The Impact of Organizational Characteristics on Information System Quality: The Mediating and Moderating Effects

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Introduction

The growth of information systems in most organizations has followed a fairly predictable path, with the most structured tasks being the first to be converted to computer processing. Thus, the accounting journals and ledgers and the time card and payroll systems were the first to be put on the computer. Inventory and production scheduling tasks were next, coincident with the development of more sophisticated management science models and techniques such as materials requirements planning (MRP). Marketing, with mostly less structured tasks, has been among the last to benefit from computer-assisted solutions [Yovovich, 1989].

Many researchers and management consultants have noted that information systems can serve as part of the organization's strategic arsenal. Jarvenpaa and Ives [1990], for example, note that the importance of information technology varies by the nature of firm, but that more successful firms tend to exploit information technology as part of their firm's strategy. Johnston and Carrico [1988] suggest a list of steps that firms can take to become better in the strategic use of information systems. Their analysis highlights the importance of considering the "value added" by information technology and "changing the rules of the game" to increase the advantage to the firm that makes the best use of information technology.

Research into the strategic use of information systems indicates that the mere acquisition of information technology and its applications to traditional tasks no longer confers a strategic advantage. In fact, we see many organizations selling what once was their proprietary, strategic information technology to amortize their development costs [Hopper, 1990]. Since the technology is available to all, those organizations that gain a strategic advantage are those that use better the information contained in the information systems [Carr, 2003].

Organizational Characteristics Affecting Information Systems

A number of factors have been found relevant to the successful development and implementation of information systems. These include the characteristics of the firm [Doll and Torkzadeh, 1987; Leifer, 1988; Jarvenpaa and Ives, 1991], and the structure of the relationship between IS staff and eventual users of the system [White and Leifer, 1986; Hogue, 1987; Markus and Bjørn-Andersen, 1987; Silver, 1988; Galletta and Heckman, 1990].

The design and development of information systems have typically been under the control of system managers rather than system users. Because of the growing recognition of the strategic value of information to managers throughout the firm, there is an increasing need for information systems to be responsive to end-user needs and perceptions [Glazer, 1991; Johnston and Carrico, 1988]. This need has recently been matched by end-user computing [Rivard and Huff, 1988]. The rapidly advancing technology in information systems and the growing information demands of user functions make the IS functions particularly susceptible to a variety of organizational influences [Leifer, 1988; Li and Shani, 1991; Marcus and Robey, 1983; White and Leifer, 1986].

Li and Shani [1991] recently proposed organizational characteristics should include not only **organizational climate** but also **IS sophistication**. The former is a potentially useful basis for exploring and interpreting the relationship between the IS function and its organizational customers and attendant performance. The latter is the overall status of an organization's IS within its growth process. They further divided organizational climate into "organization-wide" climate and "IS-related" climate. For conciseness, these are referred to as "corporate climate" and "IS climate" in this study.

Corporate Climate

The performance of individuals and groups in organizations may be influenced by a variety of factors. One pervasive influence, referred to as climate, has long been assumed to have a significant effect on behavior and attitudes of persons in the organization [Lewin, 1951; Sherif, 1958]. Corporate or organizational climate has been defined in many ways, but it may be

referred to as "... a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior" [Litwin and Stringer, 1968, p. 1]. Using various methods for operationalizing the concept of corporate climate, researchers have found a number of indicators to be correlated with climate [Downey, et al., 1975; Friedlander and Margulies, 1969; Hand, et al., 1973; Kaczka and Kirk, 1968; LaFollette and Sims, 1975; Lawler, et al., 1974; Li and Shani, 1991; Pritchard and Karasick, 1973; Steers, 1975, 1976]. It is primarily related to prevailing attitudes, values, norms and feelings of employees relative to the organization [Payne and Pugh, 1976]. These perceptions, feelings, and responses grow out of the interaction among various dimensions of an organization's structure, policies, and activities, and individual goals, needs, and abilities [Steers, 1975].

