

Research Paper ■

Organizational Factors that Influence Information Technology Diffusion in Academic Health Sciences Centers

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Abstract **Objective:** To identify the organizational factors which influence the diffusion of end user online literature searching, the computer-based patient record, and electronic mail systems in academic health sciences centers in the United States.

Design: A total of 1335 individuals working in informatics and library areas at 67 academic health sciences centers in the U.S. were surveyed. Multivariate techniques were used to evaluate the relationship between the set of six organizational factors and two measures of innovation diffusion.

Measurements: A Guttman-like scale was developed to measure infusion, or depth or sophistication, of each of the three innovations at each institution. Diffusion was measured by a question previously developed for another study. Six independent variables were measured via five formerly developed scales and one new one.

Results: The overall response rate was 41%. The set of organizational variables produced significant results in the diffusion of each of the three innovations, with individual variables influencing diffusion to varying degrees. The same set produced significant results in relation to infusion only for online searching. There was little or no correlation between infusion and diffusion for each innovation.

Conclusion: Organizational attributes are important predictors for diffusion of information technology innovations. Individual variables differ in their effect on each innovation. The set of attributes seems less able to predict infusion. It is recommended that both infusion and diffusion be measured in future studies because there is little relation between them. It is further recommended that individuals charged with implementing information technology in the health sciences receive training in managing organizational issues.

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The implementation of information technology systems in the health care arena holds great promise for improving efficiency but can also result, according to Anderson et al., in “unforeseen costs and organizational consequences and even failure.”¹ Implementa-

tion needs to be done wisely, with attention paid to organizational as well as technologic issues. Rosabeth Moss Kanter has stated this more dramatically: “‘Let a thousand flowers bloom.’ This slogan, designed to awaken an entire nation to new ideas, offers an apt

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metaphor for innovation. Innovations, like flowers, start from tiny seeds and have to be nurtured carefully until they blossom; then their essence has to be carried elsewhere for the flowers to spread. And some conditions—soil, climate, fertilizer, the layout of the garden—produce larger and more abundant flowers.² The slogan was actually, “Let a hundred flowers blossom”; it marked the beginning of the Hundred Flowers Campaign in China in 1956.³ The purpose of the present study is to identify what organizational attributes influence the diffusion of information technology innovations at academic health sciences centers, and so Kanter’s metaphor is appropriate. In other words, what particular soil and climate conditions are needed to nurture a glorious blossoming?

Background

Theory and Selection of the Variables

Two overarching theories provide the framework for this study. First, classic Diffusion of Innovations (DOI) theory, which began to be developed in the 1930s, was defined by Everett Rogers, who published his classic volume on the subject in the 1960s, as “the process by which an innovation is communicated through certain channels over time among the members of a social system” and an innovation is defined as “an idea, practice, or objective perceived as new by an individual, a group, or an organization.”⁴ The time element includes the stages of knowledge, persuasion, decision, implementation, and confirmation as individuals adopt the innovation. Rogers described these stages at the individual level; recent research in the hospital environment has confirmed similar stages at the organizational level.⁵ The present study examines the implementation stage at the organizational level.

The body of literature on the diffusion of information technology innovations is expanding rapidly; it offers a level of detail and insight missing in previous DOI studies but building on them. With information technology, it is no longer a matter of an individual or an organizational representative making an adoption decision. Rather, the organization can make a decision, but it may be up to individuals within the organization to make independent decisions about adoption and usage. For some innovations, such as electronic mail, it takes a critical mass of users within the organization to make the innovation succeed.⁶ There is also evidence that the more integrated an application, the more complex the innovation and the harder it is to implement swiftly.⁷ In addition, information technology is characterized by reconfiguring itself so that over time the old and new forms may coexist with loosely coupled links among them.⁸

In 1966, Coleman et al. published a landmark DOI study in the health sciences; it reported results of a project evaluating the introduction of a new drug.⁹ They found that physicians adopted the drug after receiving information through commercial channels and validation through professional channels. The importance of social networks in adoption behavior in health care has been validated consistently since then.¹⁰ In particular, the presence of “champions” is important. These are people who “emerge to take creative ideas (which they may or may not have generated) and bring them to life.”¹¹ They make a decisive contribution to the innovation process by actively and enthusiastically promoting the innovation, building support, overcoming resistance, and ensuring that the innovation is implemented. Few empirical DOI studies have looked at champions, but the one study of information technology that included them found them to be a significant influence.¹² The present study includes a measure of champions as an independent variable.

