating decision making to teams freed up management time to focus on strategic objectives, such as building technical infrastructure, communicating and enacting strategic business priorities, and assessing and developing staff skills. Others noted, however, that IS teams tended to align tightly with business units or projects, making them less focused on long term corporate priorities and technical objectives. Thus, by delayering or forming empowered teams, IS management may lose opportunities to communicate the vision to IS staff or to enforce staff commitment to the vision. Moreover, because teams tend to focus intensively on the individual needs of their business partners, they may not develop coordinating mechanisms for addressing issues that cross team boundaries.

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\(^2\)Our user respondents did not always associate their positive outcomes to the implementation of team structures by IS.
Keys to Successful Team Adoption

The value of team structures derives from highly productive individuals working together to creatively and efficiently address business unit needs. Participants defined three critical success factors for generating these benefits: (1) mechanisms for motivating effective within-team and user-IS communications, (2) coordinating mechanisms for developing, communicating and enacting a technology vision, and (3) coordinating mechanisms for communicating strategic priorities.

IS executives expressed dissatisfaction with current incentive systems for motivating effective communication. One has established reward mechanisms that focus team member attention on user needs, but all the firms were struggling with the dilemma of rewarding team performance (thus ignoring under-achievers) versus rewarding individual performance (and demotivating teamwork). Firms in the sample emphasized formal training on how to lead meetings, solve problems, and negotiate with others as key to effective communications. Other firms facilitated communication by (1) locating teams in a single open area to ease the sharing of tasks, (2) including users as team members so that they could regularly share their needs and observations, (3) requiring team members to spend significant amounts of time at users' sites, and (4) removing IS management from the loop for system requirements specifications. One CIO claimed that one of the keys to encouraging effective communication was for managers to "let go" enough to allow teams to own their objectives and make decisions as to how to accomplish them.

Increased delayering in IS departments seems to call for alternative mechanisms for communicating a technology vision. To this end, Firm K created part-time, networked teams to develop organizational and technical strategies and communicate these to permanent teams. Firm G established a non-hierarchical IS management team, which included all project leaders, to define and communicate IS priorities and technology directions.

With permanent teams, a particular concern was the tendency for teams to become myopic in their views of organization needs. As they become more responsive to their specific clients' needs, teams may suboptimize larger strategic needs. IS executives have implemented several mechanisms to offset the tendency to view organizational needs too narrowly. For example, high level users at Firm H were responsible for developing business cases and overseeing projects in order to improve the strategic focus of new development efforts. Firms J and L have been forming project teams
alongside their permanent teams to apply talent to specific strategic applications. One focus of these efforts was to develop and apply appropriate IS skills to organizational needs. The CIO at Firm L noted the difficulty of developing a strategic firm-wide inventory of IS skills when teams were responsible for their own skill development.

Summary of Observations on Team Structures
A model of the team implementation process is shown in Figure 2. Team implementation appears to require some initial groundwork in training individuals in team skills, designing team-based incentive systems, and establishing empowerment processes. The teams enable direct team-user communications, which can lead to improved responsiveness to business demands and increased IS productivity. However, the intense communication between IS and users can also reduce IS staff focus on overarching firm objectives leading to suboptimal solutions from a firm-wide perspective. It is difficult for teams to think broadly about IT applications for dramatic improvement in processes that are beyond their local control. Thus, the success of team structures likely depends, to some extent, on the ability of IS management to develop mechanisms for providing and implementing technical visions. Our respondents indicated these concerns with regard to both IS’s technical skills inventory and the technical architecture and infrastructure.

DISCUSSION
The full impact of client-server implementations and team adoptions on business value has not been realized by the firms in our study. Initial findings on client-server implementations suggest that their user-friendly technologies, and accompanying approaches to system development, offer the potential to generate process improvements and to provide needed information to decision makers. Early findings on teams indicate that IS teams, trained in effective communication and interpersonal skills, can enable IS staff to better understand and respond to business unit needs. Although these changes to the IT staff and technical infrastructure can lead to outcomes that clients will value, it is not certain that they will.

