
A Test of Rogers' Optional Adoption Decision Model in an Organizational Setting

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ABSTRACT

Two activities will dominate information systems department activities in the 1990s: assessing information technology innovations and facilitating the diffusion of technologies into organizations. Recently, researchers have suggested that diffusion theory may improve our understanding of the adoption process. This paper examines the validity of Rogers' optional adoption decision model of diffusion.

INTRODUCTION

Often successful implementation of information technologies (IT) depends on the adoption decisions of individual organizational members. This is especially true of knowledge workers who often adopt IT without the intervention, or even knowledge, of management. Whether technology is authorized by a formal authority or spontaneously adopted, managers must manage its introduction.

A recent survey reveals the importance of managing this process. Information system (IS) executives and general managers listed "facilitation of organizational learning and use of information technology" and "facilitation of management of end-user computing" among the most critical issues they expect to face [2]. Zmud [10] proposed that two activities will dominate IS department activities in the 1990s: recognizing and assessing information technology innovations and facilitating the diffusion of technologies into an organization. Despite much effort, researchers know little about why organizational members adopt some technologies and not others [2][6]. Recently, researchers have suggested that diffusion theory may improve our understanding of the adoption process [3][6].

Based on over 3,000 studies, Rogers [9] developed several diffusion process models. Central to this paper is his optional adoption decision model [9]. It describes the adoption decision of people who are free to adopt or reject an innovation. The optional adoption decision model includes five stages—knowledge, persuasion, decision, implementa-

tion, and confirmation. In the knowledge stage a person becomes aware of an innovation. In the persuasion stage the person actively seeks information about the innovation and forms an initial impression. In the decision stage a person either adopts or rejects the innovation. In the implementation and confirmation stages a person uses the innovation and seeks confirming data. The model also proposes how communication channels, information sources, and innovation attributes affect the decision process for early and late adopters.

People seek or receive information about the technology from two different communication channels. Rogers proposes that mass-media channels are more effective than interpersonal channels in communicating awareness during the knowledge stage. Interpersonal channels are more effective in the persuasion stage because they allow for feedback. In addition, mass-media channels are more important at all stages for earlier adopters and interpersonal channels more important for later adopters.

People seek or receive information about the technology from either local or cosmopolitan sources. Rogers argues that cosmopolitan sources are important at the knowledge stage while local sources are more important at the persuasion stage. Also, cosmopolitan sources are more important at all stages for earlier adopters and local sources are more important for later adopters.

Rogers proposes that the outcome of the adoption decision can be explained, in part, by members' perceptions

of five innovation attributes [9].

1. *Relative advantage* is the degree to which an innovation is perceived as being better than the idea it supersedes [9, pp.213].

2. *Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters [8, pp. 223].

3. *Complexity* is the degree to which an innovation is perceived as relatively difficult to understand and use [9, pp.230].

4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis [9, pp.231].

5. *Observability* is the degree to which the results of an innovation are visible to others [9, pp.232].

Two previous studies examined Rogers' optional decision model and established the validity of the five stages [3][5]. This paper examines the impact of adopter class (early, late, and non-adopter), communication channels (mass-media and interpersonal), information sources (local and cosmopolitan), and innovation attributes on implementing an information technology within an organization.

METHOD

We selected a simple random sample of 53 faculty from the colleges of business and law (combined faculty of 200). The sample included 34 adopters and 19 non-adopters. Non-adopters were faculty who had considered but then rejected the innovation. We selected the colleges of business and law because both had adopted the innovation and were now providing institutional support for it. However individual faculty were free to adopt or reject the innovation.

The innovation was Wordperfect 5.1 which included 51 improvements over previous versions. These included an equation editor, a table creation feature, enhanced printer support, pull-down menus, and support for a mouse. The previous upgrade of Wordperfect, version 5.0, had not been well received by many in the subject population because they felt it offered little advantage over the previous version but was more complex.