A number of related organizational behavior theories offer insight into diffusion of information technology innovations as well. Once a system has been adopted at an organizational level, what does it take to convince potential individual users to adopt it? The reward system within the organization could conceivably encourage or discourage usage. Expectancy theory leads to this belief. Expectancy theory argues that “the strength of a tendency to act in a certain way depends on the strength of an expectation that the act will be followed by a given outcome and on the attractiveness of that outcome to the individual.”¹³ An individual considers whether or not performance will be recognized and rewarded and if potential rewards are those that are desirable to that person. In information technology, the kinds of rewards that are most valued are not necessarily monetary. They include “professional rewards associated with the work itself, the career development process, and the organizational process employed.”¹⁴ Rewards are included as an independent variable in this study and are defined as the degree to which the reward structure is attractive to employees, how it is controlled, and what the rewards are contingent upon.

Another likely reason for adopting an innovation is that the communication channels within the organization promote the kind of social network shown to be useful in health organizations. Potential users must clearly see the need for change if they are to support change. Communication that promotes discussion within the organization and that brings in knowledge and information from outside the organization leads to greater diffusion.^{15–17} Communication is measured

in the present study and is defined as the amount of interaction taking place within and among levels of employees within an organization and with colleagues outside the organization. Organization theory suggests that a number of factors are related to the effectiveness of communication in a broad range of organizations, including top level commitment to communication, commitment to two-way communication shaping the message for the audience, and communication as an ongoing process.¹⁸

Current theory related to organizations that are capable of responding to the need for change also points to the importance of decentralized decision making and top-level support for innovative thinking. Both the decision process and top management commitment have been linked to an innovation's success or failure¹⁹ and are measured in the present study. Decision making is defined as the selection of and consultation with appropriate decision makers, including those affected by the decision. The one DOI study of information technology that measured management support found it significantly related to diffusion.²⁰ Support is defined for the purpose of the present study as the extent to which employees feel they are supported in their pursuit of new ideas. Numerous DOI studies have shown that slack resources assist the adoption of innovation. For example, a hospital study concluded that technologic innovations are more frequent when resources are abundant.²¹ Top-level commitment means more than providing resources, however. It also implies a champion role, innovative leadership, and an organizational culture that values innovation.

Organizational change theory would suggest that readiness for change can assist the process. Planned change is purposeful and proactive, seeking to help the organization change in a timely way and adopt to changes in its environment. Zaltman et al. claim that during the implementation stage of innovation diffusion, an organizational structure that promotes control and careful project management is best.²² This implies that planning plays a role in successful diffusion. A measure of planning emphasis is included in the present study. It is defined as the extent to which appropriate project planning techniques are used prior to implementing an innovation.

The Innovations

Three information technology innovations were selected for this study in consultation with a panel of experts. Criteria for inclusion were that the innovations be: extensive (potentially campus wide); important (hold real promise for instigating major change); established enough to guarantee their future presence

in health care; and different enough to provide variety. Those chosen were end user online literature searching, the computer-based patient record (CPR), and electronic mail. All represent technology clusters that can exist at varying levels of sophistication.

End user online literature searching is defined here as computerized searching of bibliographic databases by the individuals who will use the information. The definition of electronic mail is simplified to mean a method of communication by means of computer, whereby a sender types a message and sends it to another computer user. The CPR is defined as "an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids."²³ It has been stated that no complete CPR is yet available, but a few systems approach the CPR system capabilities. Nearly all of the clinical information systems that might qualify as CPR systems have been developed at strong academic medical centers.

