

The innovation adoption process:  
A panel study of microcomputer adoption among Iowa farmers

by

James R. Orr

A Thesis Submitted to the  
Graduate Faculty in Partial Fulfillment of the  
Requirements for the Degree of  
MASTER OF SCIENCE

Major: Journalism and Mass Communication

Signatures have been redacted for privacy

Iowa State University  
Ames, Iowa

1986

## TABLE OF CONTENTS

|   | Page |
|---|------|
| CHAPTER I. INTRODUCTION   | 1    |
| CHAPTER II. THE DIFFUSION PROCESS: A SURVEY OF<br>THE RESEARCH LITERATURE | 6    |
| CHAPTER III. THE ROLE OF BELIEFS AND ATTITUDES<br>IN THE ADOPTION PROCESS | 21   |
| CHAPTER IV. HYPOTHESES: THE ADOPTION PROCESS                              | 33   |
| CHAPTER V. METHODOLOGY  | 50   |
| CHAPTER VI. FINDINGS AND DISCUSSION                                       | 65   |
| CHAPTER VII. CONCLUSIONS  | 81   |
| REFERENCES  | 88   |
| ACKNOWLEDGEMENTS  | 92b  |
| APPENDIX A: 1984 IOWA FARM COMPUTER QUESTIONNAIRE                         | 93   |
| APPENDIX B: FACTOR ANALYSIS RESULTS                                       | 106  |

## LIST OF TABLES

|   | Page |
|---|------|
| Table 1. Iowa farm computer adoption study samples  | 53   |
| Table 2. Adoption stages in 1982 of farmers who subsequently adopted micros in 1983 or 1984 and farmers who never adopt micros  | 65   |
| Table 3. Interpersonal information source use by adoption stage   | 67   |
| Table 4. Test of Hypothesis 4, "After the evaluation stage, attitudes about micros will change little"  | 71   |
| Table 5. Test of Hypothesis 5, "Attitude change is not likely after micro adoption"   | 72   |
| Table 6. The percent of variance in the dependent variable (the adoption process) explained by computer information seeking and attitudes 1, 2 and 3 in 1982, 1983 and 1984 | 79   |

## LIST OF FIGURES

|  | Page |
|--|------|
| Figure 1. Model of the adoption process  | 49   |
| Figure 2. Information seeking level by adoption stage in 1982, 1983 and 1984   | 68   |
| Figure 3. Information seeking behavior of farmers who adopted micros <u>in 1983</u> and farmers who adopted micros <u>in 1984</u>  | 69   |
| Figure 4. Information seeking behavior of farmers who adopted micros before 1982, farmers who adopted micros between 1982 and 1984, and farmers who did not adopt micros     | 69   |
| Figure 5. <b>Attitude 1</b> (1982-1984): Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros        | 75   |
| Figure 6. <b>Attitude 2</b> (1982-1984): Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros        | 75   |
| Figure 7. <b>Attitude 3</b> (1982-1984): Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros        | 76   |
| Figure 8. <b>Attitude 2</b> (1982-1984): Differences in the attitude index scores of farmers <u>who adopted micros in 1983</u> and farmers <u>who adopted micros in 1984</u> | 76   |
| Figure 9. Attitude salience-information seeking model of the micro adoption process  | 85   |

## CHAPTER I. INTRODUCTION

The general research topic of this thesis is the diffusion and adoption of innovations. Most innovation diffusion research involves studying the process by which innovations spread to the members of a social system (Rogers, 1971).

Innovation diffusion is one of the most thoroughly studied topics in the social sciences. According to Rogers (1983), as of 1983 there had been over 3,000 diffusion articles and books published. Over the past forty years, a so-called "classical" model of the innovation diffusion process has evolved (Brown, 1981). One might think that there is little yet to be learned. But recent, powerful criticisms of many of the basic assumptions of the classical model indicate that controversy and uncertainty about the nature of the diffusion process still exist. In fact, Downs and Mohr (1976), after reviewing a number of earlier diffusion studies, concluded that analysis of the innovation diffusion process "may be too hopelessly complex to be productive" (Downs and Mohr, 1976:700).

The objective of this thesis is to document the process of microcomputer (micro) adoption among Iowa farmers. (The adoption of an innovation is really just one area of research within innovation diffusion. Innovation adoption focuses on the demand side of diffusion, how and why individual entities adopt, or don't adopt a particular innovation. The classical diffusion model has concentrated attention primarily in this area. Other perspectives in the diffusion literature, such as the marketing and infrastructure perspective, virtually ignore the adoption process, choosing instead to concentrate on the supply side of

diffusion (Brown, 1981)).

In order to develop an understanding of the microcomputer adoption process, the innovation diffusion literature and selected literature from other disciplines will be reviewed. Hypotheses derived from the literature will be used to guide the analysis of a data base derived from a longitudinal panel study of microcomputer adoption among Iowa farmers.

If applied to the study of microcomputer adoption among farmers, classical innovation diffusion studies would typically investigate such questions as these:

1. How many farmers have adopted micros?
2. What are the characteristics of those who have adopted micros?
3. What are the characteristics of the innovation (micros), and do these characteristics influence adoption?
4. Do micro adopters fall into distinct socioeconomic or behavioral categories?
5. Can the adoption of micros be predicted?
6. Are there stages in the adoption process?
7. What, if any, are the consequences of adoption?

The study to be evaluated in this thesis is called "The Iowa Farm Computer Diffusion Study". This study<sup>1</sup> collected data about farm computer adoption through the use of mail questionnaires distributed to two samples of farmers in 1982, 1983 and 1984.

---

<sup>1</sup> The Iowa study is sponsored by the Iowa Agricultural and Home Economics Experiment Station (Project 2514) and the Iowa Cooperative Extension Service.

One sample, the select sample, was drawn from farmers identified by county or area Extension personnel as farmers believed to be highly interested in, or actually using computers. The second sample, the random sample, was drawn from a list of subscribers to Wallaces Farmer magazine.

### **Previous Microcomputer Diffusion Studies**

Over the last few years, there have been several articles and papers pertaining to microcomputer adoption among farmers.

A study conducted in 1982 on microcomputer adoption by Iowa farmers provides some evidence that farm characteristics and marketing strategies seem to explain a great deal of the variation between different categories of adoption groups (Bultena and Hoiberg, 1983). The authors state that "given the typical uses of microcomputers by farmers, it is not surprising that the largest and most commercialized operators are those most likely to adopt this technology" (Bultena and Hoiberg, 1983:2). In their study, farmers were classified into five computer adoption categories: 1) using a micro; 2) planning a purchase; 3) unsure of adoption; 4) decided against adoption; and 5) haven't considered adoption. Those who were using micros (3 percent of the sample), had an average farm size of 1,520 acres, and for 69 percent of them, their farm income was above \$100,000. The adopters were also more actively engaged in forward contracting and hedging. Those classified as non-adopters (4th and 5th categories), constituted 80 percent of the sample and had average farm sizes between 433 and 356 acres respectively. They had the lowest proportion of farmers engaged in forward contracting and hedging.

Audirac and Beaulieu (1984), also examined micro diffusion among U.S.

farmers. They concluded that farmer adoption of personal computers is conditioned by a combination of three factors: 1) the characteristics of research and development of the innovation, 2) the diffusion infrastructure and 3) the characteristics of the technology. These authors reviewed some of the possible consequences of micro adoption. They concluded that the widespread diffusion of micros would most likely reinforce and accentuate the ongoing process of structural agricultural change (towards more concentrated farm ownership) that has been encouraged by previous technological developments.

Finally, Scherer and Yarbrough (1984) examined micro adoption using data from the Iowa farm computer study and data collected in New York state. (Scherer and Yarbrough found, that compared to non-adopters, micro adopters were a more homogenous group that practiced greater information seeking, more advanced management practices, had a higher gross income and education, and were younger.) They concluded that because of the unequal distribution of micros and the advantages of using micros, microcomputers will likely increase inequity among farmers.

### **Organization of the Literature Review**

The relationship of most of the variables found in the Iowa farm computer survey (such as education, farm size, communication behavior, change agent contact and information seeking) to innovation adoption has been extensively researched in past diffusion studies. Therefore, the first chapter of the literature review (Chapter II) will examine the classical diffusion model, along with the criticisms of and alternatives to that model.



A separate chapter (Chapter III) is devoted to reviewing the role of attitudes in the adoption process because there is little information about attitudes in the innovation diffusion literature. Material in this chapter is drawn from the fields of social psychology, consumer behavior and mass communications.

## CHAPTER II. THE DIFFUSION PROCESS: A SURVEY OF THE RESEARCH LITERATURE

### The Classical Diffusion Model

Since the 1950s, most research on the adoption of farm technologies has occurred within the classical diffusion model (Rogers, 1983). The classical model posits that as a new technology diffuses through a social system, individuals learn about the technology through formal and informal communication channels. Access to these information channels provided potential adopters with data about the new technology and the various options available to them. Several of the information sources which influence adoption behavior are the mass media, commercial entities, formal organizations, educational institutions and personal interaction (Lionberger, 1960; Rogers, 1983). Farmers evaluate information about an innovation by assessing the potential benefits and costs of adoption. If favorable attitudes toward the technologies emerge, the model assumes adoption will follow (Brown, 1981).

The classical diffusion model places a great deal of emphasis on the awareness-adoption linkage. In some respects, this is similar to the stimulus-response model of early behaviorists. The behaviorists proposed that the application of a stimulus resulted in a predictable outcome. Diffusionists have elaborated on the stimulus-response model by adding attitude formation between the stimulus (information), and the response (adoption behavior) (Hooks et al., 1983).

The classical model further assumes that all members of a population of potential adopters have an equal opportunity and ability to adopt

(Camboni and Napier, 1984). Usually, however, not everyone adopts simultaneously and some people may never adopt. Given this fact, the model has evolved a system of adopter categories that is based on the time order of adoption. The first 2.5% to adopt are called innovators, the next 13.5% are early adopters, the next 34% to adopt are the early majority, the next 34% are the late majority, and the last 16% are called laggards (Rogers, 1962). Both failure to adopt early and the rate of adoption are explained by the potential adopter's lack of innovativeness or misunderstanding of the communications directed towards them (Camboni and Napier, 1984).