We collected data through interviews and questionnaires. The questionnaire elicited data regarding the importance of communication channels and information sources during the knowledge and persuasion stages. It also included an evaluation of WordPerfect 5.1 derived from a questionnaire developed by Moore and Benbasat [8]. It included eight attributes—Rogers' original five and three developed by Moore and Benbasat—image, results demonstrability, and voluntariness of the adoption decision.

RESULTS

This section reports the results on the impacts of com-

munication channels, information sources, and innovation attributes on the technology adoption decision process.

Innovativeness of Wordperfect 5.1

A significant question regarding this study is whether Wordperfect 5.1 constitutes an innovation in the subjects' minds. Rogers' defines an innovation as an idea which is new to a person. An idea is new if the person has not learned enough about the idea to have formed an opinion about it. For those subjects who had not previously used a version of Wordperfect, version 5.1 would likely be new enough to be considered an innovation. The question is whether version 5.1 was new enough to previous users of Wordperfect to be considered an innovation. If someone regards the upgrade decision as automatic and the new version as a known quantity then it could not be considered an innovation.

An indication that this was not the case would be if previous users considered the decision important enough to investigate Wordperfect 5.1 before adopting. Active information seeking occurs during the persuasion stage of the decision model. To determine how many users passed through the persuasion stage, lists of activities the subjects engaged in regarding Wordperfect 5.1 were compiled from the interviews. Three judges then classified each of the activities into the five stages in the adoption decision model. A subject was considered to have passed through a stage if one or more activities were classified into that stage for that subject. A more detailed description of this analysis is available in Hightower [5].

Of the 23 people who had used previous versions of Wordperfect, only five did not pass through the persuasion stage. Three of these said that they automatically upgrade when new versions are released. The other two received the new version from the college unrequested.

The remaining 18 felt a need to evaluate the new version before deciding whether to adopt. One concern among previous users was whether the new version would be more difficult to use. As one subject put it:

...I knew there were some features that it would have but the first thing I checked is to see if they were going to complicate my life.

Others were looking for solutions to what they felt were deficiencies in previous versions:

We had a concern. We do a lot of stuff with math symbols and equations and using 5.0 with equations was a real problem. We were looking at alternative programs ... and we found out that 5.1 ... had math capabilities.

So for most of the previous users, the adoption of version 5.1 was significant enough that they actively sought

information prior to making their adoption decision. That would indicate these subjects did not take the decision lightly and considered version 5.1 new enough that they needed additional information to form an opinion about it.

Use of Communication Channel

The study evaluated the following communication channel hypotheses.

1. Mass-media channels should be more important than interpersonal channels in the knowledge stage for all potential adopters.
2. Interpersonal channels should be more important than mass-media channels in the persuasion stage for all potential adopters.
3. Only early adopters will consider mass-media channels as more important than interpersonal channels in both the knowledge and persuasion stages.

On the questionnaire, all subjects rated the importance of communication channels in the knowledge and persuasion stages along two five point Likert scales. The dependent variable was the ratio of the mass-media channel to the interpersonal channel Likert scores. The first two hypoth-

