The Implementation of Strategic Information Systems Planning Methodologies

By: Albert L. Lederer
Joseph M. Katz Graduate School of Business
University of Pittsburgh
Pittsburgh, PA 15260

Vijay Sethi
School of Management
State University of New York at Buffalo
Buffalo, NY 14260

Abstract

Strategic information systems planning (SISP) is the process of deciding the objectives for organizational computing and identifying potential computer applications which the organization should implement. This article gives a thorough definition of SISP and then illustrates it with three methodologies.

A survey of 80 organizations examined the problems faced by information systems managers when they attempt to implement such a methodology. The subjects' overall satisfaction with the methodology, its resource requirements, process, output, and final execution were not particularly high. The two problems rated most severe were the difficulty in securing top management commitment for implementing the plan and the need for substantial further analysis in order to carry out the plan.

The survey also investigated some potential causes of the problems. Survey results suggest that the SISP methodologies may often produce satisfactory plans but that organizations lack the management commitment and control mechanisms to ensure that they follow the plans.

Keywords: Planning, information systems, information management

ACM Categories: K.6.0, K.6.4

Introduction

Improved strategic information systems planning (SISP) is the most critical issue facing information systems executives today (Brancheau and Wetherbe, 1987). Because the purpose of SISP is to identify the most appropriate targets for automation and to schedule their installation, SISP has the potential to make huge contributions to businesses and other organizations (McFarlan, 1971). Effective SISP can help organizations use information systems to reach business goals, a major objective of senior IS executives (Hartog and Herbert, 1986). It can also enable organizations to use information systems to significantly impact their strategies. However, the failure to carefully carry out SISP can result both in lost opportunities and the waste of expensive IS resources.

In order to perform effective SISP, organizations conventionally apply one of several methodologies (Arthur Andersen and Co., 1986; Martin, 1982; Moskowitz, 1986). However, recent research by Lederer and Mendelow (1986a) has shown that implementing such a methodology is a top problem faced by systems managers during SISP. Similarly, in a study of seven companies, Sinclair (1986) found the implementation of a planning technique to be a major problem. The problem encompasses justifying the methodology, applying it, and reviewing its output. To date, however, there has been no broad study to determine the nature of this problem.

This article defines SISP and describes three popular SISP methodologies. It elucidates the relative severity of the problems and examines some factors potentially related to this severity. Finally, it considers some similarities and differences in the problems of the three popular techniques.

Background

This section first defines SISP. It then discusses frequently applied SISP methodologies. Next, it presents a categorization of common problems encountered during the SISP process. Finally, it discusses literature which lays the groundwork for an investigation of some factors potentially related to the SISP problems.

SISP defined

The concept of SISP has evolved over the last decade. In the late 1970s, according to McLean and Soden (1977), the primary objectives of sys-

tems planning were to improve communication with users, to increase top management support, to better forecast resource requirements and allocate resources, to determine more opportunities for improving the MIS department, and to identify new and higher payback computer applications. More recently, Moskowitz (1986) observes that an additional objective of SISP has become the development of an organization-wide data architecture. Simultaneously, both Vitale, et al. (1986) and Index Systems (1986) suggest that the identification of strategic applications has arisen as another main objective of SISP.

This article adopts a broad, dichotomous view of SISP. Hence, on one side of the dichotomy, SISP refers to the process of identifying a portfolio of computer-based applications that will assist an organization in executing its business plans and consequently realizing its business goals. SISP also entails the definition of databases and systems to support those applications. SISP may mean the selection of rather prosaic applications, almost as if from a list, that would best fit the current and projected needs of the organization. This assumes that information systems planners know their organization's goals, plans and strategy; such an assumption may be unfounded (Lederer and Mendelow, 1987).

On the other side of the dichotomy, SISP can also entail searching for applications with a high impact and the ability to create an advantage over competitors (Clemens, 1986; Ives and Learmonth, 1984; McFarlan, 1984; Parsons, 1983; Wiseman, 1985). SISP can help organizations use information systems in innovative ways to build barriers against new entrants, change the basis of competition, generate new products, build in switching costs, or change the balance of power in supplier relationships (McFarlan, 1984). As such, SISP promotes innovation and creativity, and might employ idea-generating techniques such as brainstorming (Osborn, 1957; Rackoff, et al., 1985), Value Chain Analysis (Porter, 1985), or the Customer Resource Life Cycle (Ives and Learmonth, 1984). Vitale, et al. (1986) recognized the distinction between the two approaches and referred to the former as attempting to "align" MIS objectives with organizational goals and the latter as attempting to "impact" organizational strategies (p. 268).

Table 1. Description of BSP Study Steps

Gaining Executive Commitment	A top executive sponsor and various other interested executives are identified as the major sources of information to the study. A team leader, perhaps the sponsor, is identified to spend full time leading the study team of 4 to 7 executives.
Preparing for the Study	Team members are trained in BSP. They compile data on the firm's business functions and current IS support, and produce a work plan, interview schedule, review schedule, and final report outline.
Starting the Study	The executive sponsor reviews the study's purpose with the team. The team leader reviews the compiled business data and the top IS executive explains recent IS activities and problems to the team.
Defining Business Processes	The study team identifies the business processes which form the basis for executive interviews, the definition of the future information architecture, and other study activities.
Defining Data Classes	Data are grouped into categories called data classes based on their relationships to the business processes identified above. Charts are built to reflect those relationships.
Analyzing Current Systems Support	The study team identifies how IS currently supports the organization. The team develops charts showing organizational processes and the responsible departments.

To carry out SISP (especially in the alignment mode), an organization usually selects an existing methodology and then embarks on a major, intensive study. The organization forms committees of users with IS specialists as members or advisors. It most likely uses the SISP vendor's educational support to train the committee members and the vendor's consulting support to guide the study and audit its results. A multi-step procedure is carried out over several weeks or months. The duration generally depends on the scope of the study. In addition to identifying the portfolio of applications, the organization prioritizes them. It defines databases, data elements, and a network of computers and communications equipment to support the applications. It also prepares a schedule for development and installation.

Frequently applied methodologies

Organizations generally apply one of a number of methodologies in order to perform these SISP studies. Three popular methodologies include Business Systems Planning (IBM, 1975; Lederer and Putnam, 1986), Strategic Systems Planning (Holland Systems, 1986), and Information Engineering (Martin, 1982). They are described briefly as illustrative methodologies and will be alluded to in the research findings. These three were selected because, together, they accounted for half of the responses to the survey.