Measuring Diffusion

Innovation diffusion has been measured in so many different ways that Fichman has recently proposed a typology into which previously used measures seem to fit. These are: time of adoption, dichotomous adoption (has it been adopted or not?), aggregated adoption (how many on a list have been adopted?), extent of diffusion, level of infusion, and stage of assimilation (which stage of diffusion was reached at a particular time?).²⁴ The first three are more traditional measures, while the last three are newer, richer, and better suited to information technology studies.

Extent of diffusion differs from the classic definition of diffusion because it measures diffusion within an organization, the extent to which use spreads across the people in an organization. It is especially useful when implementation occurs gradually on a person-by-person basis. It can be considered a breadth measure. Infusion looks at comprehensiveness or sophistication of use of an innovation. It has been defined as "the extent to which the full potential of the innovation has been embedded within an organization's operational or managerial work systems."²⁵ It is the one measure of depth related to diffusion.

Research Questions

This study was undertaken to answer the following questions:

1. To what extent do communication, participative decision making, top-management support, plan-

ning, the existence of champions, and reward systems affect internal diffusion of each of the three innovations?

2. To what extent do communication, participative decision making, top-management support, planning, the existence of champions, and reward systems affect infusion of each of the three innovations?

Methods

Survey

A random sample of 67 academic health sciences centers with accredited medical schools was selected, followed by a proportional random sample of 629 individuals working in informatics (members of the American Medical Informatics Association (AMIA) affiliated with these institutions) and 706 library staff members from the 67 institutions. These two types of professionals were selected because they were likely to be the most knowledgeable about the depth and breadth of diffusion of the three innovations. In addition, they perform boundary-spanning roles between information technology and end users. Their perceptions about information technology are more likely to be influenced by a university-wide view rather than by a narrower departmental view, as might be the case with other faculty. A written survey was sent to each selected individual, with electronic mail or post card follow-up.

Respondents

The response rate for informatics professionals was 31%; for library workers it was 48%; the overall response rate was 41%. Sixty-five institutions were represented. Electronic mail proved to be an excellent follow-up mechanism. It improved the original response rate for library staff by half again and the informatics response by three quarters. Analysis of variance tests on professional group by institution indicated that the two groups did not differ significantly in their responses on all variables except for diffusion of the CPR. To further investigate distributions within schools, responses on all variables were plotted, and within school agreement was excellent. Responses were therefore averaged and analyzed at the institutional level.

Measures

Questions included in the survey were designed to measure perceptions of individuals within an organization about the organization. Internal diffusion, the first of the dependent variables, was measured for each separate innovation using a scale developed by

Zmud.²⁶ The infusion measure was based on that developed by Zmud and Apple²⁷ using a Guttman-like scale for ascending development of a technology innovation. Three questions were developed specifically for each of the three innovations in the present study, with experts in informatics, information technology, and information services guiding selection of the levels. The questions are given in the appendix.

Five of the six independent variables were measured using previously developed scales, modified to fit a five-point Likert scale and to reflect appropriate terminology. Scales to measure the organizational theory concepts of communication, participative decision-making, management support, planning, and rewards were all located in reports of prior studies. The communication frequency scale was a modification based on a section of the Minnesota Innovation Survey.²⁸ Questions ask how often the respondent has communicated in the past 6 months with individuals in five different groups. The index for participative decision-making practices was modified from that in the *Survey of Organizations*.²⁹ The scale consists of four questions about how decisions are made within the organization. The questions concerning management support for innovation have been taken from the Siegel Scale of Support for Innovation (SSSI).³⁰ One new question about financial support for innovation was added. The six other questions in the scale concern support for creativity within the organization. Planning emphasis questions are from a study of information technology innovation.³¹ The four questions are about the organizational planning process prior to implementation of the innovation. The scale concerning effectiveness of the reward structure has been modified from the Test of an Effective Reward System developed by von Glinow for high-technology personnel at all levels.³² The scale includes ten questions about promotion, rewards and punishments for actions, and appropriateness of rewards. Despite its importance in DOI theory, the existence of champions has only been measured previously as a yes/no question. Because no previous scale of questions using a Likert scale measuring the existence of champions was located, three new questions were developed to measure the degree to which faculty, information professionals, and administrators championed the innovation.