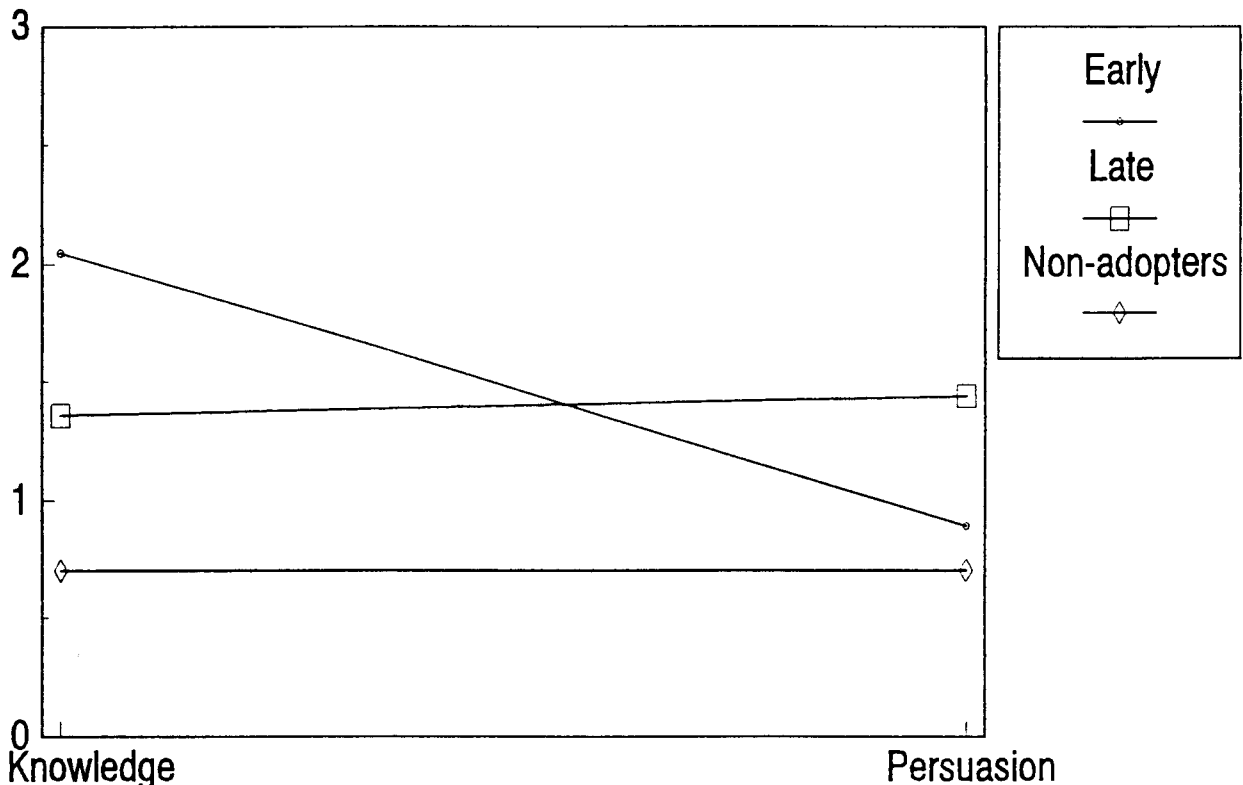
eses would be supported if the mean communication channel ratio for all subjects were significantly greater than one in the knowledge stage and significantly less than one in the persuasion stage. The third hypothesis would be supported if the mean communication channel ratio over the knowledge and persuasion stages was greater than one only for early adopters.

Of the sample of 53 faculty, 34 adopted WordPerfect 5.1 and 29 passed through both the knowledge and persuasion stages. We ranked these adopters by the length of time to adopt the innovation after its introduction at the two colleges. We defined early adopters as those whose time to adoption was less than the median time.

The data do not support the first two hypotheses. The overall sample mean communication channel ratio at the knowledge stage (1.27) is not significantly greater than 1 ($p = .1558$). The overall sample mean at the persuasion stage (0.95) is not significantly less than 1 ($p = .6297$).

A significant stage-adopter interaction ($p = .0634$) supported the third hypothesis. The profile graph in Figure 1 suggests that only early adopters consider mass-media channels more important than interpersonal channels in both the

Figure 1
Communication Channel Factor Plot



knowledge and persuasion stages. Late adopters consider interpersonal channels more important than mass-media channels in the persuasion stage. Non-adopters considered interpersonal channels more important than mass-media channels in both the knowledge and persuasion stages.

In summary, while the descriptive statistics supported the first two hypotheses, the sample mean ratios were not statistically significant from one. However, the data do support the third hypothesis.

Information Source Results

The study evaluated the following information source hypotheses.