#### Predictors of innovation adoption

Measures of access to and use of various sources of information, and selected personality and socio-economic factors are used to predict who will likely adopt an innovation (Rogers, 1983). Research findings indicate that early adopters are better educated, have higher social status, operate larger-sized farms, have more specialized operations, less fatalism and more social participation, are more highly connected in the social system, have more change agent contact, greater use of mass-media and interpersonal communication channels, engage in more active information seeking and have greater knowledge of innovations (Rogers, 1983). These differences can also be observed between early adopters, those who adopt at some intermediate time, and those who lag in adoption (Brown, 1981).

### Stages of adoption

The classical model assumes that adopters go through a linear progression of adoption stages. Rogers' (1983), present conceptualization consists of five stages:

1. Knowledge occurs when an individual is exposed to an innovation's existence and knows something about its function.
2. Persuasion occurs when an individual forms a favorable or unfavorable attitude toward the innovation.
3. Decision occurs when an individual chooses to adopt or reject the innovation.
4. Implementation occurs when an individual puts an innovation to use.
5. Confirmation occurs when an individual seeks reinforcement of the innovation-decision. The individual may reverse his/her previous decision if exposed to conflicting messages about the innovation.

### Attributes of the innovation

The classical model proposes that there are five attributes by which an innovation can be described, and that an individual's perceptions of these attributes are predictive of the rate of adoption (Rogers, 1983).

Relative advantage is the degree to which an innovation is perceived as better than the innovation it supersedes. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. Trialability is the degree to which an innovation may be experimented with on a limited basis. Observability is the degree to which the results of an innovation are visible to others. All four of these attributes are positively related to the adoption rate of the innovation.

Complexity is the degree to which an innovation is perceived as

relatively difficult to understand and use. The complexity of an innovation is negatively related to its rate of adoption.

#### Success of the classical diffusion model

The adoption perspective represents a research tradition spanning the last forty-five years. It has had a great impact on the design of programs for the United States Cooperative Extension Service, family planning programs in Third World nations and development programs of the United States Agency for International Development. Millions of dollars are spent annually on such programs, and by this measure, the classical adoption-diffusion model may be one of the most successful of all social science paradigms (Brown, 1981).

#### **Criticisms and Alternatives to the Classical Model**

Over the years, many authors have been critical of the ideological, theoretical and methodological bases of the classical diffusion model. The classical model's excessive emphasis on behavioral variables, insensitivity to socio-structural factors and limited attention to unintended consequences of the diffusion adoption process, are but a few of the many criticisms that have been leveled (Audirac and Beaulieu, 1984). Even Everett Rogers, formerly the strongest proponent of the paradigm, wrote two articles in the 1970s that called for the revision and demise of the classical model (Rogers, 1976; Rogers, 1978). Although later, in his 1983 book Diffusion of Innovations (Rogers, 1983), he seems to have backtracked somewhat from the views he expressed in the 1976 and 1978 articles. Nevertheless, over the past 10 years or so, a number of

alternative models have appeared that attempt to address some of the criticisms of the classical model. The following are some of the more prominent alternative perspectives.

#### The economic history perspective

The economic history perspective criticizes the traditional model for not recognizing that innovations often change over time (Brown, 1981). This perspective examines how innovations are adapted to the needs of potential adopters. It views innovation as a continuous process in which the form and function of the innovation and the innovation's environment change throughout the innovation's life cycle. The traditional model has focused almost exclusively on changes in the responses of adopters to a presumably immutable innovation (Brown, 1981). However, studies of the diffusion of innovations among industrial firms and public sector organizations have highlighted the importance of changes in innovations over time, changes which may increase the attractiveness of the innovation (through profitability or relative advantage) to a growing number of potential adopters.

Certainly, microcomputers changed during the two years of the farm computer survey. During that time, micro prices decreased while their capabilities increased. Agricultural software became more common and sophisticated and more information about micros was available through agricultural information sources. If anything, however, the information and knowledge requirements necessary to purchase and operate a micro also increased during this time. Constant hardware modifications and the appearance of new models often rendered software obsolete. This was

especially discouraging to farmers who were caught between buying a newer, more efficient piece of hardware for which little software was yet available, or buying an already obsolete piece of equipment for which at least some agricultural software already exists (Audirac and Beaulieu, 1984). Thus, while hardware prices may not be a major constraint to most farmers, the system's total cost, including software costs, constant updating requirements and the level of information needed to keep up with all of these changes, may act as a critical constraint for some farmers.

#### Biases in the traditional model

During the 1970s, researchers began to question why diffusion programs in developing countries often seemed to increase inequity within a social system. These researchers examined the ideological underpinnings of diffusion programs based on the classical model and discovered biases in the traditional diffusion model (Rogers, 1983; Goss, 1979).

These biases include the pro-innovation bias (the belief that an innovation is beneficial and should be adopted by all members of a social system) and the individual-blame bias (successful individual behavior is judged according to how well an individual adapts to the existing system; the possible obstacles caused by the economic, political or social systems are ignored).

Partly in response to these biases, two perspectives have developed: the market and infrastructure perspective and the economic constraint model.

### The economic constraints model

Hainard and Buttel (1983) have proposed that a shift in emphasis is occurring in rural sociology, from studying socio-behavioral factors to studying economic-structural factors. (The most important group of diffusion studies have come out of rural sociology (Goss, 1979)). The classical diffusion model represents the old socio-behavioral school, because it doesn't account for the unequal distribution of resources required to adopt complex innovations. The economic constraint model has been proposed to try and remedy this shortcoming (Brown, 1981).

Contributors to the development of this model (Brown, 1981; Flinn and Buttel, 1980; Havens and Flinn, 1976; Hooks et al., 1983) have argued that access to material resources is a necessary condition for the adoption and the continued use of farm technologies. A person may have a strong desire to adopt something when he becomes aware of the advantages of adoption, but be unable to adopt because of economic constraints. This model suggests that in a non-egalitarian society, a certain segment of people will always be at a comparative disadvantage in the diffusion process due to their lack of access to information, capital and land (Hooks et al., 1983). Subsequently, the economic constraint model emphasizes access to material resources as the primary predictor of innovation adoption.

The focus of this model on economic constraints leads researchers to study the economic and political structures of a society, instead of studying individual behavior. Economic and social characteristics are believed to be the best predictors of innovation adoption (Havens and Flinn, 1976).



Examples of economic constraints studies In their study of microcomputer diffusion among farmers, Audirac and Beaulieu (1984) argued that instead of studying a farmer's behavioral and psychological orientations, characteristics of the farm as a business firm (i.e., type and size of operation, hired labor, level and kind of management, type and diversification of production and farm income) is a better indicator of adoption.

Hooks et al. (1983) tested the predictions of the classical diffusion and economic constraint models and found that both had utility in explaining the adoption of some selected farm technologies. However, they concluded that "the economic constraint factors, especially those representing past investments in technologies, are much better predictors of existing farm technologies than are the diffusion-type variables selected for study" (Hooks et al., 1983:322).

#### The market and infrastructure perspective

The market and infrastructure perspective draws on the strengths and weaknesses associated with numerous research diffusion traditions (Audirac and Beaulieu, 1984). These include the spatial diffusion tradition (Hagerstrand, 1967), marketing (Kotler, 1972), economic history (Rosenberg, 1976) and communications in rural development (Bordenave, 1976; Beltran, 1976; and Roling et al. 1976).

This perspective assumes that the opportunity to adopt is egregiously unequal, in many cases purposely. This perspective focuses on the supply side of diffusion, how diffusion agencies make innovations and the conditions for adoption available to a targeted audience (Brown, 1981).

This perspective argues that individual behavior does not represent free will so much as it represents choices within a constraint set established and controlled by government and private institutions. It is believed that much of the variance in the diffusion process can be accounted for by looking at institutional, rather than individual behavior (Brown, 1981).

The market and infrastructure perspective views diffusion as a process consisting of three activities. For innovations propagated by commercial, government or non-profit organizations, the initial activity is the establishment of diffusion agencies (or outlets) through which the innovation can be distributed to the target population. The second step is to implement a strategy to induce adoption among the target population. Brown (1981) has termed this the "establishment of the innovation" The final step is innovation adoption. This perspective, by recognizing the supply side of diffusion, shifts study away from the adopters of an innovation to the diffusion agency.

#### The development perspective

The development perspective is concerned with the impact of innovation diffusion on economic development, social change and individual welfare (Brown, 1981). The reverse question is also asked: how does the overall level of development affect innovation diffusion? This perspective looks at such things as the negative and indirect effects of public program diffusion, the ways in which the adoption of one innovation may influence the adoption of another innovation, and the role of social norms and public infrastructure in affecting the rate and spatial

patterning of diffusion. The diffusion process of the classical model ends when an innovation has been adopted. Not surprisingly, the effects of that adoption on the social system and the individual adopter have received little study (Brown, 1981).

Audirac and Beaulieu (1984) believed that based on their analysis, the widespread diffusion of micros in farming "will probably reinforce and accentuate the ongoing process of structural/agricultural change triggered by previous technological developments" (Audirac and Beaulieu, 1984:22). They believed this will be true because micros have been "targeted at the large-farm sector, characterized by capital, energy and information intensive operations and marketing through national and international distribution networks. This is particularly true for electronic marketing applications and for remote or stand-alone software which has mostly constrained the innovation's application to sophisticated record analysis and complex management decision aids" (Audirac and Beaulieu, 1984:22).

#### Methodological critiques

There have been many criticisms of the methodology employed by past diffusion studies. Feller (1981) states that the emergence of the dominant conceptual framework in which (1) the innovation, (2) is communicated through certain channels, (3) over time, (4) among members of a social system, has produced a situation in which research has become too simplistic and unimaginative. As Radnor et al. noted:

"... diffusion scholars have often dug predominantly where the ground was softest; they focus especially and almost predominantly on characteristics related to innovativeness through cross-sectional analysis of survey data" (Radnor et al., 1978:2).

A 1968 survey of 1,084 empirical diffusion publications cited by Rogers (1983) found that 88 percent of the research designs were one-time surveys, about 6 percent were longitudinal panel studies, and 6 percent were field experiments.