There are numerous conceptualizations of the components of corporate climate. These include: 1) structure, individual responsibility, rewards, risk and risk taking, and tolerance and conflict [Litwin and Stringer, 1966]; 2) managerial support, managerial structure, concern for new employees, intra-agency conflict, and general satisfaction [Schneider and Bartlett, 1968]; 3) technological readiness, human resources primacy, communication flow, motivational conditions, and decision-making practices [Taylor and Bowers, 1972, p. 71]; 4) task structure, reward-punishment relationship, decision centralization, achievement emphasis, training and development emphasis, security versus risk, openness versus defensiveness, status and morale, recognition and feedback, and general organizational competence and flexibility [Steers, 1977]; and 5) innovation and adaptability, quality of work life, clarity and awareness of organizational policies, flexibility of organizational processes, clarity and sharing of organizational mission, and quality of resources. [Li and Shani, 1991] Among these various components, innovation and adaptability, teamwork and decision making seem to have significant effect on information system quality. Jarvenpaa and Ives [1991] studied the relationships between executive involvement and participation and a firm's innovative use of technology. They found that involvement (a psychological state, an attitude) is more strongly related to innovative use of

technology than is the executive's actual participation in IS activities. Doll and Torkzadeh [1987] studied the role of IS steering committees, finding that steering committees lead to more formalized and systematic planning, especially in larger firms. This exemplifies the importance of organizational goals and policies as these are the necessities for a formalized planning process.

Information System Climate

Although the overall corporate climate may exert a significant influence on individuals, the climates closer to their immediate work environment may wield stronger influences [Steers and Porter, 1979]. In assessing the specific effects of organizational climate on IS quality, the IS climate is studied. This climate was previously identified and measured as a function of the end user's and IS staff's attitudes toward the information systems, perceived support of upper management for the IS function, and the interaction and relationship between the end users and the IS staff [Li and Shani, 1991]. In this study, the end users are identified as the marketing executives since they are the major decision makers who use most of available marketing (as well as customer and product) information.

Information System Sophistication

In addition to measures of climate, IS researchers have attempted to measure the "maturity" of the organization's information systems following the concepts advanced by Nolan [1973, 1979]. The assumption is that the higher the IS maturity the more likely that an organization be able to support its organizational process. Several researchers have tried to validate Nolan's models, with mixed results (see Benbasat, et al. [1984] for a review of early research on the topic). Li, Rogers, and Chang [1994] have noted that failures to validate might be the result of inaccurate instruments instead of unfounded theory. They proposed an instrument that contains less ambiguous questions to measure "information system sophistication" — a concept that is more specific than stages of growth — and report some

success in the use of their instrument. A version of their instrument is used in this research to measure IS sophistication.

The level of the IS sophistication is composed of two factors — the organizational sophistication and the technological sophistication of the IS department [Cheney and Dickson, 1982]. Six possible levels or phases have been designated for each of the two concepts [Cheney and Dickson, 1982; Gibson and Nolan, 1974; Li, et al., 1994; Nolan, 1973, 1979]. Organizational sophistication refers to *the management activities associated with computer and information resources in an organization*. It includes six phases: initiation, expansion, control, integration, repositioning, and maturity. Technological sophistication refers to *the levels of hardware and software technologies utilized in an organization.* It includes six levels: faster data handling, creating new information, support to operational control, support to management control, administration of data, and support to strategic planning.

Information System Quality

The literature of IS research contains many different means for measuring IS quality [DeLone and McLean, 1992]. One popular method is based on a questionnaire of user satisfaction [Baroudi, et al., 1986; Baroudi and Orlikowski, 1988; Rivard and Huff, 1988; Rushinek and Rushinek, 1986]. The perceived utility of the system is important, as noted in Davis's [1989] study. Other researchers use some type of ideal–real differential [Miller and Doyle, 1987; Moynihan, 1990]. The present research combines user-satisfaction and ideal–real differential measures. It views IS quality as composed of four factors: 1) efficiency, 2) effectiveness, 3) support to users in respondent's area, and 4) support to general users [Ives, et al., 1983]. Efficiency in this context relates to *how well IS functions are performed*. Effectiveness is a function of whether or not *the right kinds of IS applications are developed and applied*.