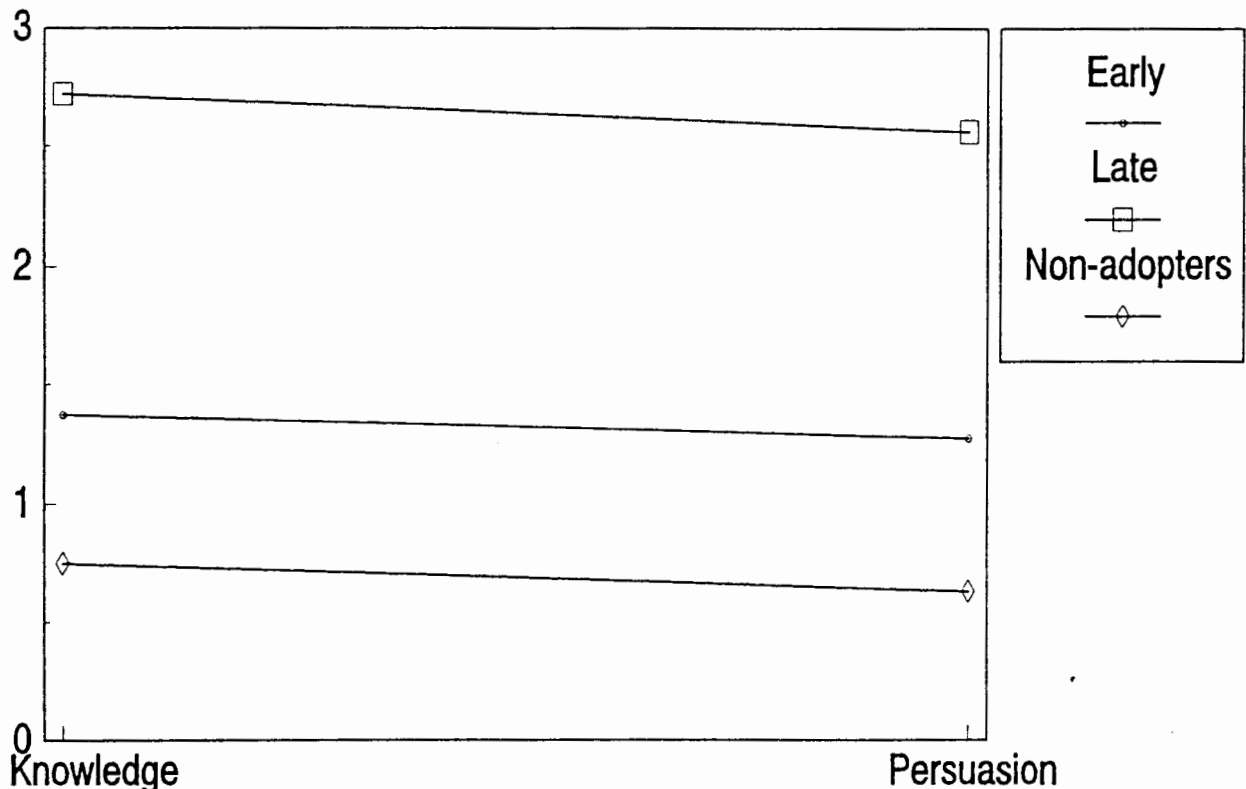
1. Cosmopolitan sources should be more important than local sources in the knowledge stage for all potential adopters.
2. Local sources should be more important than cosmopolitan sources in the persuasion stage for all potential adopters.
3. Only early adopters will consider cosmopolitan sources as more important than local sources in both the knowledge and persuasion stages.

On the questionnaire, all subjects rated the importance of information sources in the knowledge and persuasion stages along two five-point Likert scales. The dependent variable was the ratio of the cosmopolitan to local sources Likert scores. The first two hypotheses would be supported if the mean information source ratio for all subjects was significantly greater than one in the knowledge stage and less than one in the persuasion stage. The third hypothesis would be supported if the mean information source ratio at the knowledge and persuasion stages was greater than one only for early adopters.

The overall mean information source ratio (1.47) at the knowledge stage is significantly greater than one ($p = .0559$) as suggested by Rogers' theory. That is, the subjects perceived cosmopolitan sources to be more important than local sources. However, the subjects also perceived cosmopolitan sources to be more important at the persuasion stage (1.34) although the overall ratio is not significantly different from one. This is contrary to Rogers' theory that suggests that the overall information source ratio should have been less than one for the persuasion stage.