Business Systems Planning (BSP), developed by IBM, involves top-down planning with bottom-up implementation. In this methodology, a firm recognizes its business mission, objectives and functions, and how these determine its business processes. The processes are analyzed for their data needs, and data classes are then identified. Databases are developed by combining similar data classes. The final BSP plan describes an overall information system architecture as well as the installation schedule of individual systems. Table 1 details the steps in the study.

Table 1. (continued)

Determining the Executive Perspective	Executive interviews gain the commitment of additional executives and help the study team understand the problems whose solutions will be represented by the future systems.
Defining Findings and Conclusions	The study team develops categories of findings and conclusions and then classifies previously identified problems into the categories.
Defining the Information Architecture	The study team uses the business processes and the data classes to design databases. The team prepares charts relating the processes to the classes and the systems to subsystems.
Determining Architectural Priorities	The team sets systems development priorities based on potential financial and non- financial benefits, the likelihood of success, and the organization's demand for each system.
Reviewing Information Resource Management	The study team evaluates the current IS organization's strengths and weaknesses. A steering committee is established to set policy and control the function.
Developing Recommendations and Action Plan	The team prepares an action plan with recommendations about hardware, software, adjustments to current systems, and methods of strengthening IS management.
Reporting Results	The study team gives a talk along with a brief summary and a more detailed (usually very thick) report covering the study's purpose, methodology, conclusions, recommendations and prescribed actions.

BSP places heavy emphasis on top management commitment and executive involvement. Top executive sponsorship is perceived as critical. Information systems analysts might serve primarily in an advisory capacity. The study produces such a large volume of information that IBM has begun marketing an automated version called Information Quality Analysis (Vacca, 1984).

Strategic Systems Planning (SSP), developed by Robert Holland, defines a business function model by analyzing major functional areas. A data architecture is derived from the business function model by combining information requirements into generic data entities and subject databases. An information systems architecture then identifies new systems and their implementation schedule. Although the language differs slightly, the steps in the SSP procedure are similar to those in BSP.

A major difference from BSP is SSP's automated storage, manipulation, and presentation of the data collected during the SISP process. Software produces reports in a wide range of formats and with various levels of detail. For example, "affinity" reports show the frequencies of accesses to data, while "clustering" reports give guidance for database design. Menus guide the user through online data collection and maintenance. A data dictionary interface facilitates sharing SSP data with an existing data dictionary or other automated design tools.

In addition to SSP, Holland Systems Corporation offers Tactical Systems Planning (TSP) and Logical Database Design (LDD). TSP is a methodology for guiding the implementation of the information system architecture. LDD is used to develop data structures for modules from the study or from other systems, and then is used to map the structures to the SSP data architecture.

Information Engineering (IE), developed by James Martin, provides techniques for building enterprise models, data models, and process models. These form a comprehensive knowledge base which then creates and maintains information systems. IE is considered by some to be a more technically oriented approach than other SISP methodologies.

In conjunction with IE, Martin advocates the use of Critical Success Factors (CSF) (Rockart, 1979), a technique for identifying issues considered by business executives as the most vital for the success of their organization. Martin suggests that each general manager should use CSF. The resulting factors will then guide the SISP endeavor by helping identify future management control systems. (Recent versions of BSP also use CSF.)

IE provides several software packages for facilitating the SISP effort. However, IE differs from other methodologies by providing automated tools to link its output to subsequent systems development efforts. An application generator is integrated with IE and produces systems with COBOL code.

Other methodologies

Besides BSP, SSP and IE, firms might choose Method/1 (Arthur Andersen and Co., 1982), Information Quality Analysis (Vacca, 1984), Business Information Analysis and Integration Technique (Carlson, 1979), Business Information Characterization Study (Kerner, 1979), CSF (Rockart, 1979), Ends/Means Analysis (Wetherbe and Davis, 1982), Nolan Norton Methodology (Moskowitz, 1986), Portfolio Management (McFarlan, 1981), Strategy Set Transformation (King, 1978), Value Chain Analysis (Porter, 1985), or the Customer Resource Life Cycle (Ives and Learmonth, 1984).

Alternatively, firms often select features of these methodologies and then, possibly with outside consulting assistance, develop their own in-house approach (Arthur Andersen and Co, 1985; Sullivan, 1987).

Table 2 presents four major distinctions among some methodologies. It classifies them as alignment or impact approaches. The table also distinguishes them by their primary focus. Finally, it shows whether they define a data architecture, and whether they provide automated support.

Problems with the methodologies

It has long been recognized that SISP is an intricate and complex activity fraught with problems (McFarlan, 1971). Several authors have described these problems. Their work is based on field surveys, cases, and conceptual studies, and investigates most of the methodologies described previously. A review of the most significant of their articles served as the basis to create a comprehensive list of the problems (see Table 3).

In order to organize and summarize the problems, this research used three categories—resources, process, and output. Resource-related problems addressed the issues of time-requirements, money, personnel, and top management support for the initiation of the study. Process-related

Table 2. Some Characteristics of Different Methodologies

Methodology	Impact or Alignment	Focus	Defines Data Architecture	Automated Support
Business Systems Planning	Primarily Alignment	Data	Yes	No
Strategic Systems Planning	Primarily Alignment	Data	Yes	Yes
Information Engineering	Primarily Alignment	Data	Yes	Yes
Method/1	Alignment	Projects	No	No
Critical Success Factors	Can Be Both	Decision Information	No	No
Customer Resource Life Cycle	Impact	Customers	No	No
Value Chain Analysis	Impact	Internal Operations	No	No

problems involved the limitations of the analysis done by the methodology. Finally, output-related problems dealt with the comprehensiveness and appropriateness of the final plan produced by the methodology. This categorization was derived from a similar scheme used to define the different components of IS planning (King, 1984).

Table 3 shows the problems from the surveys, cases and conceptual studies. The problems have been paraphrased, simplified and categorized into the framework.

Potential causal factors

Unfortunately, very little is known about the managerial factors that affect these problems in different organizations. Johnson (1984) refers to a 1983 study by the New York consulting firm of Cresap, McCormick, and Paget. It concluded the following: "Although companies employ a variety of techniques and approaches, success in planning is surprisingly unaffected by such factors as industry, size of enterprise, methodology used, and organizational arrangement" (p. 97).

