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Abstract

Client-server is a computing strategy that has been widely hailed as a new paradigm. However, the implementation of this strategy has not always been successful. Using a sample of 350 companies, this paper investigates the benefits of client-server systems and links them to a set of implementation factors. The paper reveals that companies can expect competitive, operational, financial, and technical benefits through the use of client-server systems and reports several important steps, activities, and tasks that are positively related to those benefits.

Introduction

Client-server systems link clients with servers via a network to support distributed data management, processing, and presentation. Several corporate leaders consider client-server to be the new computing model of the '90s (Francis, 1990). However, a study of IS managers reveals that only two-fifths of them consider client-server "a worthwhile investment" (Caldwell, 1996). This is surprising, considering our collective wisdom on developing and implementing computer systems garnered over the last three decades. We performed a nation-wide study of client-server implementations to determine empirically: a) the benefits of client-server, and b) the implementation factors that are positively related to those benefits. Our goal was to provide some guidelines for the successful implementation of this computing strategy.

Delone and McLean (1992) identify six categories of IS success measures and they indicate that there are numerous, other ways to measure success. Kwon and Zmud (1987) classify implementation research into four groups: mutual understanding, political, factor, and process. We take an exploratory approach to relate a number of mutual understanding, political, factor-oriented, and process-oriented factors to a collection of diverse benefit factors.

We developed a questionnaire that was a mixture of previously validated items from other information and decision support systems implementation research and items specific to client-server implementations. Our sampling list came from a nation-wide database of executives who classified their companies as users of client-server systems. Our sample of usable responses consisted of 350 companies at various stages of development and with various types of applications.

Sample Profile

We used the Gartner Group's 1991 classification scheme to delineate the potential range of client-server applications. Almost half (48%) of the respondents classified their applications as distributed function; 19% classified their application as distributed database; 14% classified their application as remote data management; and 11% classified their application as remote presentation. The remaining 7% were distributed presentation applications.

The applications span several areas and the five most prevalent areas are customer service, operations, accounting/finance, sales, and marketing. With regard to implementation stage, 83% of the respondents were implementing or had completed implementation of their applications, with the remaining 17% being in the very early implementation stage (i.e., application identified and specified, but no installation).

Measurement and Analysis Approach

Concerning potential benefits of client-server systems, we used 16 items to represent various types of benefits. We used a number of items to represent the many steps, activities, and tasks that take place during a client-server implementation and that may be related to the benefits. For information systems planning, we used 21 items; for analysis, design, and systems implementation, we used 25 items; and for IS group and user activities, we used 28 items.

We used factor analysis to develop a parsimonious set of benefit and implementation factors for subsequent multivariate analyses. Because most of the items pertained to implementation and post implementation issues, we excluded those respondents in the very early stages of implementation from our analyses. The factor analyses extracted 13 implementation factors and four benefit factors (see Table 1). The factors demonstrated high loadings for all items, providing evidence of satisfactory construct validity. We assessed the reliability of our items with Cronbach alphas and found that the reliabilities were consistently above .50 and ranged between .65 and .83 for all but two factors, suggesting satisfactory reliability among the sets. Finally, we created summated scales by averaging the items to form a composite value for each of the benefit and implementation factors.

We use canonical correlation analysis to explicate the relationships between the set of benefit factors, and the set of implementation factors. Our results reveal that the implementation factors explain 25.4% of the variation in the benefit factors. The canonical loadings and cross-loadings, which indicate the relative importance of each factor, suggest that all benefit factors and five implementation factors merit further discussion (see Table 2).

Benefits and Related Implementation Factors

As demonstrated by the high canonical loadings (which range from .591 to .888) for the benefit factors, client-server applications can result in numerous and diverse benefits (again, see Table 2). A MANOVA reveals that type of client-server application (e.g., distributed function) is unrelated to system, operational, competitive, and financial benefits. Thus, the benefits are not just a function of a client-server application's technological complexity, as some vendors may suggest, but of other factors described in the next section.

Five implementation factors, namely, Application Suitability, Reengineering Intention, Project Management, Application Analysis, and Business Planning, have high positive cross-loadings, from .301 to .588, with the benefit factors (again, see Table 2). Thus, all of the implementation steps, activities, and tasks that comprise these five factors are significantly positively related with the benefit items that constitute the benefit factors.