One of the most important elements of the diffusion model is time. Unfortunately, the widely used one-time research design is poorly equipped to measure diffusion as a process taking place over months or years. This design has also led to problems in measuring causality, since causality requires one event to occur before another (Rogers, 1983). One-shot surveys, when they attempt to measure time, usually rely on a respondent's recollection of past events (questionably reliable). Often these surveys try to catch a snapshot of the diffusion process by correlating the responses of adoption categories with various indices. Because of these limitations, Rogers (1983) has called for more appropriate research designs for measuring the process of diffusion, such as field experiments, longitudinal panel studies, use of archival records, and case studies with data from multiple respondents to act as a validity check. Other researchers have also emphasized the need to reorient diffusion studies from studying adopter categories to studying the innovation process (Feller, 1981, p. 90). Since the farm computer study is a longitudinal panel study, the effect of time on the adoption process can be measured, a significant advantage over one-time survey designs.

#### Downs and Mohr's notion of innovation cost

Downs and Mohr (1976) contend that the empirical diffusion literature is characterized by instability. As they state, "factors found to be

important for innovation in one study are found to be considerably less important, or not important at all, or important in the reverse direction in another study" Downs and Mohr (1976:700).

Downs and Mohr suggest that one means of reducing this type of instability is to conceptualize variables at higher levels of abstraction, as having primary and secondary attributes. They define an attribute, such as cost, as primary if there is no discernible variation in categorizing the cost of an innovation - for example, if the researchers determined that the innovation was low-cost to all. They define an attribute as secondary if the attribute is perceived to vary among potential adopters - for example, it may be a high-cost innovation to one group and a low-cost innovation to another.

As Downs and Mohr explain:

"Findings of research into the determinants of high-cost innovations are generalizable only to other high-cost innovations. There would be no point in trying to generalize about the impact of a variable like wealth on innovativeness because wealth would not have a constant impact. It is no doubt an important determinant of the adoption of high-cost innovations but may have no bearing at all upon the adoption of low-cost innovations (1976:702).

Classifying innovations as possessing primary and secondary attributes appears to have empirical support. According to Feller (1981),

"...divergent findings concerning the significance of the cost of an innovation on the responsiveness of potential adopters already has been documented."

Downs and Mohr's prediction of the effect of innovation cost appears to be very similar to what would be predicted by the economic constraints model, and in fact, the two are similar in the case of the example (cost) cited in Downs and Mohr's article, however, Downs and Mohr are primarily

concerned only with methodological issues.

Unfortunately, these authors do not provide researchers a standardized method of determining whether an innovation's attributes are primary or secondary. They only say that classifications of an innovation's attributes should be consistent within a given study.

### Involvement level theory

Researchers, primarily in consumer behavior and marketing research, have found that people's involvement level (the level of identification and personal relevance the adoption decision holds for a potential adopter) influences a wide range of behavior with respect to the innovation (Robertson et al. 1984). For example, Krugman (1965) found that consumers have a low level of identification and personal relevance for a product such as soap. For "low-involvement" products like these, the usual diffusion process which proceeds from information to attitude change to behavior may not occur. Instead, Krugman suggested that under low-involvement conditions, the decision process might proceed from information to behavior (adoption) and then attitude change.

According to involvement level theory, an adopter's involvement level in the adoption-decision process depends on a number of factors, the most important of which are cost, interest, perceived risk, situation, and social visibility (Robertson et al. 1984).

1. Cost. Most research on involvement indicates that involvement increases with the cost of the good being purchased.
2. Interest. People seem to have domains of interest. For some people, clothing is in a low-involvement category, for others it is in a high-involvement category.

3. Perceived risk. Involvement is likely to increase with the adopter's perceived risk in making a purchase. The level of perceived risk is a function of the possible consequences in purchase and the likelihood of these consequences.
4. Situation. Involvement also varies by how the product will be used. For example, the selection of a particular brand of wine may be low in involvement for private use, but high in involvement if guests were coming.
5. Social visibility. Involvement seems to increase with social visibility. In general, products which are on "social display", such as a tractor, pickups, and clothes, have high-involvement levels.

Involvement level has been found to vary among individuals, although little research has been conducted so far in order to systematize these differences. Involvement level research is now only at the stage of recognizing that individual differences exist.

By way of contrast, the classical diffusion model has assumed that people are uniformly highly involved with an innovation (Robertson et al. 1984:120). The involvement level perspective argues that the potential adopters' perceptions of the importance and relevance of an innovation to him or her should be taken into account.

High- versus low-involvement adoption processes There are believed to be behavioral differences in the adoption process for high- and low-involvement innovations (Robertson et al. 1984). The following are behaviors expected to be true for high-involvement innovations:

1. Adopters actively seek product information.
2. Adopters resist discrepant information and utilize counterarguments.
3. Adopters process information in a hierarchy of effects decision sequence.
4. Attitude change about the innovation is more difficult and rare.

5. Message content about the innovation is more important than the sheer number of messages.
6. Loyalty to a particular brand is common.
7. Post-adoption cognitive dissonance is common.
8. Other people are used for information and social-imitation purposes. Personal influence is operative mainly when the innovation is important and ego-involving.



### CHAPTER III. THE ROLE OF BELIEFS AND ATTITUDES IN THE ADOPTION PROCESS

#### Controversies Over the Relationship of Attitudes to Beliefs

In the early years of social psychology, attitudes were considered to be an indispensable cornerstone of social-psychology. In 1935, Allport stated that attitudes were, "...the most distinctive and indispensable concept in contemporary American social psychology" (1935, p. 798). Unfortunately, the history and current state of this important concept is marked by "conceptual confusion and a lack of methodological consensus" (Hill, 1981).

An attitude is "the disposition to behave in particular ways toward specific objects" (Gergen, 1974). An attitude is "the degree of positive or negative affect associated with some psychological object" (Edwards 1957). An attitude is "the predisposition ... to evaluate some symbol or object" (Katz, 1960). The list, of course, could be extended, and the confusion of definitions would only increase.

Some, like Gergen, have defined the concept so broadly that we could not make distinctions between attitudes, beliefs, and behavioral intentions (Hill, 1981). Others, like Fishbein and Ajzen (1975), have narrowly limited the attitude concept to include only affective orientations.

Much of the most recent literature ignores the issue of definition; the implicit assumption seems to be that either we agree on the matter, or somehow the lack of conceptual consensus is not a serious issue (Hill, 1981). To illustrate, during the literature review for this thesis, this

author reviewed 21 articles in which attitudes were the main subject. Twelve articles made some attempt to describe which definition of attitudes they were using; 9 did not.

Today, there are even contradictory views over how the definition of attitudes is changing. In Lynn Kahle's *Attitudes and Social Adaptation* (1984), contemporary trends in the definition of attitudes are said to be drifting towards "emphasizing social cognition." However, in Chapter 2 of *Cognitive Responses in Persuasion* (1981), Cacioppo, Harkins and Petty conclude attitude definitions are becoming "more affective."

Such disagreements over recent trends in attitude research and disagreements concerning attitude definition should alarm those who use attitudinal questions in research. For scientific disciplines to advance, there should be at least some basic level of agreement over how the constructs of a discipline are defined (Moscovici, 1976).

Quine and Ullian (1970) have pointed out some reasons why research into beliefs and attitudes has been difficult. One of the assumptions of most current attitude theories (with the exception of the cognitive miser model), is that people use rational means of processing information. However, Quine and Ullian show that for many beliefs or attitudes we may hold, this is often not the case. For example, the intensity of a belief cannot be counted on to reflect its supporting evidence. When we are rational and thorough in our belief formation we can perhaps discover the linear processes by which we develop, hold and act on our beliefs. But when we are not rational in our belief formation, these belief processes may become difficult or impossible to follow. Also, while many of our beliefs are stable over time, others are perpetually in flux. Primarily,

this is because our senses keep adding information. Some beliefs (mostly trivial, low involvement ones), can get crowded out by new information and forgotten. Other beliefs can come into conflict with new information and either be modified, abandoned, or the new information can be ignored or compartmentalized.

#### Two perspectives on the relationship of attitudes to belief

This area is still marked by conceptual disarray, but currently only a couple of perspectives are used by most attitude researchers. The following is an outline of two of the most influential perspectives in attitude definition.

Fishbein and Ajzen (1975) consider attitudes to be conceptually different from, yet related to beliefs. They consider affect to be the most essential part of the attitude concept, so attitudes are defined as the amount of affect for or against some object. While attitudes represent affect (feelings, evaluations), beliefs represent cognitions. Cognitions (beliefs) are thought to serve as the informational base that ultimately determines ones attitudes, intentions, and behavior towards an object. Fishbein and Ajzen state that "a person's attitude was found to be related to the totality of his beliefs but not necessarily to any particular belief he holds" (Fishbein and Ajzen, 1975:511).

Rokeach provides a somewhat similar definition of attitude: "An attitude is a relatively enduring organization of interrelated beliefs that describe, evaluate, and advocate action with respect to an object or situation, with each belief having cognitive, affective and behavioral components" (Rokeach, 1970:132). This definition is different from

Fishbein and Ajzen's, who define beliefs as having only a cognitive component.

These differences in belief and attitude definition represent the two major perspectives found in the literature, the multiple-component and the single-component view of beliefs (Bagozzi and Burnkrant, 1975). Fishbein and Ajzen propose that beliefs lead to attitudes; Rokeach says that attitudes are a collection of related beliefs.

The current prevailing view in attitude research holds that the distinction between attitudes (affect) and beliefs (cognition), as described by Fishbein and Ajzen's single component model, has not been convincingly demonstrated. According to the prevailing view, a distinction between belief and attitude would be justified only if research could demonstrate that different factors determine these two variables, or that a change in beliefs leads to different consequences than does a change in attitudes (Fishbein and Ajzen, 1975). Fishbein and Ajzen claim that they can demonstrate such differences, other researchers are skeptical, and that's where the situation stands today.

### **The Attitude-Behavior Controversy**

One of the more important issues in the attitude literature is the subject of attitude change and its relationship to behavior. Do changed attitudes lead to a change in behavior, or does behavior change attitudes?

Many earlier studies found low correlations between attitude and behavior. A review in the late 1960s of the attitude-behavior controversy concluded that "attitudes will be unrelated or only slightly related to overt behavior" (Wicker, 1969). This pessimistic evaluation of attitudes

was common in the 1960s and early 1970s (Hill, 1981). But research since the early 1970s has resulted in a shift in emphasis. Cialdini, Petty and Cacioppo (1981) point out that "no longer are researchers questioning if attitudes predict behaviors, they are investigating when attitudes predict behaviors."