Variability among institutions for each of the dependent variables was checked to ensure that enough existed for statistical purposes (Table 1). Good variability was verified for both the CPR and online searching in that the standard deviations and minimum and maximum reported levels indicated a spread. For electronic mail infusion, there was less of a spread, with

Table 1 ■

Distribution of Variables

Variables	Mean	SD	Min	Max
Dependent (1–4 scale, low to high)				
Online Infusion	3.73	.39	2.40	4.00
Online Diffusion	2.27	.42	1.00	3.00
CPR Infusion	2.22	.76	1.00	4.00
CPR Diffusion	2.72	.85	1.00	4.00
E Mail Infusion	3.70	.27	3.00	4.00
E Mail Diffusion	2.91	.60	1.00	4.00
Independent (1–5 scale, low to high)				
Communication	3.74	.37	2.60	4.60
Decision Making	3.48	.55	2.50	5.00
Support	3.24	.49	2.21	4.43
Planning	3.27	.38	2.40	4.50
Rewards	2.56	.42	1.70	3.90
Online Champions	3.76	.56	2.28	5.00
CPR Champions	3.47	.89	1.00	5.00
E Mail Champions	4.07	.36	3.08	5.00

Table 2 ■

Cronbach’s Coefficient Alpha

Variable	Alpha
Communication (C)	.70
Decision Making (D)	.76
Support (S)	.90
Planning (P)	.58
Rewards (RE)	.90
Online Champions (CHo)	.75
CPR Champions (CHc)	.85
E Mail Champions (CHE)	.43

Table 3 ■

Correlation Coefficients

Variables	INo	Do	INc	Dc	INe	De	C	DM	S	P	RE	CHo	CHc	CHE
Dependent														
Online Infusion (INo)	1.00													
Online Diffusion (Do)	.13	1.00												
CPR Infusion (INc)	-.03	-.04	1.00											
CPR Diffusion (Dc)	-.15	.01	-.01	1.00										
E Mail Infusion (INe)	.38	.15	.27	-.03	1.00									
E Mail Diffusion (De)	.39	.31	-.01	-.02	.39	1.00								
Independent														
Communication (C)	.26	-.38	-.06	.24	.31	.07	1.00							
Decision Making (D)	.00	-.20	.08	.22	.15	.19	.20	1.00						
Support (S)	.03	-.26	.08	.04	.12	.05	.41	.70	1.00					
Planning (P)	-.01	-.16	.22	-.26	.25	.04	.15	.40	.42	1.00				
Rewards (Re)	.21	-.20	.19	.04	.11	-.01	.39	.31	.52	.48	1.00			
Online Champions (CHo)	.30	.05	.12	-.08	.19	.09	.20	.08	.30	.15	.21	1.00		
CPR Champions (CHc)	-.13	-.29	.29		.14	.09	.07	.25	.15	.42	.11	.24	1.00	
E Mail Champions (CHE)	.19	.00	.14	-.03	.13	.32	.21	.07	.21	.11	.25	.23	.16	1.00

the minimum level 3 and the maximum 4, which could cause fewer significant independent variables in a regression than might occur with more deviation in the dependent variable.

All scales for independent variables were checked for internal consistency using Cronbach’s coefficient alpha; results are shown in Table 2. All except for electronic mail champions (Che) are within an acceptable range.

A series of six regression models, one using internal diffusion and another using infusion as dependent variables for each of the three innovations, formed the basis of this investigation.

Results

Descriptive Analysis

Table 1 provides the mean, standard deviation, and minimum and maximum average for any institution for the independent as well as the dependent variables. The infusion and diffusion measures were on a scale from 1 to 4, with 1 the lowest level of sophistication or usage and 4 the highest.