Whether or not the potential for increased business value is realized from these infrastructure changes depends upon the firm’s ability to simultaneously manage multiple interrelated organizational factors, or, as Leavitt (1965) described it, to maintain a dynamic equilibrium. Both
client-server and team initiatives appear to demand initiative-specific structures and processes, such as interpersonal skills training and incentive systems for teams and prototyping and user-led design for client-server. IS executives at our sites had recognized these needs and, for the most part, they had taken action to implement appropriate structures and processes. The success of their client-server and team initiatives, however, is threatened by less obvious factors that are seemingly more difficult to address. Specifically, both initiatives appear to require attention to (1) partnership, (2) technical architecture, and (3) technical skill development. These three factors appear to enable the success of these initiatives. Paradoxically, successful implementation of these initiatives demands adjustments to the three factors.

**Partnership:** Efforts to partner tightly with users emerged in this study as an important, though not unexpected, ingredient in converting new technology to business value.\(^3\) Client-server sites, in particular, exhibited intense levels of user involvement that generated enthusiasm for the systems and a willingness to share responsibility for the risks associated with implementing new technologies. Where teams were adopted specifically to improve communications and better address business unit needs, they are generally regarded to have improved partnerships. However, in one case where teams did not focus specifically on partnership as an objective, users observed deteriorating communications as a result of the team implementation. In general, enriched communication between IS and users seems to be extremely valuable for developing mutual understanding of organizational needs and priorities. Some of the management practices associated with client-server and teams clearly foster this enriched communication.

**Technical Architecture:** There may be dangers, however, in relying too heavily on partnership as a key to business value. IS teams' support of their users can lead to a myopic view of the firm's technical architecture. As a result, firms could be headed back to "islands of automation" (McKenney and McFarlan, 1982) with applications that address only immediate needs of individual business units, not the long-term corporate technology vision. Client-server implementations that lack technical leadership from IS may be headed for the same fate, resulting in support demands that outweigh the potential benefits of new systems. Our sense from the sample firms is that inattention to the technology infrastructure poses a threat to the success of new IT practices. Conversely, a

\(^3\)The importance of business unit involvement in defining applications has often been discussed in the literature. See, for example, Boynton and Zmud (1984), McFarlan (1984), and Rockart (1988).
well-designed and implemented technical plan is likely to be a key factor in the ability of initiatives like client-server implementations and team adoptions to contribute business value.

**IS Skills:** While partnership and technical architecture factors appear to be key to generating value from IT infrastructure changes, they are dependent upon the existence of appropriate skills and expertise within the organization. The tight partnerships we witnessed resulted from both IS and user partners being able to contribute unique expertise (Henderson, 1990). Technical expertise was typically the unique contribution that IS staff could contribute. Moreover, this technical expertise appears to be important for converting a technical architecture into a leverageable asset. Even as partnership and technical architecture depend upon IS technical skills, new partnership processes and technology architectures give rise to a need for new IS skills. Infrastructure initiatives like client-server and teams can facilitate staff development or distract attention from the need to do so. Ignoring the need to develop technical and other key skills poses another threat to the success of these initiatives.

**Summary**

Leavitt (1965) proposed that task effectiveness depends upon the fit among task, technology, people and organizational structure. Rockart and Scott Morton (1984), in adapting Leavitt's model, discussed technology as a driver of strategy, structure, role, and management processes. This study builds on their work by identifying specific factors that interact with IS management's efforts to build the IT infrastructure and contribute to business value. While each initiative was accompanied by some unique adjustments in organizational processes, such as prototyping in client-server implementations and new incentive programs with team adoptions, the success of both initiatives seems to depend upon the fit among three interrelated factors: partnership, the technical architecture, and IS technical skills. We hope that future research will consider the extent to which these factors influence the ability to create business value.

The two infrastructure changes investigated in this paper approached business value from very different angles. Ultimately, however, the extent to which client-server and team initiatives meet their objectives will depend on how well the firms manage these three factors. The changes provide opportunities for better addressing business unit needs, but they also present risks. The risks are that management will not effectively manage these factors, which ultimately could threaten their
ability to achieve potential benefits and make the management initiative quite costly. Most IS organizations do not have a bank of organizational goodwill from which they can borrow should a major new management initiative prove to be costly and disruptive, so it is important that they manage new initiatives carefully.
REFERENCES