#### Measurement issues

One of the reasons for this turnaround has been the result of advances in the measurement of attitudes and behaviors. Ajzen and Fishbein (1977) determined that measures of attitude can be used to predict behavior only when the attitudinal and behavioral measures are closely interrelated. For example, measuring a general, negative attitude towards convenience foods will not likely predict whether a consumer will occasionally serve frozen TV dinners after a long day at work.

Jaccard, King and Pomasal (1977) and Kelman (1974) also found that the more specific the correspondence between the measure of attitude and behavior, the higher the correlation between the two.

Fishbein (1967) argued that the most predictive measure of attitude should be the person's attitude toward performing the behavior in question, rather than the person's attitude towards the object of the behavior. For example, how a person felt about using a computer for a particular job should be a better predictor of computer adoption than measures of how a person felt about computers in general. Jaccard, King and Pomasal (1977), in an empirical study on the specificity of attitudinal predictors of behavior, agreed with Fishbein when they concluded, "...the attitude that is most relevant for behavioral

prediction is one with respect to performing the behavior and not the object of the behavior" (Jaccard, King and Pomasal, 1977:823).

In a 1977 article, Ajzen and Fishbein (1977) classified measurement of attitudes and behaviors as either corresponding or not corresponding in their targets. They said that when the two targets are identical (when the attitudinal predictor and behavioral criterion corresponded in their target), attitude-behavior consistency will be higher. For example, in the farm computer survey, the target of one set of the belief questions is the perceived usefulness of micros for management problems. The target of the behavioral measure is microcomputer adoption. Ajzen and Fishbein argue that the attitude-behavior correlation would be higher if the two targets were identical. In other words, they would be higher if the attitudinal measure was the perceived usefulness of micros for management, and the behavior measured was the use of micros for management.

A problem with the target specificity approach is that while it may result in higher correlations between attitudes and behavior, using such highly specific measures can only tell us about the correlations between very specific items. We may also be interested in the relationship between attitudes and behaviors that do not share the same target. In the interests of prediction, it is legitimate to want to know if beliefs about the usefulness of microcomputers can predict micro adoption. While Ajzen and Fishbein's model may increase attitude-behavior correlations, it also limits the range of behavior that can be predicted from a given set of attitudes.

Belk (1975), found that situational factors, such as the physical and social surroundings, temporal factors such as time of day, and antecedent

states such as mood, can influence measures of attitude-behavior consistency. Measured attitudes usually don't account for such factors, thereby introducing a possible source of inconsistency.

Also, attitudes formed after an individual has actual experience with the attitude object have been found to be more closely correlated with behavior than attitudes formed in the absence of such experience (Regan and Fazio, 1977).

Which comes first, attitudes or behavior?

There are several models of the attitude-behavior relationship.

Fishbein and Ajzen (1975), declare that "in the final analysis a person can form new beliefs only by performing some behavior. To gain new information, he may read books, observe events, interact with other people, watch television, etc., and these activities form the basis for the formation of ...beliefs" (Fishbein and Ajzen, 1975:511). They go on to trace how these new beliefs lead to the formation of attitudes, which then determine the person's intention to perform a behavior, and finally, the behavioral intention may lead to a new behavior. This behavior might then lead to the formation of new beliefs about the object. The determination of cause in this cyclical chain of events can be very difficult.

The classical diffusion model describes a more linear relationship between attitudes and behavior. Rogers (1983) says that evaluation of messages about an innovation will lead to a favorable or unfavorable attitude toward the innovation. "It is assumed that such persuasion will lead to a subsequent change in overt behavior consistent with the attitude

held. But we know of many cases in which attitudes and actions are quite disparate" (Rogers, 1983:171). Rogers concludes that while an attitude does not always result in a specific behavior, there is a tendency for attitudes and behavior to be consistent. Rogers (1983) briefly discusses the idea that cognitive dissonance might lead to attitude change after the performance of a behavior.

Cognitive dissonance is based on the premise that people strive for consistency. Dissonance occurs when beliefs held by an individual logically contradict one another (Robertson et al. 1984). Dissonance theory places a great deal of emphasis on post-behavioral dynamics. It is thought that after a person makes a decision about adopting a product, he may wonder if he made the right decision, so dissonance is aroused. The person will be motivated to reduce the dissonance between his behavior and his cognitions by changing his knowledge, attitudes, or behavior. He may try to reduce dissonance by seeking information about the innovation (to reassure himself that he made the right decision), he may deny or distort information that conflicts with his choice, he may minimize the importance of the issue, or he may add new cognitive elements to support the decision. For example, smokers often assert that many doctors smoke and that some scientists claim that smoking is not detrimental to their health (Robertson et al. 1984).

Cognitive dissonance was an important focus of research during the 1960s and 1970s, but the results generated theoretical and methodological controversy and alternative explanations have been developed (Hill, 1981).

Typical of cognitive models, cognitive dissonance assumes that people process information in an internally consistent and orderly fashion,



relatively uninfluenced by non-rational or dynamic forces. People are believed to be motivated to reduce inconsistencies (Fiske and Taylor, 1984).

Lately, however, studies have shown that people often use short cuts in cognitive processes and do not always think or act rationally. The idea is that people are limited in their capacity to process information. The capacity-limited thinker searches for rapid adequate solutions, rather than slow accurate solutions. Consequently, errors and biases stem from inherent features of the cognitive system. This perspective is referred to as the cognitive miser model (Fiske and Taylor, 1984). One example of a cognitive miser model is self-perception theory.

Bem (1967) questioned whether it is even necessary to postulate an aversive motivational state (dissonance) to account for the effects of behavior on beliefs and attitudes. Bem argued that beliefs and attitudes are simply self-descriptive, verbal responses. One important source of stimuli for attitudinal responses is the person's own behavior. According to Bem's self-perception theory, if a person bought a computer, he subsequently infers that it must be a worthwhile product, otherwise why would he have purchased it?

#### Involvement level and the attitude-behavior relationship

Involvement level theory proposes that both of these views may be correct. Orderly and rational information processing is likely to occur only for high-involvement innovations, people usually spend little time thinking about low-involvement products (Robertson et al. 1984).

Therefore, when using this approach, it is first necessary to decide

whether the innovation being studied is perceived to be a high or low-involvement product.

There have been a number of studies that have examined the relationship between involvement level and the direction of causality between attitudes and behavior.

Calder (1979) found that for low-involvement products, attitude change occurred only after product adoption. Day and Deutscher (1982) found that attitudes formed in low-involvement situations were very susceptible to change prior to an actual purchase decision. Sawyer (1981) cited Kapferer in providing evidence that persuasion can affect behavior without affecting attitudes. These studies indicate that for low-involvement innovations, attitude measurements obtained prior to measurements of overt behavior may have little significance. However, if the innovation is high-involvement, it is expected that attitudes will more likely correlate with later behavior.

#### Belief salience and attitudes

Closely related to involvement level theory, belief salience is thought to influence the predictive value of attitudes. Fishbein and Ajzen (1975) charge that investigators usually assume that if beliefs change, a change in behavior will necessarily follow. But Fishbein and Ajzen argue that for a given object, respondents (or a group of respondents), usually have a salient belief hierarchy; some beliefs will likely be perceived to be more relevant than others.

Otway, Maurer, and Thomas (1978) conducted a factor analysis on 39 belief statements about nuclear power that yielded four factors

(psychological risk, economic and technical benefits, sociopolitical risk, and environmental and physical risk). When they compared the pro and anti-nuclear respondents, their results showed a clear relationship between the respondent's attitudinal positions and the salience level of the factor. For the pro group, the economical and technical benefits factor made the most important contribution to their attitude, whereas for the anti group, the risk factors were most important. Their study showed that separate dimensions of the nuclear issue appear differentially salient to different attitude groups.

#### Previous belief-behavior studies

There have been several earlier studies that focused on the relationship of beliefs and subsequent behavior.

Jaccard et al. (1977) found high correlations (.78) between beliefs about the consequences of smoking cigarettes and the subject's intention to smoke cigarettes. This study didn't measure actual behavior, only the relationship between beliefs and behavioral intentions.

Jaccard, Knox and Brinberg (1979) used a panel study design in a field survey in which voting behavior was predicted based on the respondent's prior beliefs about candidates. The researchers measured a series of beliefs about how presidential candidates, Carter and Ford, stood on various issues and also measured the subjects intentions to vote for each candidate based on the subject's belief about the candidate's position on each issue. Subjects were later asked, one day after the election, how they had voted. Results yielded an average correlation between predicted and actual voting behavior of .75.

Kivlin and Fliegel (1967) sampled small and middle-scale dairy farmers in Pennsylvania, controlling for social and economic characteristics commonly found to be related to adoption behavior. Respondents were asked to rate a series of innovations they had previously adopted from a list of 15 attributes (such as initial cost, time savings, social approval, etc.). Kivlin and Fliegel called the farmers' responses their "perceptions" of an innovation's attributes. These perceived attributes are the equivalent of beliefs about the innovation's attributes as defined by Fishbein and Ajzen (1975) and others. Kivlin and Fliegel found that the small-scale farmers were slower to adopt new innovations than middle-scale farmers. However, slower adoption was seen not only as a function of production scale, but was also associated with differences in farmer's beliefs about the innovation. Differences in belief strength were found to be associated with rate of adoption and size of the farm operation.

#### CHAPTER IV. HYPOTHESES: THE ADOPTION PROCESS

The various models of innovation diffusion outlined in Chapter II often deal with very different aspects of innovation diffusion. Similarly, the study of attitudes and behavior, the subject of Chapter III, seems to be applicable to just one area within the broader subject of innovation diffusion. All of these models, theories and perspectives can be classified under one or more of the following three categories:

**1. Innovation adoption prediction.**

- Classical diffusion model
- Economic constraints model
- Marketing and infrastructure perspective

**2. Correlates of the adoption process.**

- Classical diffusion model
- Involvement level theory
- Attitude-behavior theory

**3. Consequences of innovation diffusion.**

- Development perspective

The diffusion models in category 1 (Innovation adoption prediction), are primarily concerned with determining who adopts an innovation and why, and how adopters are different from non-adopters. These models typically compare adopters to non-adopters for various individual, socio-economic, or structural measures. The dependent variables selected for study by each model differs greatly. As described in Chapter II, the classical diffusion model typically explains adoption behavior through individual socio-behavioral variables, while the economic constraints model and the marketing and infrastructure perspective study the influence of economic and structural factors on innovation adoption. A review of past diffusion

studies listed in Rogers (1983) indicates that most previous diffusion studies have been concerned with innovation adoption prediction.