However, there are some reasons to believe that certain organizational and managerial factors might be related to SISP problems. The following variables represent a selection (not intended to be comprehensive) of such factors, and the text explains reasons for expecting their effects.

Sophistication in Business Planning

The complete lack of a business plan can be a severe impediment to IS planning (Lederer and Mendelow, 1986b). Similarly, as business planning becomes more sophisticated (and hence routine), organizational goals and strategies are better defined, and the IS plan can thus be more effectively aligned with business goals (King, 1978). Thus, less severe SISP problems would be expected in firms with more sophisticated business planning. McLean and Soden (1977) confirm that the absence of formal business planning makes SISP more difficult.

Participation by IS Department in Business Planning

Top IS executives who participate in strategic business planning have less difficulty understanding top management's objectives (Lederer and Mendelow, 1987). They are more experienced in planning and more informed about the firm's goals. Therefore, they are less likely to have problems guiding or participating in the SISP study and in ensuring that its output supports organizational goals. Hence, their SISP problems should be less severe.

Reporting Relationship of the IS Executive

McFarlan (1971) suggests that firms in which the top IS executive reports to a higher level business executive place more emphasis on planning, use IS resources more effectively, and have greater planning ability. These firms could more easily initiate a study, acquire its resources, and implement its output. Thus, they should encounter less severe SISP problems.

Table 3. The Problems

Problem Code	Problem Statement	Source
	Resources for Implementing the Methodology	
R1	The size of the planning team is very large.	Vacca, 1983
R2	It is difficult to find a team leader who meets the criteria specified by the methodology.	Vacca, 1983
R3	It is difficult to find team members who meet the criteria specified by the methodology.	Vacca, 1983
R4	The success of the methodology is greatly dependent on the team leader.	Zachman, 1982
R5	Many support personnel are required for data gathering and analysis during the study.	Rockart, 1979
R6	The planning exercise takes very long.	Bowman, et al., 1983
R7	The planning exercise is very expensive.	Moskowitz, 1986
R8	The documentation does not adequately describe the steps that should be followed for implementing the methodology.	Zachman, 1982
R9	The methodology lacks sufficient computer support.	Zachman, 1982
R10	Adequate external consultant support is not available for implementing the methodology.	Zachman, 1982
R11	The methodology is not based on any theoretical framework.	Zachman, 1982
R12	The planning horizon considered by the methodology is inappropriate.	McLean and Soden, 1977
R13	It is difficult to convince top management to approve the methodology.	Vacca, 1983
R14	The methodology makes inappropriate assumptions about organization structure.	Yadav, 1983
R15	The methodology makes inappropriate assumptions about organization size.	Yadav, 1983
	Planning Process Specified by the Methodology	
P1	The methodology fails to take into account organizational goals and strategies.	King, 1978
P2	The methodology fails to assess the current information systems applications portfolio.	Schwartz, 1970
P3	The methodology fails to analyze the current strengths and weaknesses of the IS department.	King, 1984
P4	The methodology fails to take into account legal and environmental issues.	King, 1984
P5	The methodology fails to assess the external technological environment.	King, 1984
P6	The methodology fails to assess the organization's competitive environment.	King, 1984
P7	The methodology fails to take into account issues related to plan implementation.	Zachman, 1982
P8	The methodology fails to take into account changes in the organization during SISP.	
P9	The methodology does not sufficiently involve users.	Kay, et al., 1980
P10	Managers find it difficult to answer questions specified by the methodology.	Boynton and Zmud, 1984
P11	The methodology requires too much top management involvement.	Bowman, et al., 1983
P12	The methodology requires too much user involvement.	Boynton and Zmud, 1984
P13	The planning procedure is rigid.	Zachman, 1982
P14	The methodology does not sufficiently involve top management.	Kay, et al., 1980

Table 3. (continued)

	Output of the Planning Methodology	
O1	SISP output fails to provide a statement of organizational objectives for the IS department.	McLean and Soden, 1977
O2	SISP output fails to designate specific new steering committees.	
O3	SISP output fails to identify specific new projects.	McLean and Soden, 1977
O4	SISP output fails to determine a uniform basis for prioritizing projects.	King, 1978
O5	SISP output fails to determine an overall data architecture for the organization.	Zachman, 1982
O6	SISP output fails to provide priorities for developing specific databases.	Zachman, 1982
O7	SISP output fails to sufficiently address the need for Data Administration in the organization.	Sullivan, 1985
O8	SISP output fails to include an overall organizational hardware plan.	McLean and Soden, 1977
O9	SISP output fails to include an overall organizational data communications plan.	Sullivan, 1985
O10	SISP output fails to outline changes in the reporting relationships in the IS department.	
O11	SISP output fails to include an overall personnel and training plan for the IS department.	McLean and Soden, 1977
O12	SISP output fails to include an overall financial plan for the IS department.	McLean and Soden, 1977
O13	SISP output fails to sufficiently address the role of a permanent IS planning group.	King, 1984
O14	The output plans are not flexible enough to take into account unanticipated changes in the organization and its environment.	McLean and Soden, 1977
O15	The output is not in accordance with the expectations of top management.	Gill, 1981
O16	Implementing the projects and the data architecture identified in the SISP output requires substantial further analysis.	Zachman, 1982
O17	It is difficult to secure top management commitment for implementing the plan.	Gill, 1981
O18	The experiences from implementing the methodology are not sufficiently transferable across divisions.	Zachman, 1982
O19	The final output document is not very useful.	King, 1984
O20	The SISP output does not capture all the information that was developed during the study.	Gill, 1981

Initiator of the SISP Study

Top management involvement in SISP has been emphasized (IBM Corporation, 1975; Martin, 1982; Rockart and Crescenzi, 1984). Thus, top management initiation of the study should reflect the commitment and involvement that IS executives seek, and less severe SISP problems would then be anticipated.

Scope of the SISP Study

The scope of the SISP study refers to the organizational unit under investigation. A study might cover the entire organization, a division, or merely a particular functional area. SISP at the corporate level must address additional complex issues such as technology management, the use of data communications, and data architecture (Kay, et al., 1980; Sullivan, 1985). Thus, a broad, corporate scope may be associated with more severe problems.

Planning Horizon

The planning horizon refers to the planning period covered by the study. Effective users of information resources employ such horizons (McFarlan, 1971). IS planning horizons vary depending on business planning horizons, management style, and other organizational factors (Martin, 1982). Because the use of a planning horizon might force the study team to be more detailed in its analysis and to develop a schedule, less severe problems

may occur in studies that consider a specific planning horizon.