Pearson’s correlation coefficients, shown in Table 3, indicated low and sometimes nearly nonexistent correlations between infusion and diffusion measures for each innovation. Pearson’s correlation coefficients are also given for relations between each of the six independent variables for each innovation. In past diffusion studies, .82 has been considered high,³³ and .47 was considered low.³⁴ In the present study, all alphas were acceptably low with the exception of that be-

Diffusion

Online End User Literature Searching		
Variable	beta	p
Communication	-.29	.05
Decision Making	.04	.82
Support	-.33	.10
Champions	.18	.18
Rewards	.05	.73
R sq. = .18*		
Adjusted R sq. = .10		
Set is significant at p<.05		

Computer-Based Patient Record		
Variable	beta	p
Communication*	.39	.04
Decision Making*	.61	.01
Support	-.32	.17
Champions	.03	.81
Planning*	-.54	.01
R sq. = .28*		
Adjusted R sq. = .20		
Set is significant at p<.05		

Electronic Mail		
Variable	beta	p
Communication*	-.30	.04
Decision Making	.16	.40
Support	-.13	.51
Champions*	.34	.01
Rewards	.19	.20
R sq. = .20*		
Adjusted R sq. = .13		
Set is significant at p<.05		

Infusion

Online End User Literature Searching		
Variable	beta	p
Communication*	.28	.04
Decision Making	.19	.29
Support*	-.48	.02
Champions*	.26	.04
Rewards*	.31	.03
R sq. = .20*		
Adjusted R sq. = .13		
Set is significant at p<.05		

Computer-Based Patient Record		
Variable	beta	p
Communication	-.27	.11
Decision Making	.01	.98
Support	.00	.99
Champions	.20	.13
Rewards	.34	.05
R sq. = .17		
Adjusted R sq. = .07		
Set is not significant at p<.05		

Electronic Mail		
Variable	beta	p
Communication	.26	.08
Decision Making	.08	.69
Support	-.15	.49
Champions	-.09	.52
Rewards	.22	.16
R sq. = .08		
Adjusted R sq. = .00		
Set is not significant at p<.05		

Figure 1 Results of the six regressions completed to answer infusion and internal diffusion questions.

tween top level support (S) and decision making (DM) at .70. That between top level support (S) and rewards (RE) is somewhat high at .52.

Research Questions

Figure 1 indicates results of the six regressions that were completed to answer both the infusion and internal diffusion questions. Results for online searching diffusion are shown in the upper left. Because the alpha for the planning scale was relatively low, and because the N, representing 65 institutions and not the 541 individual respondents, is not large enough to give adequate power to a regression model of more than five independent variables, planning was not included in the analysis. Using a whole-model F test, the set was significant, but no individual variables were significant at $p < .05$, although communication was significant at $p = .05$.

CPR diffusion results, in the upper middle of the table, are quite different. Without the planning variable, the F test on the set of independent variables was not significant in relation to diffusion of the CPR and is not reported in the table. Interestingly, rewards contributed the least toward explaining the diffusion measure. When planning was entered into the model for exploratory purposes (fully recognizing that because the alpha for the planning scale was low, the results may be suspect), the set became significant, and three variables contributed significantly to explaining the variance in diffusion: communication, decision making, and planning were all significant. Planning, however, had a negative influence on diffusion, as indicated by the negative beta.

The F test on the set of variables for electronic mail diffusion was significant. Two of the variables, champions and communication, were significant at $p < .05$. Communication had a negative beta, though. It should be noted that electronic mail champions had a relatively low alpha (.43), indicating a low level of consistency in the scale.

The second question was about infusion. Results for online searching infusion are on the bottom left in Figure 1. The F test on the set of variables for infusion of online searching was significant. Communication, support, champions, and rewards were all individually significant, although support had a negative relation with infusion.

The F test on the set of variables was not significant at $p < .05$ for either the CPR or electronic mail.

Discussion

The overall averages for infusion and diffusion of each innovation, indicated in Table 1, reflect a nationwide trend. For online searching infusion, the mean was a good deal higher than for diffusion, indicating that sophisticated systems exist but are not widely used. The relatively low infusion mean for the CPR indicates that the Institute of Medicine statement about present systems not being fully developed is valid. Electronic mail rates quite high on both infusion and diffusion.

The first question related to diffusion. F tests on the set of organizational variables were significant for diffusion of all innovations, although no individual var-

ables were significant for online searching. For the CPR, the set was modified to include planning rather than rewards. The fact that planning was negatively related to diffusion is intriguing. It may be that attention to planning slows down the process and therefore slows diffusion of the CPR. Communication and participative decision making were significant as well. Organizational behavior research has shown that when potential users are included in making decisions, they accept those decisions more readily.³⁵ There is also evidence in the organizational literature that accurate and timely communication assists in acceptance.³⁶ It was interesting that the champions variable was not significant, but it helped to make the set and the other variables significant.