The models and theories in category 2 (Correlates of the adoption process), measure individual socio-behavioral variables before, during and after innovation adoption in an attempt to isolate the effects of the innovation adoption process. These models and theories are concerned with such questions as: What is the role of attitudes in the adoption process? Does attitude change occur before or after adoption? Do individuals go through stages in the adoption process? Do behavioral changes occur after innovation adoption?

The development perspective of category 3 employs macro level variables to analyze the impact of innovation adoption. For example, if the development perspective were used to study microcomputer diffusion among farmers, such factors as the impact of micros on the economic and social system and how these changes might affect individual farmers would be studied.

#### **Selection of the Research Problem: Studying the Innovation Adoption Process**

An analysis of each of the models, perspectives and theories in all three of these categories would be an enormous task well beyond the scope of this thesis. Therefore, this study will limit its investigation to exploring the models and theories found under the second category of innovation diffusion, correlates of the adoption process.

The panel study design of the Iowa farm computer study is well suited to study the adoption process because, over a two year period, the pre and post-adoption behavior of one group of farmers was recorded. The data

also allow this group of farmers to be compared with two other groups: those who had already adopted micros when the survey began in 1982, and those who never adopted micros during the two year period of the survey.

Research that looks at the stages and decision processes that occur during innovation adoption has been lacking, according to Rogers: "Given the importance of the stages concept in diffusion research, it is rather puzzling that more research has not been directed toward understanding the innovation-decision process. Perhaps it is because the process nature of this research topic does not fit the variance type of research methods used by most diffusion researchers" (Rogers, 1983:193).

Generally, the three perspectives listed under correlates of the adoption process (the classical diffusion model, involvement level theory, and attitude-behavior theory), are complementary.

Selected concepts from each of these three perspectives can be brought together in order to develop hypotheses about events that occur in the microcomputer adoption process.

### **The Process of Innovation Adoption**

The innovation adoption process occurs over time and consists of a series of actions and choices (Rogers, 1983). It is the process by which an adopter passes from awareness of the existence of an innovation, to building knowledge and forming an attitude about the innovation, to deciding to adopt or reject the innovation, and finally, to actual adoption of the innovation and confirmation of the adoption decision (Robertson et al., 1984). Through this process an individual evaluates a new idea and decides whether or not to adopt the new idea or product.

Assuming that there are no significant economic or structural constraints on the ability to adopt, adoption behavior basically consists of dealing with the uncertainty that is inherently involved in the adoption decision.

#### The classical diffusion model

The classical model postulates that during the innovation adoption process an adopter sequentially passes through a series of stages. The names ascribed to these stages vary somewhat from researcher to researcher. The following adoption stages are taken from Robertson et al. (1984), because they are a typical classification of the stages, and because they are very similar to the adoption stages used in the Iowa farm computer study.

In the first adoption stage, an individual becomes aware of the existence of an innovation. At this stage, a person has little information about the innovation and has not developed an attitude towards the innovation because he has not yet evaluated the innovation. During the second stage, the individual acquires some knowledge about the innovation by searching for additional information. This information search involves an active search for external information sources, such as the experience of friends or information from the mass media. Based on this information, the individual evaluates the innovation and forms a positive or negative attitude towards it. Following the evaluation stage, a decision is made whether or not to adopt the innovation. During this trial stage, the innovation is symbolically or actually used to determine whether or not the innovation is worthwhile. Based on the additional information obtained during this trial stage, a decision is made whether



or not to adopt the innovation and adoption or rejection follows (Robertson et al., 1984).

Attitude formation occurs at the evaluation stage. Many individuals know about innovations they don't adopt. Sometimes this is because an individual doesn't regard the innovation as relevant to his situation. Consideration of a new idea doesn't pass beyond the awareness stage if an individual doesn't define the innovation as relevant or if the individual lacks sufficient knowledge so an attitude about the innovation can form (Rogers, 1983).

At the evaluation stage, the individual becomes more psychologically involved with the innovation and seeks more information about the idea. At this stage, the individual wants to know if his thinking is similar to his peers on this matter, so he seeks out the subjective opinions of his near-peers who have had personal experience with the innovation (Rogers, 1983:170). Interpersonal communication sources are more important at this stage because mass media messages are too general to provide the specific kind of information that's needed (Rogers, 1971).

It is assumed that formation of an attitude about the innovation at the evaluation stage will be consistent with subsequent behavior, although many times attitudes and actions are quite disparate. However, there is a tendency for attitudes and behavior to become consistent (Rogers, 1971). Rogers does not mention the possibility of attitude change after adoption.

In their 1971 book, Communication of Innovations, Rogers and Shoemaker modified this model with the replacement of the adoption stage by the implementation and confirmation stages.

The implementation stage occurs when an individual puts an innovation

into use (Rogers, 1983). The adopter will likely have questions about how to use the innovation, so active information seeking takes place. The length of the implementation stage is indeterminant. But eventually a point is reached in which the new idea becomes institutionalized. This point is considered to be the end of the implementation stage. Although Rogers (1983) does not say so, it would seem that the end of the implementation stage is marked by a decline in information seeking.

The confirmation stage is marked by information seeking also, but this information seeking is motivated by cognitive dissonance. The individual seeks reinforcement for the adoption decision. Throughout this stage, the individual seeks to avoid a state of dissonance or to reduce it if it occurs. The dissonance may occur if the individual discovers further information that persuades him that he should not have adopted. This dissonance may be reduced by discontinuing the innovation. If an individual originally decided to reject the innovation, exposure to pro-innovation messages may cause a state of dissonance that can be reduced by adoption. But it is often difficult to change one's prior decision to adopt or reject an innovation, perhaps a considerable cash outlay was involved in adoption. Therefore, individuals frequently try to avoid becoming dissonant by selectively seeking information that they expect will support or confirm the decision already made (Rogers, 1983).

It would seem to be somewhat difficult to determine how these two stages are different from each other. Both involve information seeking, the main difference seems to involve the motivation behind the information seeking. One could easily imagine a situation in which both the implementation and confirmation stages were occurring at the same time.

However, Rogers seems to indicate that they are sequential (for example Rogers, 1983:165). Further refinement of these two stages would be beneficial for future research.

The classical diffusion model implies that the stages in the adoption process are hierarchically ordered. Individuals tend to pass through the stages in some sort of sequential order (Brown, 1981).

These are the five adoption stages used in the Iowa farm computer study (refer to question 4., page 96, Appendix A):

- Stage 1. Awareness - Individuals know the innovation exists, but have no detailed information about it.
- Stage 2. Knowledge - Individuals know details about micros but have not considered acquiring one.
- Stage 3. Evaluation - Individuals consider adopting micros, but have not made an adoption decision.
- Stage 4. Symbolic adoption - Individuals say they definitely intend to acquire a micro.
- Stage 5a. Rejection - Individuals are assumed to know the innovation exists, but reject the idea of adopting it.
- Stage 5b. Adoption - Individuals have adopted micros.

Two of these stages (the symbolic adoption and the rejection stages) are not usually found in classical diffusion studies. In the classical model, the trial stage normally refers to the stage at which individuals actually try out the innovation. In the farm computer study, individuals were considered to have symbolically adopted micros when they said they had decided to purchase a micro. Respondents were not asked if they had actually used micros. Also, unlike most classical studies, respondents could indicate whether they had definitely decided not to acquire a microcomputer (the rejection stage).

### Involvement level theory

According to involvement level theory, it is very important to determine the involvement level of an innovation because involvement level affects an individual's behavior towards an innovation. As described in Chapter II, an adopter's involvement level in the adoption-decision process depends on these five factors:

1. Cost
2. Interest
3. Perceived risk
4. Situation
5. Social visibility

Involvement level of micros      The cost of micros is in the thousands of dollars, and the perceived risk of adopting micros is probably fairly high (based on their purchase price and the farmer's concern that he receive a return on his investment). According to the Iowa farm computer survey (Scherer and Yarbrough, 1984), farmers use micros primarily for business, therefore, the level of interest in micros is assumed to be high. The social visibility of micros seems to be low, since they are normally situated within the adopter's home. Social visibility would probably be higher if the adopter was involved in a computer user group. Situational factors associated with micros are difficult to judge. Perhaps if the individual bought a micro cooperatively with another person involvement might be higher. Therefore, when microcomputers are judged according to this list, they appear to be a high-involvement innovation.

Involvement level theory hypothesizes that there are behavioral differences in the adoption process for high- versus low-involvement

innovations (Robertson et al., 1984). The following are behaviors expected to be true only for high-involvement innovations:

1. Adopters actively seek product information.
2. Adopters resist discrepant information and utilize counter-arguments.
3. Adopters process information in a hierarchy of effects decision sequence.
4. Attitude change about the innovation is more difficult and rare.
5. Message content about the innovation is more important than the sheer number of messages.
6. Loyalty to a particular brand is common.
7. Post-adoption cognitive dissonance is common.
8. Other people are used for information and social-imitation purposes. Personal influence is operative mainly when the innovation is important and ego-involving.

#### Attitude-behavior theory

It is first necessary to decide whether the Iowa farm computer survey's belief questions concerning micros constitute attitudes. According to the definition of attitudes used by Rokeach (1970), if the belief questions found in the Iowa farm computer survey are grouped into sets of interrelated beliefs, they can be defined as attitudes. Fishbein and Ajzen (1975) would consider these questions to be just beliefs, beliefs that might later lead respondents to form an attitude about computers. They postulate that these beliefs would likely correlate with the respondents attitudes toward computers, yet the beliefs could not be considered to be attitudes.

Because of the attitude definition controversy in the literature, there are no clear guidelines for deciding whether the farm computer survey's belief questions constitute attitudes. For the purposes of this study, I will use Rokeach's conceptualization of attitudes and consider the belief questions to be attitudes.

For different reasons, Rogers (1983) and Fishbein and Ajzen (1975) raise the possibility that attitudes can change after innovation adoption. Rogers conceives of post-behavioral attitude change as being caused by cognitive dissonance. Fishbein and Ajzen believe attitudes can change as a result of learning new information about the innovation. Neither specify the conditions under which attitude change occurs. Bem (1967) postulated that attitude change would occur after adoption, but in his conceptualization, because attitudes derive from behavior, attitudes would not be expected to have any predictive power with respect to adoption.