Organization Ownership

McLean and Soden (1977) had expected but failed to find a relationship in the SISP characteristics of publicly and privately held companies. Their study showed that in publicly held firms, planning is more dependent on external constraints. Therefore, SISP problems would likely be more severe.

Methodology

The survey instrument was a three-part questionnaire. In the first part, respondents identified the methodology that they had used. They also identified the extent to which they had encountered the aforementioned problems. Subjects rated each problem on a scale of one to five, where

1 = not a problem
2 = an insignificant problem
3 = a minor problem
4 = a major problem
5 = an extreme problem

This scale has been used in similar previous studies (McLean and Soden, 1977).

The second part of the instrument included questions related to the implementation of plans. In this section, respondents indicated the extent to which different outputs of the plan had been affected. This follows King's (1984) recommendation that a criterion for evaluating a planning system is the extent to which the final plan actually guides the strategic direction of the IS function.

In the second part, the subjects also answered scaled questions about their satisfaction with various aspects of the SISP experience and about the reasons for any deviation from the final SISP recommendations.

The third part of the survey contained a number of questions related to respondent and organizational characteristics. These were adapted from Mclean and Soden (1977).

Two experienced strategic IS planners pilot-tested the questionnaire. One planner, with 21 years of IS experience, is currently responsible for SISP at a large regional grocery chain and was previously one of the top planners at a *Fortune* 50 international petroleum corporation. The other planner, with nearly 30 years of IS experience, is currently an independent consultant in the SISP area. The pilot test brought out three additional problems that were incorporated into the questionnaire. They appear in Table 3 without references.

The revised questionnaire was then mailed to members of the Strategic Data Planning Institute and to the firms in Vacca's (1983) study. A total of 251 organizations received the questionnaire. Three weeks after the first mailing, reminders were sent to those who had not yet responded.

Results

This section initially discusses some characteristics of the respondents. It then examines the findings about the problems of implementing an SISP methodology. Next, it focuses on a particular dimension of the problems and considers the organizational and managerial factors potentially related to the problems. Finally, it compares frequently used methodologies.

Characteristics of the respondents

One hundred sixty-three firms returned the completed survey for a response rate of 65%. Eighty (or 32%) of these firms had already participated in an SISP study and thus provided usable data. This was a high rate considering that the questionnaire was eight pages long and fairly complex. The rate attests to the fact that the respondents found this topic to be important.

Although all of the 80 SISP participants had either completed or were completing an ongoing SISP study, their demographic profiles differed. Table 4 shows that the respondents were, in general, highly experienced professionals with exposure to more than one employer and that they currently worked for medium and large firms. Table 4 also shows that BSP, SSP and IE accounted for 50% of the methodologies used by the participants.

Extent of problems of SISP methodologies

Table 5 shows a ranking of the problems of adopting an SISP methodology. In the questionnaire, subjects had rated the problems listed in Table 3 as extreme, major, minor, insignificant, or not a problem at all. The "Extreme or Major Problem" column in the table shows the percentage of subjects rating the problem as such; the "Minor Problem" column displays the analogous percentage.

As Table 5 shows, the most severe problem is the failure to secure top management commitment for

Table 4. Characteristics of Respondents

Job Titles of Respondents	
President	6%
Vice President	8%
Director	14%
Manager	36%
Supervisor/Group Leader	6%
Analyst/Data Administrator	9%
Consultant	6%
Other	15%
IS Experience of Respondents	
Less than 10 years	17%
10 to 20 years	63%
Over 20 years	20%
Industries of Respondents	
Manufacturing	26%
Utilities	13%
Insurance	10%
Government	8%
Retail	5%
Other/Not Available	38%
Scope of Studies	
Entire Enterprise	44%
Division	40%
Functional Area	10%
Not Available	6%
Number of Employees	
Fewer than 1,000	23%
1,000 to 10,000	42%
More than 10,000	32%
Not available	3%
Number of IS Employees	
Fewer than 100	36%
100 to 500	55%
More than 500	9%
Methodology	
Business Systems Planning	21%
Strategic Systems Planning	15%
Information Engineering	14%
Method/1	9%
Critical Success Factors	4%
Nolan Norton	3%
In-house	14%
Others	16%
Not Available	5%

carrying out the final plan. The second most severe problem is the requirement for substantial further analysis after the completion of the SISP study. Furthermore, despite the fact that those two problems are output-related, it is interesting to note that six of the eight remaining top ten problems are resource-related. Thus, it might be argued that the difficulty of securing top management commitment to carry out the plan (ranked first) is associated with the approval of insufficient resources. It might also possibly be reasoned that the requirement for further analysis (ranked second) is a problem simply because insufficient resources are allotted to complete an appropriately comprehensive study. Alternatively, it may be that the methodologies make poor use of the resources allocated to the study. Regardless, in the view of the respondents, the lack of resources appears to play a very significant role.

Further evidence of the resource problem

On a scale of zero to six (where zero refers to extremely dissatisfied and six refers to extremely satisfied), the respondents' average rating for overall satisfaction with the SISP methodology was 3.55, where a neutral score would have been 3.00. Satisfaction scores for the different dimensions of SISP were also slightly favorable. Satisfaction with the SISP process was 3.68, with the SISP output was 3.38, and with the SISP resource requirements was 3.02. Given the evidence in the previous subsection, it is not surprising that satisfaction with the SISP resource requirements is less than satisfaction with the process and output.

However, satisfaction with carrying out final SISP plans was much lower (2.53); in fact, only 32% of the respondents were satisfied while 53% were dissatisfied. Table 6 summarizes the respondents' satisfaction with these aspects of the SISP.[1]

Further evidence focusing on the problem of effecting the plan arises from a comparison of the elapsed planning horizon with the degree of completion of SISP outputs. The average planning horizon of the SISP studies was 3.73 years, while an average of 2.1 years had passed since the studies' completion; thus, 56% of the planning horizons had elapsed. However, out of an average of 23.4 projects recommended in the SISP studies, only 5.7 (24%) had been initiated. Therefore, it appears that firms may have been failing to initiate projects as rapidly as necessary in order to complete them during the planning horizon. It also appears that there may have been insufficient project start-ups in order to realize the plan.