Research Model

Based on the foregoing discussion of past research, the input variables underlying the analysis is the corporate climate which consists of two variables: the goals and policies (G) and

the innovation (IN). The mediating variable is the IS climate (ISC) and the moderating variable is the IS sophistication (ISS). The output variable is the perceived IS quality (ISQ). Operationalization of these variables is discussed below.

The causal relationships between these variables are postulated in Figure 1. The model postulates that **G** and **IN** both have direct positive effects on **ISC**, but not **ISQ**. The rationale is that the state of company goals and policies may affect the working conditions or climate of information services, but not the IS quality. Similarly, the state of innovation may encourage the employees to strive for improvement on the IS climate, but it does not affect directly the IS quality.

The model postulates that **ISC** has direct positive effects on **ISQ**. The rationale is that a harmonious IS climate may engender teamwork among users and IS personnel, thus, increase the chance of IS success. Furthermore, **ISS** is postulated to have moderating effects on the two corporate climate variables and the **ISQ**. The rationale is that in a state of high IS sophistication, information would be managed as a corporate resource, end-user computing would be effectively managed, and IS quality would be accountable jointly by users and IS personnel. Therefore, these may affect how goals and innovation affect the IS climate.

—— INSERT FIGURE 1 ABOUT HERE ——

Based on this model, four overall directional relationships are hypothesized:

Hypothesis 1: ***The perception of goals and policies positively affects the perception of ISC***. That is, the more positive the perceived goals and policies, the better the perceived IS climate.

Hypothesis 2: ***The perception of innovation positively affects the perception of ISC***. That is, the more positive the perceived innovation, the more positive the perceived IS climate.

Hypothesis 3: ***The perception of ISC positively affects the perception of ISQ.*** That is, the more positive the perceived IS climate, the better the perceived IS quality.

Hypothesis 4: ***The level of ISS significantly affects the relationships between the perception of COC variables (i.e., G and IN) and the perception of ISC.*** That is, the perceived IS climate may have a different relationship with the perceived goals and policies or the perceived innovation under high level of the perceived IS sophistication.

Research Methodology

Subjects

Data were collected from a sample of 1000 companies randomly selected from a recent version of the *Standard and Poor's Directory.* The questionnaire was sent twice to the marketing executive in each sampled company. A total of 162 questionnaires was received, giving a 16% response rate. Such level of response rate is typical in industrial research [Berry, 1983; Mentzer, Schuster, and Roberts, 1987]. Furthermore, four of the responded questionnaires were unusable due to excessive missing values. Among the 158 usable ones, 74 were received from our first wave of mailing while 84 were received from the second wave.

Table 1 provides a summary of the characteristics of the firms responding to the questionnaire. Respondents tend to be concentrated among larger firms. Most of them have small to medium size of departmental budget and number of employees. Ninety-two percent of the companies indicated that their IS experience exceeded 10 years. The diverse distribution of each demographic variable indicates the absence of response bias which may come from a particular category of subjects.

—— INSERT TABLE 1 ABOUT HERE ——

Moreover, most of the executives (94%) have been with the companies for at least one year. They are quite aware of the current conditions of the companies. A majority (91%) of them are using computers daily or weekly. They are experienced computer users; 94% of them have at least two years of computer experience. The is one executive who after 12 years with the company has been using computers during the past year. There are 3 executives who have either

never used computers for their work or no responses. These executives do not indicate their years in the companies. They are among the five executives not providing information about their years of computer experience. These five executives are excluded from this study. Furthermore, two executives indicate that they are new comers; only working for their companies for 6 and 10 months respectively. Because one of them is among the five excluded executive, only one more executive is excluded from this study. The remaining sample of 152 respondents are more knowledgeable about the work conditions and the IS status in their companies. They are more likely to provide valid responses to our questionnaire items.