Belief salience may be important for understanding the relationship between attitudes and micro adoption in the farm computer study, because this idea leads us to expect that not all beliefs about micros will be given equal consideration by all potential adopters. A sort of belief hierarchy may develop (Fishbein and Ajzen, 1975). The concept of salience has been extended to attitudes as well as beliefs (Fiske and Taylor, 1984). Therefore, we might expect that with regard to adoption, attitudes about the overall economic value of micros might be more important than attitudes about the reliability of micros.

### **Formation of Hypotheses**

The literature contains many models and conceptualizations of the

process of innovation evaluation and adoption. Hypotheses derived from this literature can be classified under three categories:

- A. Stages in the adoption process.
- B. Information use during the adoption process.
- C. The role of attitudes in the adoption process.

For each of these categories, hypotheses will be developed based on the literature and the variables available from the Iowa farm computer survey.

#### A. Stages in the adoption process

Hypothesis 1. Adopters of micros move through stages in the adoption process: through awareness, knowledge, evaluation and symbolic adoption (trial), and finally, to innovation adoption or rejection.

Hypothesis 1 is derived from the classical diffusion model and involvement level theory. Movement through these stages is believed to be characterized by a linear progression through the adoption stages.

Involvement level theory characterizes this as the hierarchy of effects decision sequence, which is believed to occur only with high involvement level innovations.

#### B. Information use during the adoption process

Hypothesis 2. Individuals who are in the evaluation and symbolic adoption stages will seek information about an innovation from interpersonal sources to a greater degree than individuals in earlier adoption stages.

This hypothesis is derived from two closely related generalizations made by Rogers: 1) at the evaluation and symbolic adoption stages, individuals are motivated to seek innovation evaluation information

especially from interpersonal contacts with near-peers who have had previous experience with the innovation (Rogers 1983:170), and 2) "Mass media are relatively more important at the knowledge stage and interpersonal channels are relatively more important at the persuasion (evaluation) stage in the innovation-decision process" (Rogers, 1983:198-199).

Unfortunately, it is not easy to directly test either of these generalizations. In the case of the first generalization, the Iowa farm computer survey does not provide an adequate measure of near-peers as information sources, although two items from the survey likely include near-peers: 1) Item 3k (see Appendix A, 1984 questionnaire), "Talked about computers with other farmers who are using them," and 2) Item 3l, "Talked about computers with non-farm users."

It is not known exactly who these people are. Another contributing problem in this area is Rogers' failure to define what a "near-peer" is, other than saying they're "...someone like ourselves" (Rogers, 1983:170). One mollifying factor is that research has shown that interpersonal diffusion is mostly homophilous (Rohling et al. 1976:159). Therefore, to some unknown degree, these contacts are likely to be at least somewhat homophilous.

The Iowa farm computer survey also does not provide an adequate measure of mass media information sources. While four of the computer information sources are clearly interpersonal information sources, only one of the twelve sources can be classified as a mass media information source, (reading magazines and newspaper articles about computers). The other seven information sources, such as attending a computer exhibit at a



fair, visiting a computer dealer, or taking a college computer course, can't clearly be placed in either category. Therefore, the available questions do not allow an adequate measure of the relative importance of mass media versus interpersonal computer information sources, nor does the literature provide guidance in how to deal with information sources that are neither interpersonal nor mass media.

Nevertheless, the literature does suggest that the use of interpersonal information sources should be higher for those who are evaluating and have symbolically adopted micros than the use of interpersonal information sources by those who are in earlier adoption stages. The two items from the questionnaire that were outlined earlier (3k and 3l), will be summed and used to test hypothesis 2. Nothing can be found in the literature concerning what happens to interpersonal information seeking relative to other types of information seeking after adoption.

Hypothesis 3. Individuals will continue to seek information about computers after they adopt microcomputers.

Generally, there is very little in the literature about post-adoption information seeking. One of the few studies that measured post-adoption information seeking (Mason, 1963) found that information seeking continued to be high after innovation adoption. Both Mason (1963) and Rogers (1983) attribute post-adoption information seeking to dissonance reduction, to the need for reinforcement of the adoption decision already made. Rogers (1983) predicts that information seeking will occur in the implementation and confirmation stages, but he does not predict the level of post-adoption information seeking that will occur. Mason (1963) concluded that

post-adoption information seeking normally occurred. Neither differentiate between what types of information seeking might be more commonly used after adoption.

The lack of research in this area reveals a weakness in the classical diffusion model. Study of the adoption process has typically stopped when an innovation has been adopted (Brown, 1981).

### C. The role of attitudes in the adoption process

Hypothesis 4. After the evaluation stage, attitudes about micros will change little.

Hypothesis 5. Attitude change is not likely after micro adoption.

Hypotheses 4 and 5 are derived from involvement level theory.

Attitudes that have been formed about high involvement innovations after product evaluation are believed to be relatively stable (Robertson et al., 1984).

Hypothesis 6. Prior to adopting micros, individuals who will adopt micros during the time span of the farm computer survey will have more positive attitudes towards micros than individuals who never adopt micros.

This hypothesis is derived from involvement level theory and the classical diffusion model. Attitudes and behavior are believed to have a tendency to be consistent, according to the classical model (Rogers, 1983). Therefore, a more positive attitude towards computers that develops during the evaluation stage will more likely lead to micro adoption. Involvement level theory modifies this stance by predicting attitude-behavior consistency will occur only with a high involvement innovation (such as microcomputers). This hypothesis assumes that individuals who are about to adopt micros will be in, or have already

passed through the evaluation stage (see Hypothesis 1).

Hypothesis 7. Prior to adopting micros, individuals who will adopt micros during the time span of the farm computer survey will not have more positive attitudes towards micros than individuals who never adopt micros. Instead, attitudes about micros will become more positive only after micro adoption.

This hypothesis, which is the opposite, or null hypothesis of hypothesis 6, is based on Bem's (1967) self-perception theory, which proposes that changes in attitude occur only after behavior.

Self-perception theory and involvement level theory are the only two perspectives that specify the conditions under which attitude change might occur after the performance of a behavior. Self-perception theory proposes that this usually occurs. Involvement level theory states that this is likely to occur only with low-involvement products. However, this does not apply to micros, since they have been defined as high-involvement level products (see page 40 of this chapter).

The other theories and perspectives that have been reviewed are not this specific. For example, the classical diffusion model and Fishbein and Ajzen (1975) predict that attitude change might follow behavior. Fishbein and Ajzen postulate that new knowledge gained about the innovation after adoption might lead to attitude change. The classical diffusion model proposes that post-adoption dissonance might result in attitude change. However, neither perspective clearly specifies the conditions under which post-adoption attitude change will occur.

Hypothesis 8. Attitudes will vary in the strength of their association with the micro adoption process.

This hypothesis is derived from the Fishbein and Ajzen (1975) and Fiske and Taylor (1984) conception of a hierarchy of beliefs or attitudes.

Some beliefs about an object will likely be perceived to be more salient to an individual than others.

Hypothesis 9. An attitude about performing a particular behavior associated with micros will be more highly correlated with the micro adoption process than attitudes about micros as an object.

Hypothesis 9 is derived from Fishbein (1967), Jaccard, King and Pomasal (1977) and Kelman (1974), all of whom postulated that a person's attitude toward performing a particular act in a given situation with respect to a given object is a better predictor of behavior than an attitude toward the object.

Ajzen and Fishbein (1977) also argued that attitudes and behavior will be more highly correlated when their measures are more closely interrelated. This postulate is actually very similar to their earlier assertion that attitudes towards performing a behavior will be more highly correlated with behavior than attitudes towards the object of the behavior. In this case, attitudes toward performing a behavior related to the object are more specific than attitudes about the object itself. Therefore, based on the attitudes available for analysis from the Iowa farm computer study, these two conceptions of attitude-behavior consistency lead to the same prediction.

#### **Overall Model of the Adoption Process**

The relationships between the variables measured in the Iowa farm computer study are represented by the model in Figure 1.



## CHAPTER V. METHODOLOGY

The Iowa State University (ISU) department of Journalism and Mass Communication, in cooperation with the Iowa State University Cooperative Extension Service, has conducted a survey of computer use among farmers in Iowa each year since 1982 (1985 was the most recent year in which data were accessible). However, only data from 1982 through 1984 will be used in this thesis because during these years the same respondents were surveyed, in 1985 a different sample of farmers was surveyed.

The Iowa farm computer study began in 1981 under the direction of Dr. J. Paul Yarbrough, who at that time was with the department of Journalism and Mass Communication at ISU. Then, beginning in January, 1983 until his departure in January, 1985, Dr. Clifford Scherer was the project leader. The current project director is Dr. Eric Abbott, of the ISU Journalism and Mass Communication department.

The Iowa farm computer study's theoretical design owes much to the classical diffusion model. Microcomputer diffusion among farmers is studied by measuring such individual socio-behavioral variables as communication and social behavior, management practices, and other psychological, attitudinal and demographic measures.

### **Selection of the Random and Select Farmer Samples**

Two groups of farmers were sampled in this study. The first group, the random sample, was a group of farmers systematically sampled from a list of subscribers to Wallaces Farmer magazine. The second group, or select sample, was compiled from a list of farmers identified by county or

area Extension personnel as farmers known to use, or be highly interested in computers. About half of the 522 farmers (51.7%) in the select sample actually owned microcomputers in 1982.

Only the select sample of farmers will be evaluated for this thesis. The random group of farmers contains but a small number of microcomputer adopters (2.4% in 1982, 7.4% in 1984). Such small numbers severely limit the validity of any statistical tests employed to study the adoption process. The select sample is well suited for studying the microcomputer adoption process, because, when viewed over the three year period of the study (1982 to 1984), three microcomputer adoption groups emerge:

1. Group 1 -- Farmers who adopted micros before 1982 (n=125).
2. Group 2 -- Farmers who adopted micros between the 1982 and 1984 surveys (n=55).
3. Group 3 -- Farmers who never adopted micros (n=100).

Since group 2 has been tracked through the micro adoption process, pre and post-adoption measurements have been recorded. This group of farmers can be compared to farmers who had adopted micros before the survey began in 1982, and to the farmers who never adopted micros. In this way, changes that occur during the adoption process can be better evaluated.