The third information source hypothesis was supported

Figure 2
Information Source Factor Plot



($p=.0078$). The factor plot is shown in Figure 2. Tukey multiple comparisons show that the mean information source ratios are significantly different for early and late adopters. Early adopters rated cosmopolitan sources as significantly more important than local sources; the sample mean was 2.22. Late adopters rated cosmopolitan sources slightly more important than local sources; the sample mean was 1.22. Non-adopters rated local sources as significantly more important than cosmopolitan sources; the sample mean was 0.69.

In summary, the study supported Rogers' claim that cosmopolitan sources are more important than local sources at the knowledge stage. The data do not support Rogers' claim that local sources are more important at the persuasion stage. Finally, only early adopters rate cosmopolitan sources more important than local sources at both the knowledge and persuasion stages.

Innovation Attributes Results

Rogers claims that potential adopters evaluate an innovation on five attributes—relative advantage, compatibility, trialability, observability, and complexity. Rogers also proposes that these five attributes (or some subset) will discriminate between adopters and non-adopters.

We factor analyzed the data from the 28 item innovation attributes questionnaire to determine whether the subjects evaluated the innovation on the five attributes suggested by Rogers. We dropped seven observations because of incomplete responses.

Because the instrument measured eight constructs (Rogers' five attributes and Moore and Benbasat's three attributes), eight factors were retained. Also, since we did not expect orthogonal factors, we used an oblique PROMAX rotation that produced a simple structure. All eight factors had eigenvalues greater than one and accounted for 79% of the variance. The factor structure showed only minor discrepancies from that of Moore and Benbasat.

Because an oblique rotation may produce correlated factors, we tested the factors for high collinearity. The condition index for the eight factors of 2.10 suggests a low degree of collinearity [1, pp.104].

We included eight factors in a stepwise discriminant analysis to discriminate between adopters (both early and late) and non-adopters. The discriminant analysis retained only three factors: relative advantage ($p < .0001$), results demonstrability ($p < .0001$), and voluntariness ($p < .0051$). Of Rogers' five innovation attributes, only relative advantage significantly discriminated between adopters and non-adopters.

We used a jackknife procedure to develop the cross validation hit matrix in Table 1. Table 1 shows that the discriminant model successfully classified 12 of the 14 non-adopters and 29 of the 31 adopters.

Table 1
Classification Hit Matrix

	Observations Classified as		
	Non-adopter	Adopter	Total
Non-adopter	12 85.72%	2 14.29%	14
Adopters	3 9.38%	29 90.62%	32
Total	15	31	46
Priors	0.3043	0.6957	

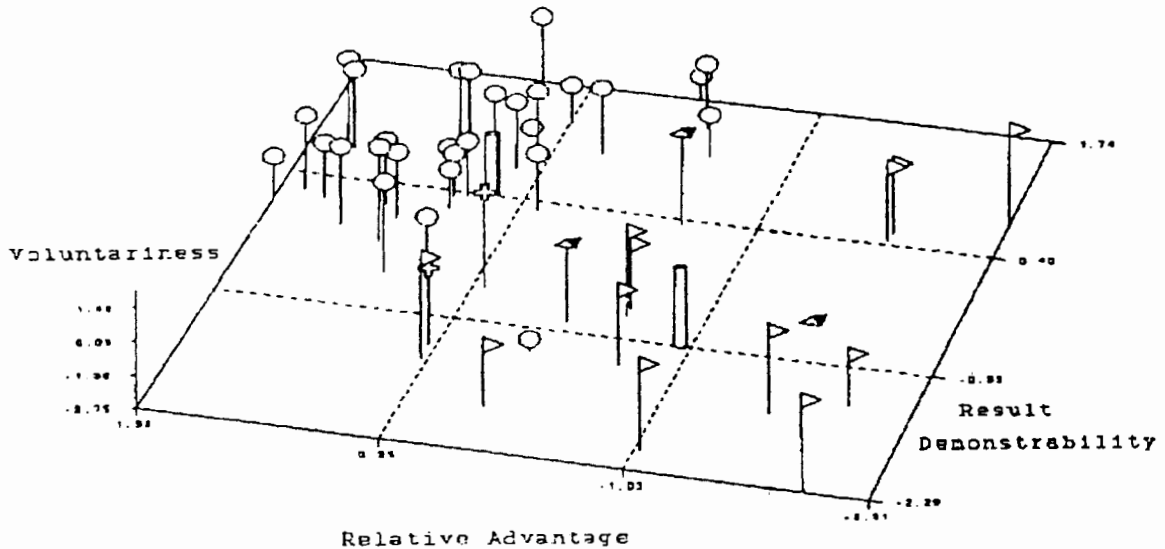
Figure 3 shows a three dimensional scatter plot of the classification data. The graph visualizes the discriminant function's classification results [4]. The axes are the three significant factors from the discriminant analysis. The plot represents correctly classified adopters by balloons and correctly classified non-adopters by flags. Faculty who were classified by the discriminant analysis as adopters but did not adopt WordPerfect 5.1 are represented by crosses. Faculty who were classified as non-adopters but did adopt WordPerfect 5.1 are represented by pyramids.