[1]The authors offer no assertions about the absolute values of the satisfaction ratings. However, after examining them, one university professor noted that if his students' ratings of his classroom instruction remained consistently at these levels, he would eventually be fired for incompetent teaching!

Table 5. Extent of Problems of SISP Methodologies

Problem Code	Abbreviated Problem Statement	Extreme or Major Problem	Minor Problem
O17	Difficult to secure top management commitment	52%	16%
O16	Requires further analysis	46%	31%
R4	Success dependent on team leader	41%	30%
R2	Difficult to find team leader meeting criteria	37%	17%
R9	Methodology lacks sufficient computer support	36%	27%
R6	Planning exercise takes long time	33%	30%
P7	Ignores plan implementation issues	33%	18%
R13	Difficult to obtain top management approval	32%	36%
O11	No training plan for IS department	30%	29%
R3	Difficult to find team members meeting criteria	30%	24%
O12	No financial plan for IS department	29%	28%
R8	Documentation is inadequate	28%	33%
O6	No priorities for developing databases	27%	26%
O5	No overall data architecture is determined	27%	22%
R7	Very expensive	26%	29%
O13	No permanent IS planning group	26%	24%
R5	Many support personnel required	26%	23%
O7	No data administration need addressed	26%	16%
O18	Experiences not sufficiently transferable	24%	19%
O9	No organizational data communications plan	22%	38%
O10	No changes in IS reporting relationships	22%	31%
O4	No prioritization scheme provided	22%	19%
O15	Output belies top management expectations	22%	15%
P3	No analysis of IS department strengths/weaknesses	21%	32%
O8	No hardware plan	20%	36%
P11	Heavy top management involvement	20%	21%
O14	Resulting plans are inflexible	20%	18%
P5	No analysis of technological environment	19%	20%
P12	Too much user involvement	18%	28%
O19	Final output document not very useful	18%	20%
P10	Questions difficult for managers to answer	17%	39%
O20	Information during study not captured	17%	25%
P4	Methodology ignores legal/environmental issues	14%	16%
R14	Bad assumptions about organization structure	14%	14%
P8	Ignores organization changes during SISP	13%	25%
O1	No objectives for IS department are provided	13%	21%
P9	Insufficient user involvement	13%	5%
R1	Very large planning team required	12%	21%
P6	Methodology ignores competitive environment	12%	19%
O3	No new projects identified in final plans	12%	13%
O2	Output fails to designate new steering committees	11%	18%
P13	Rigidity of planning procedure	9%	17%
P2	No assessment of current applications portfolio	9%	16%
P14	Lack of top management involvement	9%	13%
P1	Ignores organizational goals and strategies	8%	10%
R12	Inappropriate planning horizon	6%	7%
R10	Inadequate consultant support	5%	11%
R15	Inappropriate size assumptions	4%	8%
R11	No theoretical framework	3%	5%

Table 6. Overall Satisfaction

	Average	Satisfied	Neutral	Dissatisfied
The Methodology	3.55	54%	23%	23%
The Resources Required	3.02	38%	24%	38%
The Methodology's Process	3.68	48%	17%	25%
The Methodology's Output	3.38	55%	17%	28%
Carrying Out the Plan	2.53	32%	15%	53%

At the same time, organizations had begun projects which were *not* part of their SISP plan. These constituted about 38% of all projects initiated after the study. Finally, in organizations where the SISP had recommended changes in the IS department, only 50% of these changes had been carried out.

These data suggest that the respondents did not execute their final plans very scrupulously. They raise questions about the resemblance between the systems envisioned by the planning group and their final implementations. One might also speculate that the methodologies have failed to generate useful ideas which organizations could then translate into implementable computer systems. Given their great expense and time consumption, such findings seriously challenge the utility of the planning methodologies represented in this study.

However, the findings are not necessarily surprising. They confirm the work of Runge (1985) who studied successfully implemented strategic information systems. In 80% of his cases, existing SISP procedures were either purposely circumvented or ignored. Runge attributed the successful implementation of these systems, not to SISP methodologies, but largely to "product champions," i.e., top general business executives who secured the necessary resources, overcame resistance to approval and development, and actively promoted the systems during implementation.

Potential causal factors affecting extent of problems

Table 7 identifies the previously discussed organizational and managerial factors potentially related to the severity of the SISP problems. It shows the mean ratings of the problems from the resources, process, and output categories and for all 49 (i.e., overall) problems. For example, the 2.38 in row 1, column 1 refers to the average severity of the 15 resource problems (in Table 3) for subjects who stated that their business planning was financial/tactical rather than strategic. Analysis of variance tested the difference in the mean scores under alternatives for each factor. Thus, Table 7 shows the levels of statistical significance for the alternative with more severe problems. (The relatively low mean scores reflect that some of the problems are considerably less severe than others.)

The following subsections discuss the problem factors. The headings reflect the study's findings based strictly on the alternative with the lower mean score. The subsequent discussion further considers the strength of the findings; cautious interpretation of the non-significant differences is suggested.

Factor 1: Organizations with less sophistication in business planning had more severe problems than more sophisticated organizations.

Organizations that characterized their business planning as financial or tactical had significantly more severe problems than organizations that characterized their business planning as strategic. The effect was significant for ratings in all four categories. It is not surprising that a general sophistication in setting goals and objectives permeates the SISP activities. In such sophisticated organizations, IS executives have less trouble justifying resources, carrying out the process, and analyzing the output.

Factor 2: Organizations with less participation by the IS department in business planning had more severe problems than organizations with greater participation.

Although the differences were not statistically significant in any category, this effect held in all four. The direction of the effect suggests the importance of such participation. Participation in strategy formulation enables the IS department to better understand top management's objectives and thus, to ensure that the SISP outputs support their goals.

Factor 3: Organizations where the top IS executive reported to a controller had more severe problems than organizations where the top IS executive reported to a president or vice president.

This effect was statistically significant for all four categories. It parallels the findings of Benjamin, et al. (1985) who observed that chief information officers in leading-edge companies frequently report to an area other than finance. More highly placed IS executives can more easily initiate, carry out, and analyze SISP exercises. Also, the primarily financial orientation of the controller may not enhance the IS Department's position or contribute to its SISP skills. The reporting relationship might merely reflect more archaic organizations.

This result is particularly important because top IS executives frequently report to a controller. Arthur Andersen and Co. (1986) recently found that 32% of the top information executives surveyed reported to a senior-level financial officer.