For electronic mail, communication was significant as well. However, it bore a negative relationship to diffusion, indicated by a negative beta. One other study found such a negative relation; the author of that study found that, though a great deal of communication took place, it was not as trustworthy, because it fostered expectations that could not be met.³⁷ In the case of electronic mail diffusion, the champions variable was significant. Considering the high average level of diffusion of electronic mail at all 65 institutions, this finding is important.

The second question was about infusion. Only online searching infusion was significant. Apparently, organizational variables are not as important for infusion as for diffusion of information technology. With online searching, communication, support, champions, and rewards were all significant. Communication here bore a positive relation to infusion, but support had a negative relationship. That top-level moral and resource support would be negatively associated with infusion is puzzling. Perhaps it means that infusion levels for this innovation improve despite top-level management actions.

The existence of champions as a factor in infusion, meaning the level of sophistication of searching, is somewhat surprising. The questions asked about faculty, information professionals, and administrators who encouraged usage, but the champions variable was not significant for diffusion (which might be expected), only for infusion. Finally, this is the one regression model that found rewards to be significant. Perhaps there is a relation between using online searching and the research and publication that might be impacted by it that will lead to promotion, tenure, and intangible rewards.

Limitations of this study included length of the survey, representativeness of the sample, generalizability, and determination of causality. The number of ques-

tions in the survey instrument had to be restricted, so questions could not always be asked in relation to each of the three innovations. The only independent variable studied for each innovation was the champions variable. The representativeness of the sample may be problematic in that most likely only people with a special interest in the topic or sufficient time returned their surveys. While the response rate of 41% is respectable for a diffusion survey, a higher rate would be more convincing for validity purposes. In addition, characteristics of non-respondents are unknown. Generalizability for the population represented by the sample cannot be assumed, because informatics professionals pre-selected themselves by joining AMIA, and they were not randomly selected. Also, generalizability to other innovations should not be assumed, especially since this study found such differences among the three innovations. Finally, this study was intended to determine relationships but not causality.

Implications and Conclusions

Organizational attributes are important predictors for the spread of usage of information technology innovations within academic health sciences centers. Individual variables differ in their effect on each innovation, however. The set of attributes seems less able to predict infusion, or level of sophistication, of the innovations. Only the infusion of online end user literature searching could be explained to a significant degree by these variables.

Infusion and diffusion are decidedly different and bear little or no relation to one another. It is recommended that both infusion and internal diffusion be measured in future diffusion studies because only together can they tell the whole story.

Implications for managers include the awareness that accurate, timely communication, a reward structure that applies principles of expectancy theory, participative decision making, and the nurturing of champions are needed if information technology innovations are to be successfully diffused. Not only does attention need to focus on implementing the technology side of the innovation, but success calls for a focus on the organizational side as well.

The results of this study also have implications for the education of health care professionals, such as those in informatics, library managers, and information technology specialists. All professionals who are involved in implementing information technology innovations need to be taught contemporary management methods for humanizing the workplace in light of technology.

To conclude with further reference to the “thousand flowers” analogy suggested by Kanter, it would appear that, like the blossoming of flowers in a garden, diffusion of information technology innovations depends on some standard baseline conditions. However, individual varieties of flowers, or innovations, also depend on certain special conditions. Blossoming is encouraged and cultivated when conditions that are most favorable are recognized and effectively managed.

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APPENDIX

*Organizational Attributes Survey Questions***A. Infusion Questions**

Please **circle one number** to the left of the statement which best describes your institution's level of implementation of on-line searching:

1. Does not offer it.
2. In-library access to a single user CD-ROM-based MEDLINE database or Grateful Med searching via modem on library machines.
3. Multi-user access over a network, but not extending to the entire health sciences center and hospital.
4. Health sciences center-wide access to numerous services, including full MEDLINE.