Figure 3 shows that correctly classified adopters (balloons) have high scores on relative advantage and results demonstrability and cluster in the northwest sector. High scores (above zero) on the results demonstrability factor mean that the relative advantages of WordPerfect 5.1 are easy to communicate to others. High scores (above zero) on the relative advantage factor mean that WordPerfect 5.1 can significantly improve faculty productivity. Correctly classified non-adopters (flags) have low scores on relative advantage and results demonstrability and cluster more toward the southeast and east sectors. It is less clear that voluntariness can discriminate between the adopters and non-adopters. However, no non-adopters have low voluntariness scores while several adopters do. High scores on voluntariness (above zero) mean the faculty member felt the decision was not voluntary.

Figure 3 shows that the two non-adopters misclassified as adopters (crosses) had higher relative advantage scores than properly classified non-adopters. Both subjects expressed an interest in using the WordPerfect 5.1 but the effort required to learn it discouraged them.

Figure 3 shows that the three adopters misclassified as non-adopters (pyramids) all had lower relative advantage scores than properly classified adopters. Two misclassified adopters had lower results demonstrability scores than prop-

Figure 3
Three-Dimensional Scatter Plot of Classification Data



		Actual	
		Adopter	Non-adopter
Classified as	Adopter	Balloon	Cross
	Non-adopter	Pyramid	Flag

Pillars represent group centroids

erly classified adopters and one had a much lower voluntariness score. The adopter with low relative advantage, low results demonstrability, and low voluntariness (mideast sector) adopted under pressure when his department decided to adopt WordPerfect 5.1.

In summary, there is partial support for Rogers' innovation attributes. While the factor analysis uncovered Rogers' five innovation attributes, only one attribute—relative advantage—discriminated between adopters and non adopters. In short, adopters thought WordPerfect 5.1 offered significant and demonstrable advantages and felt that they were given little choice in the adoption decision. Non-adopters did not consider WordPerfect 5.1 to have significant and demonstrable advantages and felt that they had a choice in the adoption decision.

DISCUSSION

When considering the results of this study the reader should consider two limitations. First, the sample size is small. This makes it more difficult to find significant statisti-

cal results. Second, Rogers' model is a generalized conceptual model and may not apply in all situations. Because this study is limited to one organization and one innovation, it is impossible to draw generalized conclusions regarding the validity of the model in organizational settings. However, the results suggests that the model may be useful in understanding the diffusion process in organizations. Even for those cases when the model was not accurate, the results are informative.

Adoption-Decision Process

That the stage model seems to be valid for this innovation is promising. One implication for managers is that they may identify the stage that people are in by observing their activities. They can then influence the decision process by responding to peoples' information needs at each stage of the process.