#### **Data Collection Methods**

Mailed survey questionnaires were used to collect the data. The questionnaires were mailed in the winter, before planting season, so that farmers would more likely be able to have time to complete the questionnaire. The questionnaire, 10 to 12 pages long, was modified

somewhat from year to year through the addition or deletion of some of the variables. However, the basic format of the questionnaires was essentially the same from 1982 through 1984 (a sample of the 1984 questionnaire can be found in Appendix A).

Development of the questionnaire began in 1981 with telephone and face-to-face interviews of microcomputer vendors and computer service personnel. These interviews were used to determine what computer services, equipment (hardware) and software were available to Iowa farmers. Farmers who used personal computers, programmable calculators or computer services were also interviewed. Robert W. Jolly, Extension economist, Barbara Woods, assistant to the Extension director, and other Extension Service personnel provided input into the development of the questionnaire.

The mail survey basically followed the methodology recommended for mail surveys by Dilman (1978). The first questionnaire was sent by first class mail in February or March of each year. A personally addressed letter on departmental letterhead, and a business reply envelope for returns were enclosed with each questionnaire. About one week later, a postcard was sent to all those surveyed, thanking them for having returned the questionnaire, or, if they had not done so, reminding them to return it. Two or three weeks after the initial mailing, non-respondents were sent a second personalized letter, another questionnaire and a reply envelope. Finally, after another two weeks, a second reminder postcard was mailed to those who still had not returned the questionnaire.

Data on the samples and the usable responses obtained from the select sample of farmers are presented in Table 1. The targeted return rates



were 75 percent for each year.

Table 1. Iowa farm computer adoption study samples

| SAMPLE                      | SPRING 1982 | WINTER 1983 | WINTER 1984 |
|-----------------------------|-------------|-------------|-------------|
| <u>Select farmer sample</u> |             |             |             |
| Sampled                     | 522         | 420         | 365         |
| Usable responses            | 423 (81%)   | 370 (88%)   | 307 (84%)   |

### Statistical Procedures Used to Test Each Hypothesis

#### Stages in the adoption process

Hypothesis 1. Adopters of micros move through stages in the adoption process: through awareness, knowledge, evaluation and symbolic adoption (trial), and finally, to innovation adoption or rejection.

Hypothesis 1 can be tested simply by determining whether individuals who adopt micros during the time frame of the Iowa farm computer study are randomly distributed among adoption stages (awareness through symbolic adoption), or whether they tend to cluster in the evaluation and symbolic adoption stages, as might be expected if individuals go through stages during the adoption process.

To test this hypothesis, adoption groups 2 and 3 will be crosstabulated by adoption stages in 1982, before anyone had adopted micros. The crosstabulation chi-square statistic will test the significance of the differences between the two groups.

Information use during the adoption process

- Hypothesis 2. Individuals who are in the evaluation and symbolic adoption stages will seek information about an innovation from interpersonal sources to a greater degree than individuals in earlier adoption stages.
- Hypothesis 3. Individuals will continue to seek information about computers after they adopt microcomputers.

In order to test these hypotheses, a computer information seeking index needs to be constructed. For hypothesis 2, this index consists only of near-peer (interpersonal) information sources. As described in Chapter IV (under the discussion of hypothesis 2), it was decided that item 1k (see Appendix A, 1984 questionnaire), "Talked about computers with other farmers who are using them," and item 1l, "Talked about computers with non-farm users", would represent interpersonal information sources.

For hypothesis 3, which was concerned with the use of all computer information sources, a computer information seeking index was developed from items 1 b, c, d, f, g, i, j, k and l on the farm computer questionnaire (Appendix A). These items were selected because they were assumed to represent active computer information seeking, information that an individual would normally have to make some effort to obtain, such as visiting a computer dealer. The other three items (1a, e, and h), were believed to be information sources that were less likely to represent active information seeking, (such as 1e, "Attended a computer exhibit at a fair or expo").

For the items used in both hypotheses 2 and 3, the responses to these items were assigned numbers (Never=0, once=1, twice=2, three times=3, and four or more times=4), and the responses were summed in order to create computer information seeking indices for each year. A higher information

seeking index number is assumed to indicate a higher level of information seeking about computers.

Hypotheses 2 and 3 can be analyzed through use of the SPSSPC+ MEANS program. This program performs an analysis of variance in order to measure the significance of the variance levels between nominal or ordinal level data and ordinal or ratio level data. For these hypotheses, the evaluation and symbolic adoption stages were recorded as one adoption stage and run against either the awareness and knowledge stages (for hypothesis 2), or the adoption stage (for hypothesis 3). The dependent variable was interpersonal computer information sources (hypothesis 2), or all computer information sources (hypothesis 3). The combined evaluation and symbolic adoption stage was also run against the adoption stage for hypothesis 2. The value of the F test and the significance of the F test can be taken from the summary ANOVA table created by the MEANS program.

The SPSSPC+ MANOVA (multiple analysis of variance) program was also used for testing the differences over time in the computer information seeking levels between adoption groups 1, 2 and 3, and to test differences in information seeking for those who adopted micros by 1983 and those who adopted by 1984. (See pp. 60-61 of this chapter for a more detailed discussion of the MANOVA program.)

#### The role of attitudes in the adoption process

- Hypothesis 4. After the evaluation stage, attitudes about micros will change little.
- Hypothesis 5. Attitude change is not likely after micro adoption.

One problem with analyzing these hypotheses is the question of

whether to include individuals who may have been in the evaluation stage, or had adopted micros in 1982, but by 1984 had slipped back to earlier stages (such as the awareness stage). It could be argued that anyone who was at the evaluation stage, or had adopted a micro in 1982 should be included in the analysis, since their later behavior is just another aspect of the diffusion process. This is the position taken by the author. The classical diffusion model tends to assume that movement through the stages is linear and progressive, so this should occur very rarely.

As it turns out, this issue is not really a problem, because most people either stayed at the stage they were at in 1982, or in the case of those at the evaluation stage in 1982, the majority moved to either the symbolic adoption stage or actually adoption micros. Twelve and one-half percent of the 1982 evaluators (10 out of 80 respondents) moved to the awareness and knowledge stages in 1984. The remainder either stayed at the evaluation stage (33.8%) or moved to the symbolic adoption (10%), rejection (1.3%), or adoption stages (42.5%). Only 4.8% (6 of 126 people) of the 1982 adopters moved back to an earlier adoption stage by 1984.

In conclusion, it was decided to include everyone in the data analysis who was at the evaluation stage in 1982 (n=80) and everyone who had adopted micros in 1982 (n=177).

The SPSSPC+ MANOVA program was used to test changes in the attitudes over time of those who were in the evaluation and adoption stages in 1982. (See p. 60-61 of this chapter for a more detailed discussion of this program.)

- Hypothesis 6. Prior to their adoption of micros, individuals who will adopt micros during the time span of the farm computer survey will have more positive attitudes towards micros than individuals who never adopt micros.
- Hypothesis 7. Prior to their adoption of micros, individuals who will adopt micros during the time span of the farm computer survey will not have more positive attitudes towards micros than individuals who never adopt micros. Instead, attitudes about micros will become more positive only after micro adoption.
- Hypothesis 8. Attitudes will vary in the strength of their association with the adoption process.
- Hypothesis 9. An attitude about performing a particular behavior associated with micros will be more highly correlated with the micro adoption process than attitudes about micros as an object.

Hypotheses 6 through 9 are included together here, because for all four of these hypotheses (and also hypotheses 4 and 5), attitudes needed to be derived from the fifteen belief statements about computers found in the questionnaire (Items 3a through 3o, 1984 questionnaire, Appendix A). The SPSSPC+ factor analysis program (Norusis, 1986) was used to develop attitudes (underlying belief structures) from the belief statements. (The theoretical justification for doing this is based on Rokeach's (1970) definition of attitudes, see Chapter III, page 23. Also, researchers such as Otway, Maurer and Thomas (1978) commonly use factor analysis on a collection of belief statements in order to yield underlying factors. These factors are called attitudes by the researchers).

The factor analysis consisted of several steps. First, the possible responses to each belief statement were coded. The belief statements were written in a Likert scale format, a 1 represented strong disagreement with a belief statement about some attribute of computers, 2 indicated disagreement, 3 represented a neutral response, 4 represented agreement,

and 5 indicated strong agreement. Some of the statements had to be recoded into their reverse values so that the values for all 15 belief statements were consistently positive or negative towards computers (for example, statement 3c (see Appendix A) needed to be recoded so that a 5 became a 1, a 4 became a 2, and so on). In this way, a higher number always represented a more positive evaluation of computers.

Next, following the recommendations of Kim and Mueller (1985), varimax rotation and an eigenvalue of 1.0 were used in the SPSSPC+ factor analysis program. (These are the SPSSPC+ defaults.) Factor analyses were separately run for each of the three years of the survey in order to increase the reliability of the factor results. Also, to increase reliability, three extraction methods were used: principal components analysis (the SPSSPC+ default), principal axis factoring and the maximum likelihood method. This step was not recommended by Kim and Mueller (1985). They recommend that the default extraction method of the statistical package be used. However, based on conversations with two statistical consultants at ISU, (Robert Hurd of the Journalism and Mass Communication department, and Dr. Daniel Hoyt of the Sociology department), the use of more than one extraction method was recommended, because this was an exploratory exercise. The questions used in the survey had not previously been tested for reliability or validity. Using more than one extraction method was considered to be a useful means of indicating the stability of the factors over time. There was some deviation from 1982 to 1984 in the factor results, but three factors (or attitudes) tended to emerge (see Appendix B).

The work of Fishbein and Ajzen (1975), Kelman (1974) and Jaccard,

King and Pomasal (1977), led to the expectation that the five belief statements that deal with using computers for farm management would all load as one factor. These five statements all deal with performing a behavior specifically related to computers. The other ten belief statements were more general statements about various attributes of computers as objects. The literature did not provide a guide for predicting how these items would factor.

#### Factor analysis results

Factor 1 (Attitude 1) consisted of the respondent's beliefs about the usefulness of computers for farm management as predicted by the literature. This attitude was derived from these five statements:

1. By using a computer I would be able to solve many of my own problems without relying on others.
2. Owning a computer will give me far greater control over my farm management decisions.
3. It will be easier to keep my records on a computer than it is in my usual way.
4. A computer will allow me to keep records that I can't keep now.
5. Computers will make it easy to get information I need for farm management.