Measures

Considering the research model depicted in Figure 1, a three-part questionnaire (See Appendices A through F) was developed. The first part contains 12 items measuring the climate of the company, the second part contains 2 items measuring IS sophistication, and the third part contains 4 items measuring the IS quality perceived by the respondent. Among the 12 climate items, 8 items measure aspects of the **COC** and 4 items measure the **ISC**. For the 4 **ISC** items, these were adapted from Bailey and Pearson [1983] to measure the relationship between users and the IS staff as well as organizational attitude toward the IS function.

The four questions used to measure perceived **ISQ** (Appendix F) were adapted from the 4-item instrument developed by Ives, et al. [1983]. In the first and the third part of the questionnaire, the subjects were asked to indicate the extent to which they agree with the condition described by the questionnaire item on a 7-point Likert-type scale, ranging from 1 (strongly disagree/dissatisfied) to 7 (strongly agree/satisfied). Therefore, the data collected by this study are self-report scores that represent the perception of the respondents toward the conditions of the questionnaire items. Table 2 summarizes the sources of the questionnaire items.

—— INSERT TABLE 2 ABOUT HERE ——

In contrast, the second part contains a detailed description of a company's **ISS** phase-by-phase from organizational (Appendix D) and technological (Appendix E) aspects and asks the

respondent to identify the company's IS growth with one of the six phases for each aspect of **ISS**. The description and phases in this aspect were adapted from Nolan [1973, 1979], Gibson and Nolan [1974], Cheney and Dickson [1982], and Li, et al. [1994].

Composite Score

To facilitate the analysis of the moderating effect of the ISS, a composite average of the two item scores of the IS sophistication was computed. Namely, IS sophistication as a whole has two items, organizational sophistication and technological sophistication, thus its composite average is the total score of the 2 items divided by 2. The other variables which have multiple items will be treated as latent variables and theirs items will be used to derive latent variables. Table 3 shows the number of items used by each research variable and the reliability coefficient of the variable.

—— INSERT TABLE 3 ABOUT HERE ——

Procedure for Analysis

Before we begin the analysis, the psychometric qualities of the instrument and the non-response bias must be examined. It is confirmed that the reliability coefficients [Cronbach, 1951] of the scales measuring the variables range from 0.835 to 0.876 (see Table 3 above), all exceed the threshold of 0.7 as recommended by Nunnally [1978, p. 245]. As for the non-response bias, a series of chi-square tests are performed between the two samples obtained from the two waves of mailing. The results show no significant difference in any item responded between the two samples, indicating there is no significant non-response bias.

These findings allow us to continue the analysis using a fully-mediated structural equations model to evaluate the dynamic impact of organizational characteristics on the perceived IS quality.

Analyses and Results

To test the first three hypotheses, we conducted an analysis using AMOS 4.0 based on the structural equations model in Figure 1. The output statistics are shown in Table 4. Based on the

statistics, the model has acceptable (≥ 0.90) GFI, CFI, and TLI. The ratio of χ^2 to the degree of freedom is 1.39 (≤ 3 recommended) [Anderson and Gerbing 1988]. As shown in the first column of the standardized path estimates, the coefficient of goals and policies → ISC is 0.177 ($p < 0.05$); Innovation → ISC is 0.262 ($p > 0.05$); and ISC → ISQ is 0.847 ($p < 0.001$). Based on these statistics, hypotheses 1 and 3 are supported while hypothesis 2 is not.

—— INSERT TABLE 4 ABOUT HERE ——

In order to explore the moderating effort of the ISS, we performed two separate analyses; one with high ISS (composite score ≥ 4.5) and the other with low ISS (composite score ≤ 3.5). The AMOS 4.0 output statistics are shown in Table 4 as well. As shown in the second and the third column of the standardized path estimates, the coefficients of ISC → ISQ are 0.863 for low ISS and 0.769 for high ISS, both are significant at $p < 0.001$. While the coefficient of innovation → ISC is 0.392 ($p > 0.05$), the coefficient of goals and policies → ISC is 0.486 ($p < 0.05$).

Conclusions and Recommendations

Information technology has become a commodity today. It is ubiquitous and becoming the cost of doing business that must be paid by all but provides distinction to none. What makes a company distinct is its information system quality and innovative use of this quality for strategic purposes. In this paper, we reveal that the states of goals and policies and innovation in a company will not affect the quality of information systems. It is the state of IS climate that does. IS climate is the mediator of IS quality. Without harmonious IS-user climate a company cannot attain IS quality even the corporate goals and policies are clearly defined and shared, and even innovation is highly encouraged and facilitated.