The adoption process begins with the knowledge stage. One thing a manager can do to speed the diffusion process is to create awareness of the innovation throughout the social

system. It is not necessary at this point to convince people to adopt or reject. The goal is simply to give potential adopters an awareness of the innovation and an idea of its purpose.

After awareness is created, the manager should watch for information seeking activity that indicates a person is in the persuasion stage. This will occur at different times for different people. As people enter the persuasion stage, a manager should provide information supporting the decision the manager desires. The information would have greater impact since the person is in an information seeking mode. It is especially important to identify those people who tend to be early adopters at this stage since they influence the decisions of others. Early adopters tend to be eager to try new ideas and are often opinion leaders with regard to the innovations they adopt [8, pp.248-249].

The implementation and confirmation stages have received less attention from researchers than the knowledge and persuasion stages. Little is known about people's behavior during these stages. However, some guidelines can be gleaned from what is known.

During implementation the adopter implements the innovation. The manager should take a proactive approach to facilitating this process. Making people aware of how to acquire the innovation and how to receive technical support and training can ease the implementation phase. Some adopters in this study became frustrated when they had decided to adopt Wordperfect 5.1 and then could not get the software from the college. As one faculty member put it:

...the purchase process here at the university is elongated and from budget request...to university approval...is sometimes a year...

Others decided to adopt and obtained the software but found it too complex and so did not use it.

During the confirmation stage, adopters and non-adopters alike re-evaluate their decisions. Managers should continue to provide information even after people's adoption decisions are made. In this study a Wordperfect newsletter served this purpose. Many adopters learned new features of the package from the newsletter. This reinforced the decisions of adopters and caused some non-adopters to reconsider. If the manager wishes to change a person's decision, the confirmation stage would be an ideal time to attempt this.

One thing that became clear during the interviews is that organization members' decision processes are separate from the adoption decision process of the organization. In fact, awareness and persuasion began for some faculty members before management was even aware of the innovation. Several subjects in this study lamented the slow decision making of the organizational authorities:

...I'm not sure if the college...is always the first, is always quick to adopt the latest version...I think we

were using it before the college had officially sanctioned us to use it.

The college takes so long to get these things...I upgrade it myself...

Often organization members' attitudes or even their adoption decisions about an innovation may be made before management is aware of the innovation. By the time the organization authorizes the innovation, many people, especially those who tend to be early adopters, may already have made their adoption decisions. Since early adopters often influence the extent to which an innovation diffuses, it may be too late for management to affect the diffusion process. Managers should not wait for the organization's formal decision to be made before they begin to sell the innovation. A manager's ability to influence the decision process will be greatest in the first two stages.

Communication channels and information sources

Mass-media channels were not more important than interpersonal channels in the knowledge stage. This inconsistency with Rogers' model is probably due to the impact of the social system. In organizations, interpersonal channels play a more important role in spreading awareness because of the close interaction among its members [3]. Several subjects stated during the interviews that they had first heard of WordPerfect 5.1 from either colleagues or the administrative staff.

Interpersonal channels were not more important than mass-media channels in the persuasion stage. This was probably because of two important mass-media channels within the college— a Wordperfect newsletter and the availability of popular computer magazine reviews. These reviews were very influential and tended to offset the strong influence that interpersonal communication channels have. As a result, faculty members used both mass-media and interpersonal channels equally at the persuasion stage.

Rogers' hypothesis that cosmopolitan sources are more important in the knowledge stage was supported. However contrary to Rogers, cosmopolitan sources were also more important in the persuasion stage. Many faculty members relied on published software reviews to evaluate WordPerfect 5.1. Also, several faculty collaborated electronically with colleagues outside the social system. Thus, software compatibility often became an issue. Many faculty members learned about the innovation from these cosmopolitan sources. This also would increase the importance of cosmopolitan sources in the persuasion stage.