Factor 4: Organizations where top management initiated the study had more severe problems than organizations where IS management initiated it.

This finding was surprising. Although differences in ratings were not statistically significant, the effect was uniform across all four categories. The finding suggests that although IS executives seek top management involvement, they still prefer to maintain control. Top management-initiated SISP studies may likely be the result of displeasure with the performance of IS management. IS management-initiated SISP studies probably permit IS management to exercise more influence over the SISP study. However, the finding might simply be attributable to the fact that the respondents were IS executives.

Table 7. Factors Related to SISP Problems

Category	Mean Severity of Problems			
	Resources	Process	Output	Overall
1. Organizational Unit's Degree of Sophistication in Business Planning				
Financial/Tactical	2.38**	2.13***	2.46***	2.34***
Strategic	1.87	1.55	1.91	1.80
2. Participation by IS Department in Business Planning				
Does Not Participate	2.38	2.13	2.45	2.34
Participates	2.26	1.98	2.30	2.20
3. To Whom Does the Top IS Executive Report				
Controller	2.69***	2.55***	2.66**	2.59**
President/VP	2.10	1.82	2.28	2.14
4. Initiator of the SISP Study				
Top Management	2.33	2.16	2.39	2.31
IS/Other Management	2.27	1.95	2.32	2.20
5. Scope of the SISP Study				
Division/Function	2.43*	2.04	2.33	2.28
Enterprise	2.09	1.94	2.35	2.16
6. Consideration of Specific Planning Horizon By the SISP Study				
No Planning Horizon	2.58*	2.29	2.53	2.47*
Horizon Specified	2.20	1.94	2.28	2.16
7. Organization Ownership				
Publicly Owned	2.39	2.20	2.40	2.31
Privately Owned	2.08	1.87	2.21	2.07

* Refers to the .10 level of significance.
** Refers to the .05 level of significance.
*** Refers to the .01 level of significance.

Factor 5: SISP studies with a division or function as their scope had more severe problems than studies with the entire enterprise as their scope.

Again, the finding, although very weak, is surprising. Studies of divisions and functions had significantly more severe resource problems than studies of entire enterprises. The same effect, although not statistically significant, was true for the process and overall categories. For the output category, the ratings were nearly equal (although in the opposite direction as the others). The implication of this finding is that the broad and general recommendations of the methodologies might simply be better suited to the definition of data architectures of broader scopes.

Factor 6: When the SISP study failed to specify a planning horizon, problems were more severe than when it did specify a planning horizon.

The effect of this finding was consistent across all four categories and was significant for the resources and overall categories. Its implication is fairly straightforward — a planning horizon is a control mechanism. It demands that a schedule be drawn up and followed. It forces planning participants to confront and resolve problems in order to meet their milestones. This finding suggests that the importance of a planning horizon has not diminished even though increasing environmental volatility has made its use more difficult (Lederer and Mendelow, 1986c; Sullivan, 1987).

Factor 7: Publicly-owned organizations had more severe problems than privately-owned organizations.

Although the effect was consistent for all four categories, none of the differences were significant. Still, the implication might be that publicly-owned firms are generally more bureaucratic and more subject to external pressures than privately-held organizations, possibly because it is easier to control planning in a privately-held firm. Thus, IS departments in public companies would find more difficulty in obtaining resources, executing the process, and analyzing the output.

The problems of specific SISP methodologies

The top ten problems of the four most frequently used SISP methodologies appear in Table 8. Despite the common belief that one of BSP's major strengths is its detailed documentation (Bowman, et al., 1983; Zachman, 1982), BSP's top problem is that its documentation does not adequately describe the steps to follow. The top problem of SSP and IE is the difficulty of obtaining top management commitment for implementing the plan, perhaps because these methodologies (and their vendors) are less well-known to top management than IBM. It may also be due to their more recent origin. The major problem of in-house-developed methodologies is their lack of sufficient computer support; this is not surprising when one considers the expense of developing such support and the likelihood that a firm would do so.

Table 8 also shows some other potential differences among the methodologies. Lack of a training plan and the lengthy duration of the planning exercise are two problems in SSP's and IE's top ten that are not in BSP's top ten. Inadequate documentation, lack of computer support, and dependence on a team leader are three problems in BSP's top ten that are not in SSP's and IE's top ten.

Among the top ten problems of the four methodologies, three are common to all four. These include the difficulty in obtaining top management commitment for implementing the outputs, the requirement for substantial further analysis, and the difficulty finding a good team leader. In fact, most of the top ten problems of each methodology are related to carrying out the plan and the planning team; this finding accents the underlying similarities among the methodologies.

These similarities and differences might offer some preliminary guidance to firms selecting or developing an SISP methodology. However, due to small sample sizes (17, 11, 12, and 11, respectively, for the four methodologies in Table 8), cautious interpretation of this table is suggested.

Summary and Conclusion

Improved SISP is a major challenge facing IS executives today. Effective planning is essential to the realization of the potential strategic impact of computer-based information systems. This article has examined the difficulties of implementing a methodology to perform SISP.

The results suggest that IS planners are not particularly satisfied with their methodologies. Planning requires too many resources. Top management commitment is not easily obtained. When the SISP exercise is complete, further analysis is required before the execution of the plan

Table 8. Extent of Problems of Different Methodologies

Problem Code	Abbreviated Problem Statement	Extreme or Major Problem	Minor Problem
BSP			
R8	Documentation is inadequate	58%	16%
O17	Difficult to secure top management commitment	53%	32%
R4	Success dependent on team leader	53%	26%
O16	Requires further analysis	53%	21%
R9	Methodology lacks sufficient computer support	47%	26%
O6	No priorities for developing databases	47%	26%
P7	Ignores plan implementation issues	44%	17%
R2	Difficult to find team leader meeting criteria	42%	26%
R7	Very expensive	37%	32%
P5	No analysis of technological environment	37%	21%
IE			
O17	Difficult to secure top management commitment	60%	10%
R2	Difficult to find team leader meeting criteria	46%	9%
O16	Requires further analysis	44%	11%
O11	No training plan for IS department	40%	10%
O8	No hardware plan	36%	27%
P12	Too much user involvement	36%	27%
R6	Planning exercise takes long time	36%	18%
P11	Heavy top management involvement	36%	18%
O7	No data administration need addressed	36%	9%
O13	No permanent IS planning group	30%	20%
SSP			
O17	Difficult to secure top management commitment	67%	8%
O11	No training plan for IS department	58%	17%
O16	Requires further analysis	46%	39%
R13	Difficult to obtain top management approval	46%	39%
P3	No analysis of IS department strengths/weaknesses	46%	27%
R3	Difficult to find team members meeting criteria	46%	15%
R6	Planning exercise takes long time	42%	25%
O12	No financial plan for IS department	42%	25%
O18	Experiences not sufficiently transferable	42%	8%
R2	Difficult to find team leader meeting criteria	38%	31%
In-House			
R9	Methodology lacks sufficient computer support	55%	18%
O16	Requires further analysis	50%	30%
R4	Success dependent on team leader	46%	36%
R3	Difficult to find team members meeting criteria	46%	36%
O17	Difficult to secure top management commitment	40%	20%
R8	Documentation is inadequate	36%	46%
P10	Questions difficult for managers to answer	36%	18%
R2	Difficult to find team leader meeting criteria	36%	9%
O18	Experiences not sufficiently transferable	33%	11%
R13	Difficult to obtain top management approval	30%	20%