When we analyze the moderating effect of IS sophistication, we found that highly sophisticated companies tend to focus more on the defining and sharing of goals and policies. In contrast, companies with low IS sophistication tend to focus more on the innovativeness. These findings are consistent with the fact that companies with high IS sophistication are typically large companies. It is of greater importance to them to make sure that all employees

share the same goals and policies. On the contrary, companies with low IS sophistication tend to be small. Their resource is limited, thus innovative use of information systems is their effective weapon in their fight against corporate giants.

Our most important finding in this study is that IS climate is the key to attain IS quality. It is necessary for a company to create harmonious IS climate making sure that the manner and methods of interaction, conduct, association, and information exchange between the user and the IS staff are adequate and effective; that the hierarchical relationship of the IS function to the overall organizational structure is adequate; and that the IS staff is willing and committed to subjugate external, professional goals in favor of organizational goals and tasks. Only a company maintains a harmonious IS climate can it attain high IS quality.

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Table 1. Demographic Profile of the Companies (N = 158)

Characteristic	N	%
Industry Type:		
• Manufacturing product	80	51
• Non-manufacturing product	38	24
• Service	40	25
Annual Company Sales:		
• Small (less than $100 million)	24	15
• Medium ($100 million to less than $500 million)	36	23
• Large ($500 million to less than $1 billion)	38	24
• Very large ($1 billion or more)	60	38
Number of Company Employees:		
• 500 or less	8	5
• 501 to 2,000	33	21
• 2,001 to 10,000	59	37
• Over 10,000	58	37
Annual Department Budget:		
• Small (less than $1 million)	42	27
• Medium ($1 million to less than $5 million)	30	19
• Large ($5 million to less than $20 million)	17	11
• Very large ($20 million or more)	7	4
• No response	62	39
Number of Department Employees:		
• 10 or less	75	48
• 11 to 50	50	32
• 51 to 200	10	6
• Over 200	7	4
• No response	16	10

Characteristic	N	%
Years of Company's Computer Experience:		
• Less than 5 years	1	1
• 5 to 10 years	11	7
• 11 to 20 years	21	13
• 11 to 20 years	21	13
• 21 to 30 years	42	27
• Over 30 years	18	11
• No response	65	41
Respondent's Years in the Company:		
• Less than 1 years	2	1
• 1 to 5 years	60	38
• 6 to 10 years	38	24
• 11 to 20 years	39	25
• Over 20 years	16	10
• No response	3	2
Respondent's Years of Computer Experience:		
• Less than 2 year	1	1
• 2 to 5 years	13	8
• 6 to 10 years	56	35
• 11 to 20 years	55	35
• Over 20 years	28	18
• No response	5	3
Respondent's Frequency of Computer Usage:		
• Daily	116	73
• Two or three times per week	20	13
• Once per week	10	6
• Once per month	8	5
• Less than once per month	1	1
• Never	1	1
• No response	2	1

Table 2. Sources of Questionnaire Items

Research Variable/Factor	No. of Items	Source
Corporate Climate	8	Litwin and Stringer [1968], Taylor and Bowers [1972], Couger and Zawacki [1980] Maidique and Hays [1984], Li and Shani [1991], this study.
IS Climate	4	Bailey and Pearson [1983], Li and Shani [1991].
IS Sophistication	2	Nolan [1973, 1979], Gibson and Nolan [1974], Cheney and Dickson [1982], Li, Rogers, and Chang [1994].
IS Quality	4	Ives, Olson, and Baroudi [1983]

Table 3. Reliability Coefficients of the Research Variables

Research Variable (N = 152)	No. of Items	Reliability Coefficient
Goals and Policies	4	0.835
Innovation and Adaptability	4	0.876
IS Climate	4	0.870
IS Quality	4	0.859