Consistent with Rogers, early adopters relied more heavily on cosmopolitan sources than did late adopters or non-adopters. Cosmopolitan sources were more than twice as important than local sources for early adopters. Cosmo-

politan sources were as important as local sources for late adopters. Only non-adopters relied on local sources more than cosmopolitan sources. Given the college's pressure to use Wordperfect 5.1, local sources may have been less than enthusiastic about WordPerfect 5.1. As one subject who did adopt the innovation stated when asked if he would have switched if the college had not standardized on WordPerfect 5.1:

Absolutely not ...I simply have to conform to whatever the requirements of the office in order to work with other people, in order to work with the clerical staff and that's the main reason why I use it.

Managers should make an attempt to know the types of communication channels and information sources their people use. A wealth of information regarding information technology is available in the popular press. In previous diffusion research this type of information was not considered very influential in forming peoples' opinions. However, based on the results of this study, this does not seem to be as true with information technology. One important way of keeping pace with rapid changes in technology is through reviews and articles published in popular magazines.

While managers obviously cannot control their workers' access to this information they can use it to their advantage. By seeking articles that promote the direction they wish the diffusion process to take and developing a forum by which these articles can be circulated the manager may be able to influence the diffusion process.

The importance of the organizational newsletter in this study suggests another way that managers can influence the diffusion process. The purpose of the newsletter was to educate the user community on various features of the package and to address common questions or problems. Many of those interviewed mentioned they had learned features through the newsletter. This was true before adoption in the persuasion stage and after adoption during the confirmation stage.

While the organizational environment and nature of the technology may suggest changes in the model, much of what Rogers model says about communication channels and information sources remains useful. Cosmopolitan sources are most influential early in the decision process and for early adopters. While mass-media channels are relatively more important than in the previous research, interpersonal channels are equally important. The optional decision model suggests that one way to speed the diffusion process is to concentrate on those people who tend to be early adopters. These people tend to be influential for other adopters especially if they are opinion leaders.

Innovation Attributes

People base their adoption decisions on their percep-

tions of an innovation's attributes. Their evaluation is based on what effect they perceive the innovation will have on them. To encourage people to adopt an innovation, managers should pay attention, not to what the innovation means to the organization, but what the innovation means to the people who will be using it.

In this study, the innovation's relative advantage and results demonstrability and voluntariness of the adoption decision distinguished adopters from non-adopters. Consistent with previous research, relative advantage was the most important attribute used to judge the innovation [8, p.220]. What constitutes a relative advantage is unique to each innovation. The following quotes suggest a major relative advantage of WordPerfect 5.1 in the college of business.

...to have better laser support I went to WordPerfect.

The problem is there is no printer support available for [a competitor's product]...the laser printer is not connected directly to it and so I don't have a choice.

It would be useful to determine what constitutes a relative advantage for the people in an organization before determining what technologies to promote or how to promote them. For the faculty members in this study, compatibility with colleagues and administrative staff was another relative advantage for Wordperfect 5.1. Although most subjects disliked the complexity of Wordperfect 5.1, many adopted to be compatible. A word processor that provided compatibility with staff and colleagues but eliminated much of the complexity would have met the needs of the organization members more closely. An executive version of Wordperfect was available for a lower price than Wordperfect 5.1. Had management evaluated the needs of the organization members more closely they might have been able to provide a less complex alternative that was perceived to have the same relative advantage at a lower cost than Wordperfect 5.1.

The appearance of voluntariness in the discriminant function is interesting. The choice of word processor by faculty members was not dictated by the organization. However, many subjects felt they had little choice, adopting to remain compatible with the administrative staff or to receive technical support. On the other hand, Leonard-Barton found that, even when the use of a technology is mandated by management, users may choose to under-use or misuse it [8]. Different people regard the voluntariness of their choices differently.

In summary, Rogers' optional adoption decision model can help managers understand the diffusion of technology in their organizations. Managers can influence the decision process by providing the right information at different stages of the decision process. Managers should be aware of the different information sources and communication channels

that their people use. Managers can also gauge the potential success of a technology by understanding the users' perceptions of the technology in terms of its attributes. Finally, managers should be aware that an individual's decision process does not necessarily coincide with that of the organization. A manager should continuously monitor the information seeking behavior of their workers especially those who tend to be early adopters.

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