can take place. Consequently, carrying out the plan is often not very extensive.

The final plan might be a good plan. However, management commitment to the plan might be missing or the means of controlling its execution might be ineffective.

Therefore, if the objective of the SISP exercise is to align IS objectives with business goals (as is the primary objective of most of the methodologies used by participants in this study), then detailed, lengthy and complex SISP may be of limited value. Alternatively, the objective of an SISP exercise can be to use information technology to

impact a business strategy; however, the methodologies in this study may not generate the useful ideas to fulfill that purpose.

Implications for practitioners

This article provides practitioners with a comprehensive list of the potential problems of implementing an SISP methodology. Practitioners can examine the problems and attempt to anticipate them within their own organizations. Practitioners can develop strategies for circumventing the problems. Table 3 can serve as a comprehensive checklist for discussion and debate. Table 5 incorporates evidence about the relative concerns of the various problems in other organizations.

Practitioners might also consider the managerial and organizational issues investigated in this article and their potential effect on SISP in their firms. The two most significant issues are the top IS executive's reporting relationship and the organization's business planning sophistication. The findings relating to the first issue add strength to the position of any IS directors who are attempting to convince management that they should report to a president rather than a controller. The findings relating to the second issue suggest that the need for effective IS planning might possibly stimulate the need for effective business planning; such a notion was proposed in Lederer and Mendelow (1986b).

Practitioners might also pay particular attention to methods of attenuating the potential, detrimental effects of some of the unavoidable factors (such as public ownership or top management initiation of the study). Special consideration could be directed to the IS management's use of rewards and sanctions to control the execution of the final plans.

Thus the practitioner might ask: How in my company will I secure genuine top management commitment? How will I develop a plan that does not require extensive further analysis? How will I identify a team leader with excellent business skills and sufficient IS savvy? What can I offer to management to convince them to authorize sufficient SISP resources?

How will I avoid developing a thick and detailed plan that ultimately sits on my shelf and collects dust?

Implications for researchers

Researchers need to recognize the importance of SISP and investigate it. It has reached the top of several practitioner surveys and therefore deserves the attention of IS researchers. This study lays the foundation for further work in the area.

This article has examined a number of critical problems of SISP and has identified the most important ones. In doing so, it has prepared researchers to study the relationships between the problems. For example, under what circumstances might specific resource problems lead to specific process problems? Likewise, how might specific resource problems and process problems be related to specific output problems?

The investigation of a small number of factors potentially associated with the problems of SISP methodology implementation was reported in this article. The results suggest that it might be fruitful to develop a comprehensive model and test a wider variety of such factors. Using this model, researchers might ask: Under what circumstances would a firm best choose one methodology or another? How would a firm cull features from the various techniques in order to assemble its own in-house methodology?

The article prompts one final research question: What are the alternatives to the methodologies described in this study? Perhaps these methodologies require too much detail in their business analysis and database design. It may be too much to expect that a committee charged with detailed business analysis and database design could generate strategic visions about systems for creating a competitive advantage. It may be too much to expect that the combination of the strategic application identification phase and the data architecture development activity, without product champions for each, can produce valuable results. Perhaps because they use extensive resources, provide limited results, and raise expectations for projects that might never be implemented, the methodologies are actually hazardous to their users' health. Perhaps researchers should search for completely new and innovative alternatives for performing SISP.

Acknowledgement

The authors acknowledge their appreciation to Premkumar Gopalaswamy and T.N. Menon, who contributed to the early phases of this research.

References

Arthur Andersen and Co. *Method/1: An Information Systems Methodology*, Subject File AA4665, Item 57, 1982.

Arthur Andersen and Co. *Executive Guide to Strategic Information Planning*, booklet #85-6129, 1985.

Arthur Andersen and Co. *The Changing Shape of MIS*, #86-6230, 1986.

Benjamin, R.I., Dickinson, C., Jr. and Rockart, J.F. "The Changing Role of the Corporate Information Systems Officer," *MIS Quarterly* (9:3), September 1985, pp. 177-188.

Bowman, B., Davis, G. and Wetherbe, J. "Three Stage Model of MIS Planning," *Information and Management* (6:1), August 1983, pp. 11- 25.

Boynton, A. C. and Zmud, R. W. "An Assessment of Critical Success Factors," *Sloan Management Review* (25:4), Summer 1984, pp. 17-27.

Brancheau, J.C. and Wetherbe, J.C. "Key Issues in Information Systems Management," *MIS Quarterly* (11:1), March 1987, pp. 23-45.

Carlson, W. M. "Business Information Analysis and Integration Technique (BIAIT): A New Horizon," *Data Base*, Spring 1979, pp. 3-9.

Clemons, E.K. "Information Systems for Sustainable Competitive Advantage," *Information and Management* (11:3), October 1986, pp. 131-136.

Gill, S. "Information Systems Planning: A Case Review," *Information and Management* (4:5), December 1981, pp. 233-238.

Hartog, C. and Herbert, M. "1985 Opinion Survey of MIS Managers: Key Issues," *MIS Quarterly* (10:4), December 1986, pp. 350-361.

Holland Systems Corporation. *Strategic Systems Planning*, document #M0154-04861986, Ann Arbor, MI, 1986.

IBM Corporation. *Business Systems Planning - Information Systems Planning Guide*, publication #GE20-0527-4, 1975.