Table 4: Results of Structural Equations Analyses

Structural Model Statistics	
$\chi 2$	138.569 ($\chi^2_{\text{low group}}$=104.038;$\chi^2_{\text{high group}}$=154.261)
d.f.	100
GFI	0.902
CFI	0.971
TLI	0.966
RMSEA	0.051

Standardized Path Estimates

Path	All Participants	Low IS Sophistication	High IS Sophistication
Goals and Policies → IS Climate	0.177*	0.018	0.486*
Innovation → IS Climate	0.262	0.392	0.018
IS Climate → IS Quality	0.847***	0.863***	0.769***
Measurement Paths			
Goals and Policies → G1	0.685***	0.742***	0.522***
Goals and Policies → G2	0.820***	0.758***	0.872***
Goals and Policies → G3	0.739***	0.754***	0.770***
Goals and Policies → G4	0.769(fixed)	0.811(fixed)	0.689(fixed)
Innovativeness → IN1	0.824(fixed)	0.766(fixed)	0.841(fixed)
Innovativeness → IN2	0.771***	0.784***	0.806***
Innovativeness → IN3	0.802***	0.784***	0.742***
Innovativeness → IN4	0.802***	0.837***	0.713***
IS Climate → ISC1	0.847(fixed)	0.836(fixed)	0.747(fixed)
IS Climate → ISC2	0.705***	0.728***	0.667***
IS Climate → ISC3	0.876***	0.853***	0.847***
IS Climate → ISC4	0.752***	0.692***	0.873***
IS Quality → ISQ1	0.672(fixed)	0.612(fixed)	0.718(fixed)
IS Quality → ISQ2	0.817***	0.828***	0.762***
IS Quality → ISQ3	0.795***	0.827***	0.744***
IS Quality → ISQ4	0.841***	0.821***	0.819***
Squared Multiple Correlations for IS Climate	0.163	0.166	0.246
Squared Multiple Correlations for IS Quality	0.717	0.745	0.591

* p < .05; ** p < .01; ***p<.001
Note: N=152；Standardized path estimates are shown.

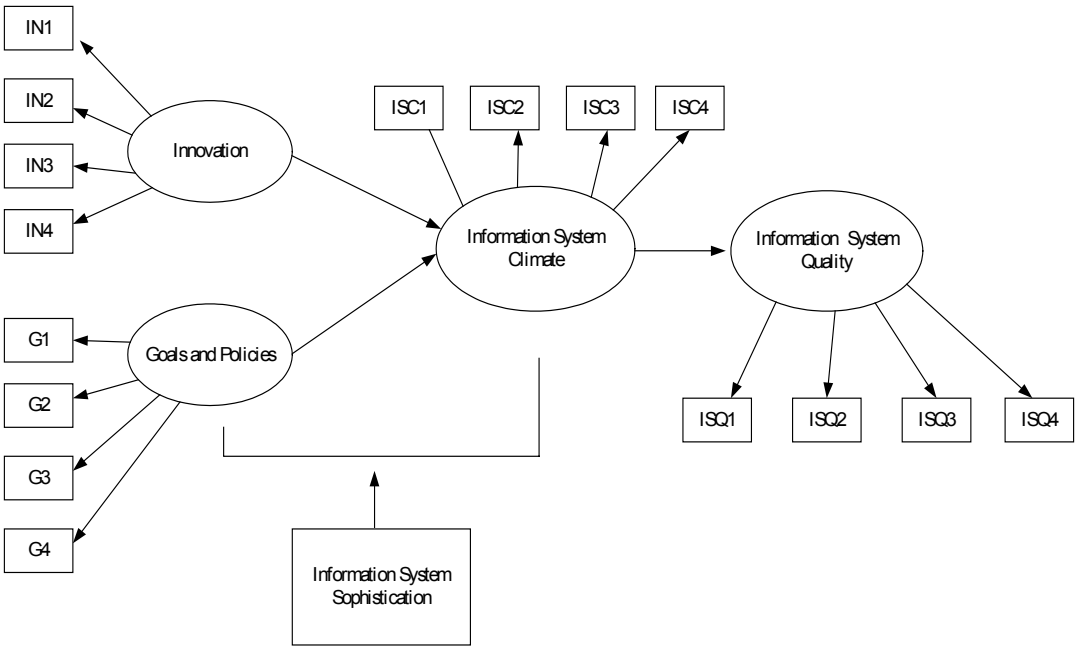

Figure 1. The Causal Relationship Between Organizational Characteristics and IS Quality

Appendix A: Items Used to Assess Organizational Goals and Policies

All items are rated on a seven-point scale from 1 (definitely disagree) to 7 (definitely agree).