Please **circle one number** to the left of the statement which best describes your institution's level of implementation of the CPR:

1. No CPR modules have been implemented to date.
2. Some departmental clinical information systems (lab, radiology, pharmacy, nursing) with some use by individuals outside the department are in place. An example is a laboratory information system that has a physician query terminal on the wards. [A billing or hospital information system not used by physicians or other care providers is prior to this level and does not count.]
3. A system that captures and stores significant data about the clinical encounter itself. Examples are diagnosis/problem lists, medication lists, and symptoms and signs. Also at the medium level is an organization that has an institution-wide network with access to one or two departmental systems.
4. An integrated repository of information from a wide variety of departmental and clinical systems. It includes decision support systems for clinicians and forms a foundation for a) the eventual electronic medical record and b) a network with workstation access to a wide variety of departmental and clinical systems.

Please **circle one number** which best describes your institution's level of implementation of electronic mail:

1. No campus electronic mail.
2. Electronic mail exists on campus, but there are no connections outside the institution and there is fragmentation within.
3. Connected to the Internet but fragmented internal electronic mail so not everyone has access or no Internet connection but a unified electronic mail system is accessible by everyone.
4. Internet connection plus unified internal electronic mail access.

B. Diffusion Question (asked in relation to each of the three innovations)

If your institution provides online searching/any modules of the CPR/electronic mail, please **circle one number** to the left of the most appropriate statement:

1. Fewer than 25% of people in the health sciences center regularly use it.
2. Between 26% and 50% of people in the health sciences center regularly use it.
3. Between 51% and 75% of people in the health sciences center regularly use it.
4. Over 75% of people in the health sciences center regularly use it.

C. Champion Questions (asked in relation to each of the three innovations, answered on a 5-point scale)

There were some faculty members who really encouraged their colleagues to use online searching/the CPR/electronic mail.

There were some information professionals who really encouraged users to use online searching/the CPR/electronic mail.

There were some campus administrators who really encouraged departments to use online searching/the CPR/electronic mail.

D. Communication Questions

During the past six months, how frequently have you personally communicated on work-related matters with the following people. **PLEASE CIRCLE ONE NUMBER to the right of each statement where 1 = no contact, 2 = monthly or less, 3 = about weekly, 4 = about daily, and 5 = more than once a day**

Other individuals in your department

Individuals in other departments

Managers at higher levels in my organization

People seeking help in using information; clients

Colleagues in other organizations

E. Decision Making Questions (answered on a 5-point scale)

In this organization, decisions are made at those levels where the most adequate and accurate information is available.

When decisions are being made, the people affected are asked for their ideas.

People at all levels in our organization usually have know-how that could be of use to other decision-makers.

Information is widely shared in this organization so that those who make decisions have access to all available know-how.

F. Support Questions (answered on a 5-point scale)

Our ability to function creatively is respected by the leadership.

The role of the leader in this organization can best be described as supportive.

The leadership acts as if we are not very creative.

Assistance in developing new ideas is readily available.

People in this organization are encouraged to develop their own interests, even when they deviate from those of the organization.

Individual independence is encouraged in this organization.

The leadership will usually come up with some financial support if we need it to try out a new idea.

G. Planning Questions (answered on a 5-point scale)

Predicting the way a system will fit into our work procedures is usually too complex to assess in advance of implementation.

When we start implementing a system we have a clear-cut plan to guide us.

Rather than worrying about setting priorities, we deal with each problem as it comes up.

The process of deciding to acquire any system includes a formal justification, such as a return on investment, payback, or cost-benefit analysis.

H. Rewards Questions (answered on a 5-point scale)

Our promotion system is flexible enough to allow rewards for involvement in information technology projects.

Attractive rewards are available to organization members.

Important rewards are performance-related.

Rewards are distributed in a timely manner after performance occurs.

The performance appraisal system is clearly understood by organization members.

Desired activities are really rewarded in this organization.

Undesired activities are really punished in this organization.

The right managers control the important rewards desired by their subordinates in this organization.

The distribution of rewards truly reflects differences in employee performance.

The goal-setting, appraisal, feedback, and rewards systems are integrated in this organization.