Concerning Business Planning, to obtain numerous benefits, it appears that companies may need to have the CIO play an active role in strategic planning, define clear organizational objectives and strategies, make the IT strategy an integral part of the business's strategic plan, use competitive and technology assessments to formulate an IT strategy, and have the CEO act as a technology champion. Moreover, we find that companies with CEOs who are technology champions and CIOs who are active in strategic planning are more likely to train users for the client-server application and have users feel responsible for the client-server applications overall success.

With regard to project management, the results indicate that project managers need to develop a well organized roll out for the application, accomplish the project plan's target dates and emphasize the importance of testing multiple levels of clients and servers. Testing multiple levels of clients and servers is essential because client-server consists of numerous interacting components, creating opportunities for more to go wrong as the system is implemented.

Not surprisingly, Reengineering Intention is positively related to benefits. Companies may facilitate the attainment of benefits by basing functional requirements on reengineered business needs, reorganizing corporate data to suit the client-server application, viewing the client-server application as an opportunity to reengineer business processes and standardizing system components. Over 70% of the companies in our sample had established technical standards for their networks, operating systems, and equipment.

Concerning Application Analysis, the results reveal that companies need to take the following steps during a client-server project: employ prototyping to determine detailed specifications, give users input into designing client-server application, use a pilot/test system to evaluate client-server architecture, evaluate vendor products/services to determine if they function as advertised, distribute responsibility for client-server application to user community and give users opportunity to guide and test client-server application.

Finally, with regard to Application Suitability, the results demonstrate that, in order to attain benefits, client-server applications need to enhance users' job performance, enable users to accomplish tasks not previously feasible, be an integral part of the IT strategy and perform a mission critical function.

Summary

Client server can deliver important system, operational, competitive, and financial benefits. The study provides guidelines for managers seeking to implement this recent computing strategy. Some of these confirm the importance of applying past implementation strategies and activities, while others apply directly to the client-server environment.

References

References are available upon request from first author (lc307@albany.edu).

Table 1. Summary of Factor Analysis

Factors*	Items	Eigen Values	Percentage of Explained Variation	n	Reliabilities
IS Maintenance	2	10.90	19.8	284	0.76
Project Management	3	2.98	5.4	282	0.67
Vendor Support	3	2.78	5.1	282	0.75
Organizational Arrangements	6	2.39	4.3	290	0.80
Business Planning	5	1.98	3.6	281	0.77
IS/User Interaction	4	1.91	3.5	282	0.73
IS Management's Role	3	1.69	3.1	288	0.68
Functional Management's Role	2	1.59	2.9	290	0.65
Application Complexity	4	1.44	2.6	278	0.52
Application Suitability	4	1.30	2.4	282	0.66
Reengineering Intention	4	1.20	2.2	279	0.59
Application Analysis	6	1.14	2.1	285	0.73
Standards and Integration	5	1.08	2.0	274	0.66
Benefits					
Operational Benefits	7	6.19	38.7	275	0.83
Competitive Benefits	5	1.56	9.8	275	0.79
System Benefits	2	1.2	7.5	275	0.70
Financial Benefits	2	1.04	6.5	275	0.66

Factors are listed in descending order of percent of variation explained.

Table 1. Summary of Factor Analysis

Implementation Factors*	Canonical Loadings	Canonical Cross-loadings
Application Suitability	0.891	0.588
Reengineering Intentions	0.569	0.375
Project Management	0.516	0.341
Application Analysis	0.493	0.325
Business Planning	0.456	0.301
IS/User Interaction	0.435	0.287
Standards and integration	0.413	0.273
Vendor Support	0.328	0.216
IS Maintenance	0.317	0.209
Organizational Arrangements	0.303	0.199
Application Complexity	0.250	0.165
IS Management's Role	0.231	0.153
Functional Management's Role	0.224	0.148
Benefit Factors*		
Operational Benefits	0.888	0.586
Competitive Benefits	0.874	0.577
Financial Benefits	0.658	0.434
System Benefits	0.591	0.389

Implementation and Benefit Factors are listed in descending order of their canonical loadings and cross-loadings.