Organizational Goals and Policies

G1. The mission and objectives of this company are reasonable.

G2. The mission and objectives of this company are clearly stated and well known by each employee.

G3. The procedures and policies of this company are clearly stated and well-known by each employee.

G4. In this company, the standards against which job performance is measured are reasonable and well established.

Appendix B: Items Used to Assess Organizational Goals and Policies

All items are rated on a seven-point scale from 1 (definitely disagree) to 7 (definitely agree).

Innovation and Adaptability

IN1. The company is generally quick to adopt improved work methods.

IN2. Innovation is highly encouraged in this company.

IN3. This company generally responds fast to technological changes.

IN4. This company is generally fast to adjust to new demands, conditions, or circumstances.

Appendix C: Items Used to Assess the IS Climate

All items are rated on a seven-point scale from 1 (definitely disagree) to 7 (definitely agree).

Information System Climate

ISC1. In this company, the manner and methods of interaction, conduct, and association between the user and the IS staff are adequate.

ISC2. The IS staff is willing and committed to subjugate external, professional goals in favor of organizational goals and tasks.

ISC3. The manner and methods of information exchange between the user and the IS staff are effective.

ISC4. The hierarchical relationship of the IS function to the overall organizational structure is adequate.

Appendix D: Scale of IS Organizational Sophistication

Organizational Sophistication refers to the planning, organizing, staffing, directing, and controlling activities associated with managing the computer and information resources in an organization. There are six general phases of organizational sophistication:

Phase I. ***Initiation*:** First computer acquisition. Lax management. Controls notably lacking. Priorities assigned by FIFO. Loose budget: IS expenditure tracks the rate of sales growth. User is "hands off" but aware of advantages of automation. IS organization is composed of technologists and operated as a "closed shop" with specialization for technology-learning.

Phase II. ***Expansion*:** Intense system expansion due to the early success during the initiation phase. More lax, sales-oriented management. Lax controls: few standards, informal project control. Loose budget: uncontrolled systems expenditure which exceeds the rate of sales growth. User is superficially enthusiastic. IS organization consists of user-oriented programmers supporting each functional area.

Phase III. ***Control*:** Proliferation of controls. Control-oriented management. Formal priority setting, programming standards, and project management. Systems quality control and post system audits. Formal IS budget planning and justification. Regard computer as a resource. Initiate company-wide steering committee and database standards. IS expenditure is less than the rate of sales growth. User is arbitrarily held accountable. IS organization is moved up to middle management level and assigned more responsibility.

Phase IV. ***Integration*:** Tailored planning and control systems. Formal data-base standards and policies. Establish computer utility and reliability. Focus on capacity planning and pricing of computer services for engendering effective use of the computer. Initiate database administrator and functional steering committee. Formation of information centers. IS expenditure exceeds the rate of sales growth. User is directly involved with data entry and data use and accountable for data quality and for value-added end use. IS organization focuses on data custodian and computer resource management.

Phase V. ***Repositioning*:** Effective planning and control systems. Organization-wide integration of applications and databases. Formal two-level steering committees and database administration function. End-user computing and shared data/common systems. Multiple 3-5 year plans for MIS budget. IS expenditure is less than the rate of sales growth. Effective value-added user chargeback system. IS organization focuses on data administration.

Phase VI. ***Maturity*:** Resource-oriented planning and control systems. Regard data as a resource. Strategic planning for data resource. Balance between centralized shared data/common system applications and decentralized user-controlled applications. Effective management of end-user computing and databases. Use of IS as a competitive weapon. IS expenditure tracks the rate of sales growth. Acceptance of joint user and IS staff accountability for data quality and for effective design of valued added applications. IS organization is moved up to top management level.