Index Systems, Inc. "PRISM: Information Systems Planning in the Contemporary Environment: Final Report," Cambridge, MA, December 1986.

Ives, B. and Learmonth, G. "The Information System as a Competitive Weapon," *Communications of the ACM* (27:12), December 1984, pp. 1193-1201.

Johnson, J. R. "Enterprise Analysis," *Datamation*, December 15, 1984, pp. 97-103.

Kay, R.M., Szypenski, N., Horing, K. and Bartz, G. "Strategic Planning of Information Systems at the Corporate Level," *Information and Management* (3:5), December 1980, pp. 175-186.

Kerner, D. V. "Business Information Characterization Study," *Data Base*, Spring 1979, pp. 10-17.

King, W. R. "Strategic Planning for Management Information Systems," *MIS Quarterly* (2:1), March 1978, pp. 27-37.

King, W. R. "Evaluating an Information Systems Planning Process," Working Paper #592, Graduate School of Business, University of Pittsburgh, 1984.

Lederer, A. L. and Mendelow, A. L. "Issues in Information Systems Planning," *Information and Management* (10:10), May 1986a, pp. 245-254.

Lederer, A. L. and Mendelow, A. L. "Paradoxes of Information Systems Planning," *Proceedings of the Seventh International Conference on Information Systems*, December 15-17, 1986b, San Diego, CA, pp. 255- 264.

Lederer, A. L. and Mendelow, A. L. "The Impact of the Environment on the Management of Information Systems: A Theoretical Model," Working Paper Series, Graduate School of Business, University of Pittsburgh, 1986c.

Lederer, A. L. and Mendelow, A. L. "Information Resource Planning: Overcoming Difficulties in Identifying Top Management's Objectives," *MIS Quarterly* (11:3), September 1987, pp. 389-400.

Lederer, A. L. and Putnam, A. "Connecting Systems Objectives to Business Strategy with BSP," *Information Strategy: The Executives' Journal* (2:2), Winter 1986, pp. 12-18.

Martin, J. *Strategic Data-Planning Methodologies*, Prentice-Hall Inc., Englewood Cliffs, NJ, 1982.

McFarlan, F.W. "Problems in Planning the Information System," *Harvard Business Review* (49:2), March-April 1971, pp. 75-89.

McFarlan, F.W. "Portfolio Approach to Information Systems," *Harvard Business Review* (59:5), September-October 1981, pp. 142-150.

McFarlan, F.W. "Information Technology Changes the Way You Compete," *Harvard Business Review* (62:3), May-June 1984, pp. 98-103.

McLean, E. R. and Soden, J. V. *Strategic Planning for MIS*, John Wiley and Sons, Inc., New York, 1977.

Moskowitz, R. "Strategic Systems Planning Shifts to Data-Oriented Approach," *Computerworld*, May 12, 1986, pp. 109-119.

Osborn, A.F. *Applied Imagination*, Scribners, New York, 1957.

Parsons, G.L. "Information Technology: A New Competitive Weapon," *Sloan Management Review* (25:1), Fall 1983, pp. 3-14.

Porter, M.E. *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York, 1985.

Rackoff, N., Wiseman, C. and Ullrich, W.A. "Information Systems for Competitive Advantage: Implementation of a Planning Process," *MIS Quarterly* (9:4), December 1985, pp. 285-294.

Rockart, J. F. "Chief Executives Define Their Own Data Needs," *Harvard Business Review*, March-April 1979, pp. 215-229.
Rockart, J. F. and Crescenzi, A.D. "Engaging Top Management in Information Technology," *Sloan Management Review* (25:4), May 1984, pp. 3-16.
Runge, D.A. *Using Telecommunications for Competitive Advantage*, unpublished doctoral dissertation, University of Oxford, Oxford, England, 1985.
Schwartz, M.H. "MIS Planning," *Datamation*, September 1, 1970, pp. 18-31.
Sinclair, S.W. "The Three Domains of Information Systems Planning," *Journal of Information Systems Management* (3:2), Spring 1986, pp. 8-16.
Sullivan, C. H., Jr. "Systems Planning in the Information Age," *Sloan Management Review* (26:2), Winter 1985, pp. 3-13.
Sullivan, C. H., Jr. "An Evolutionary New Logic Redefines Strategic Systems Planning," *Information Strategy: The Executive's Journal* (3:2), Winter 1987, pp. 13-19.
Vacca, J. R. "BSP: How Is It Working," *Computerworld*, March 1983.
Vacca, J. R. "IBM's Information Quality Analysis," *Computerworld*, December 10, 1984.
Vitale, M.R., Ives, B. and Beath, C.M. "Linking Information Technology and Corporate Strategy: An Organizational View," *Proceedings of the Seventh International Conference on Information Systems*, San Diego, CA, December 15-17, 1986, pp. 265-276.
Wetherbe, J. C. and Davis, G. B. "Strategic Planning Through Ends/Means Analysis," MIS Research Center, Working Paper, University of Minnesota, 1982.
Wiseman, C. *Strategy and Computers: Information Systems as Competitive Weapons*, Dow Jones-Irwin, Homewood, IL, 1985.
Yadav, S. B. "Determining an Organization's Information Requirements: A State of the Art Survey," *Data Base*, Spring 1983, pp. 3-20.
Zachman, J. A. "Business Systems Planning and Business Information Control Study: A Comparison," *IBM Systems Journal* (21:1), 1982, pp. 31-53.

About the Authors

Albert L. Lederer is an assistant professor at the Joseph M. Katz Graduate School of Business at the University of Pittsburgh. He earned his M.S. in computer and information science and his Ph.D. in industrial and systems engineering at the Ohio State University. Dr. Lederer spent over ten years in industry in the MIS field. His articles have appeared in the *MIS Quarterly, Sloan Management Review, Information and Management, Journal of Systems Management, Business Horizons*, and several other journals. He is the consulting editor for a new journal, *Computers in Personnel*. His research interests include the planning and implementation of management information systems.

Vijay Sethi is an assistant professor at the School of Management at the State University of New York at Buffalo. He earned his M.B.A. from Ohio University. He is currently completing his doctoral dissertation at the Joseph M. Katz Graduate School of Business at the University of Pittsburgh on the measurement of the extent to which an information technology application provides competitive advantage. His articles have appeared or are forthcoming in *INFOR, Interfaces, Information Management Review*, and *DATA BASE*. His other research interests are information systems planning, decision support systems, end-user computing, and expert systems.