The activities that best characterize the organizational sophistication of your ***current*** IS are in:

(1) phase I.
(2) phase II.
(3) phase III.
(4) phase IV.
(5) phase V.
(6) phase VI.

Appendix E: Scale of IS Technological Sophistication

Technological sophistication refers to the levels of hardware and software technologies utilized in an organization. There are six general phases of technological sophistication:

Phase I. ***Faster data handling*:** labor-intensive and batch applications only: begin payroll, billing, accounting, scientific or mathematical computation, etc. Terminals for data entry only. Begin to support **operational management**. Decentralized IS resources with hardware, software, database, and personnel owned by a few functional areas.

Phase II. ***Creating new information*:** proliferation of systems. Mostly batch, individual **file processing**: begin order processing, report generators, cash flow, inventory control, personnel inventory, etc. Some remote job entry and on-line data entry. Begin to support **middle management**. Decentralized IS resources owned by each and every functional area.

Phase III. ***Support to operational control*:** Mainly batch processing: begin machine and transportation scheduling, statistical analysis, sales and cost analyses, document preparation, purchasing and material controls, etc. Some time-sharing **database processing**: on-line inquiry, data/order entry, order and freight tracking, etc. Centralized IS resources owned and managed by the IS department.

Phase IV. ***Support to management control*:** 50% batch processing. More on-line applications built around a centralized/integrated database. Easier access to data via data base management systems (DBMS) and 4th generation languages (4th GL's). Better timing of information. Significant increase in supporting **middle management**: master production scheduling, investment analysis, some simulation and manpower planning. Begin to support **top management**. IS resources are mostly centralized with some mini-, micro-, and personal computers distributed to each functional area.

Phase V. ***Administration of data*:** significant reduction of batch processing by replacing it with on-line database processing. Integrated databases and compatible systems. Distributed network and telecommunication systems. Flexible interactive data retrieval and application prototyping with a full-scale data base management system. Increasing use of decision models and decision support systems (DSS). Distributed IS resources with proliferation of mini-/micro-/personal computers or workstations as well as end-user's development of databases and application systems.

Phase VI. ***Support to strategic planning*:** mostly on-line database processing. 10% batch processing. Application integration "mirroring" information flows. Extensive use of decision models and data bases through DBMS, 4th GL's, DSS, and expert systems. Integrated electronic office and teleconference environment. Extensive use of on-line external database services. More support for **middle** and **top management** than for **operational management**. Balance of centralized and decentralized IS resources with more small computers and end-user computing.

The activities that best characterize the technological sophistication of your ***current*** IS are in:

(1) phase I.
(2) phase II.
(3) phase III.
(4) phase IV.
(5) phase V.
(6) phase VI

Appendix F: Questions Relating to IS Quality

IS support may be judged on two criteria: efficiency and effectiveness. ***Efficiency*** deals with how well they do what they do. Are reports on time? Are projects developed within budget? ***Effectiveness*** takes a broader focus. Are they doing the right things? Are critical ***life-blood*** applications being developed? Are new computer technologies being successfully integrated into the organization? From another perspective, ***efficiency*** refers to the ability of the IS to help the users in obtaining the greatest possible return from the resources consumed while ***effectiveness*** refers to the ability of the IS to help the users in identifying what should be done to better resolve problems.

Information System Quality

ISQ1. How *efficient* do you feel the *current* IS support is?

Very Efficient 7 6 5 4 3 2 1 Very Inefficient

ISQ2. How *effective* do you feel the *current* IS support is?

Very Effective 7 6 5 4 3 2 1 Very Ineffective

ISQ3. How adequately do you feel the *current* IS support meets the information processing needs of the computer users in your own area?

Very Adequately 7 6 5 4 3 2 1 Very Inadequately

ISQ4. How adequately do you feel the *current* IS support meets the information needs of the broader class of users they serve?

Very Adequately 7 6 5 4 3 2 1 Very Inadequately