The factor analysis partitioned out the remaining ten statements as follows: Factor 2 (Attitude 2) consisted of the respondent's beliefs about the overall value of computers today. This attitude was derived from these four statements:

1. Farm computers won't be economically feasible for at least five years.
2. Until computer programs for use on the farm are improved, computers won't be worth using.

3. The kinds of computers being sold to farmers are just toys.
4. If a computer is to be useful for my farm, it will be necessary to write my own programs (or hire it done).

Factor 3 (Attitude 3) consisted of the respondent's fears about the safety of storing records on computers. This attitude was derived from these two statements:

1. I'm afraid the IRS or government could get access to my farm records if I use a computer.
2. I am afraid I'll lose my records if I put them into a computer.

For all three attitudes, an attitude index was created by summing the responses (values 1 through 5) for each belief statement in order to create attitude indices for each year. A higher attitude index number is assumed to indicate a more positive attitude towards some attribute of micros.

Four of the belief statements did not correspond to the other three factors, nor did they correlate with each other. Therefore, these four belief statements are not included in the data analysis:

1. It will be very difficult to develop or modify computer programs to fit my farming operation.
2. In order to use a computer you must be smart in math.
3. I would have a computer now, but they are too difficult to operate.
4. Computers are just for the big farmers.

#### Manova and repeated measures design

The repeated measures design of the SPSSPC+ multivariate analysis of variance (MANOVA) package was considered to be the appropriate statistical test for analyzing the variables associated with hypotheses 3 through 8



because these hypotheses deal with variables that are measured for each respondent over a three year period. Repeated measures design is useful for this circumstance, when responses are given for the same items by the same respondents over time. The advantage of this design lies in its ability to eliminate variability due to differences between subjects from the experimental error (Norusis, 1986).

Hypotheses 3 through 8 were analyzed by the repeated measures design of the SPSSPC+ MANOVA program (in order to analyze changes between the adoption groups over time), and by the MANOVA program without the repeated measures design (in order to analyze differences between groups for each separate year).

#### Multiple regression

The SPSSPC+ multiple regression program was used to test hypothesis 9 instead of the MANOVA program. Multiple regression is a method used to test the ability of independent variables to explain the variance in a dependent variable at any given period of time (Dowdy and Wearden, 1983). MANOVA was used in hypotheses 3 through 8 to track the behavioral changes of respondents over time for each variable. Manova is used to measure differences over time among respondents for a variable; multiple regression can be used to measure the relationship of a dependent variable to two or more independent variables. Hypothesis 9 is concerned with how well the three attitudes about computers can explain the variance associated with the dependent variable (the adoption process). Multiple regression is considered to be appropriate for this type of analysis (Norusis, 1986:B-197).

For hypothesis 9, we want to discover whether the three attitudes about computers can account for variance associated with progression through the adoption stages. In multiple regression, this can be accomplished by building a model consisting of the independent variables that are believed to explain variance in the dependent variable. The reliability of the regression equation is measured by the multiple regression correlation coefficient ( $R$ ). The square of  $R$  ( $R^2$ ) can be interpreted as the proportion of the variance in the dependent variable that can be explained by the model (Dowdy and Wearden, 1983).  $R^2$  will fall between 0 and 1, and if the model fits the data well,  $R^2$  will be close to 1. If the linear model is a poor fit,  $R^2$  will be close to 0. Multiplied by 100,  $R^2$  can be interpreted as the percent of variance in the dependent variable explained by the independent variables.

For this thesis, the major independent variables that are being evaluated in relationship to the adoption process (the dependent variable) are computer information seeking and the three attitudes about computers. When these variables are entered into the multiple regression program (using stepwise regression), they constitute a model of the adoption process. The four independent variables (computer information seeking, and attitudes 1 through 3), can be analyzed to determine what percent of variance in the adoption process ( $R^2$  multiplied by 100) each of these variables explains (Dowdy and Wearden, 1983).

Computer information seeking has been entered into the model as well as the three attitudes because, according to Norusis (1986), adding all the variables that are believed to account for a significant proportion of the variance in the dependent variable produces a more accurate

representation of the variance explained by each independent variable. Since computer information seeking is hypothesized to be related to progression through the adoption process (hypotheses 2 and 3), this variable will be included in the regression model.

The dependent variable (the adoption process), is operationalized by assigning a number to the stages in the adoption process as represented by question 4 (Appendix A). Respondents were asked to indicate which statement best described their knowledge of, or experience with farm computer equipment which you operate yourself. The responses available for this question<sup>2</sup>, the values associated with these responses, and the stages they represent include:

1. Awareness - Have heard about (micros), but know few details.
2. Knowledge - Know details, but have not considered acquiring a micro.
3. Evaluation - Considered acquiring a micro, but have made no decision.
4. Symbolic adoption - Have definitely decided to acquire a micro.
5. Adoption - Have acquired computer equipment.

The numbering of the responses (1 through 5), creates an ordinal level index in which a higher number is assumed to represent progression through the stages of adoption. (The ordinal nature of this variable is based on the assumption that movement through the adoption stages is progressive, cognitive and linear.)

---

<sup>2</sup> The choices in Question 4 numbered 1 and 6 (have not heard of micros, and have decided not to acquire one) are not included in this analysis because: a. there was only one person in the unaware stage, and b. the behavior of those who reject the idea of owning a micro is worthy of another thesis, and will not be examined at this time.

Therefore, multiple regression will measure the percent of variance associated with progression through the adoption stages that can be explained by the independent variables. This will test whether attitude 1 (an attitude about performing a particular behavior associated with micros, i.e., using micros for farm management), or attitudes 2 and 3 (attitudes about micros as objects) explain a greater percent of the variance associated with movement through the adoption stages. (Movement through the adoption stages is considered to be operationally synonymous with the adoption process.)

## CHAPTER VI. FINDINGS AND DISCUSSION

The following discussion of the results will be presented in the same basic format as Chapters IV and V.

### Stages in the Adoption Process

Hypothesis 1. Adopters of micros move through stages in the adoption process: through awareness, knowledge, evaluation and symbolic adoption (trial), and finally, to innovation adoption or rejection.

If the process of micro adoption is characterized by a cognitively directed, linear progression through the adoption stages, we might expect that farmers who are going to adopt micros during the next two years will have progressed further through the adoption stage sequence than farmers who will not adopt micros during the farm computer study. We might also expect that farmers who will later adopt micros will more likely be in the evaluation and symbolic adoption stages than those who do not adopt. As can be seen in Table 2, this is what appears to occur.

Table 2. Adoption stages in 1982 of farmers who subsequently adopted micros in 1983 or 1984 and farmers who never adopt micros

| Adoption Stage    | Adopted<br>83-84<br>(n=55) | Never<br>Adopted<br>(n=100) |
|-------------------|----------------------------|-----------------------------|
| Unaware           | 0                          | 1.0%                        |
| Awareness         | 5.5%                       | 12.0%                       |
| Knowledge         | 7.3%                       | 24.0%                       |
| Evaluation        | 61.8%                      | 46.0%                       |
| Symbolic Adoption | 25.5%                      | 12.0%                       |

Table 2. Continued

| Adoption Stage | Adopted<br>83-84<br>(n=55) | Never<br>Adopted<br>(n=100) |
|----------------|----------------------------|-----------------------------|
| Rejection      | 0                          | 5.5%                        |
|                | <u>Chi-square</u> = 15.9   | <u>Significance</u> = .007  |

Fifty-five farmers adopted micros during the time span of the Iowa farm computer study (1982 to 1984). As indicated in Table 2, of the 55 farmers who adopted micros between the 1982 and 1984 surveys, 87.3% (n=48) of them were in the evaluation or symbolic adoption stages in 1982. Three people were at the awareness stage and 4 were at the knowledge stage.

The results were quite different for the 100 farmers who did not adopt micros during the farm computer study. In 1982, 58 (58%) of these people were in the evaluation or symbolic adoption stages, 37 were in earlier adoption stages (unaware to knowledge) and 5 had rejected the idea of adopting micros. The chi-square for this crosstabulation was significant at the .007 level. Therefore, hypothesis 1 is supported. Almost 90% of the farmers who adopted micros during the farm computer study were in the later stages of the adoption process (evaluation and symbolic adoption). This percentage was significantly higher than it was for those who did not adopt micros.

#### Information Use During the Adoption Process

**Hypothesis 2.** Individuals who are in the evaluation and symbolic adoption stages will seek information about an innovation from interpersonal sources to a greater degree than individuals in earlier adoption stages.

Table 3 indicates that in every year, individuals at the evaluation and symbolic adoption stages sought significantly more information about micros from interpersonal sources than individuals at the awareness and knowledge stages (F test significant at levels of .000 to .005).

Therefore, hypothesis 2 is supported.

However, Table 3 also indicates that in every year, individuals who have already adopted micros seek significantly more information about micros from interpersonal sources than individuals who are in other stages. The literature does not specifically discuss this possibility.

Table 3. Interpersonal information source use by adoption stage<sup>a</sup>

| Adoption Stage                   | 1982 | Sig  | 1983 | Sig  | 1984 | Sig  |
|----------------------------------|------|------|------|------|------|------|
| Awareness                        | 2.53 |      | 2.33 |      | 4.0  |      |
| Knowledge                        | 2.40 |      | 3.20 |      | 3.24 |      |
| Evaluation and Symbolic Adoption | 4.60 | .000 | 4.48 | .000 | 5.11 | .005 |
| Post-adoption                    | 5.94 | .000 | 6.16 | .000 | 6.28 | .000 |

<sup>a</sup>The sample sizes for each year were: Awareness - 1982=15, 1983=15, 1984=16. Knowledge - 1982=25, 1983=10, 1984=17. Evaluation and Symbolic Adoption - 1982=101, 1983=90, 1984=62. Adoption - 1982=118, 1983=144, 1984=172.

Hypothesis 3. Individuals will continue to seek information about computers after they adopt microcomputers.

Figure 2 indicates that in all three years of the survey, as individuals move through the adoption stages, the use of all micro information sources increases. High levels of computer information

seeking continue even after micros have been adopted; therefore, hypothesis 3 is supported. But an interesting phenomena not discussed in the literature is operating here. At least in the case of micros, individuals do more than just continue to seek information after adoption. Instead, micro adoption appears to lead to a pronounced increase in information seeking.

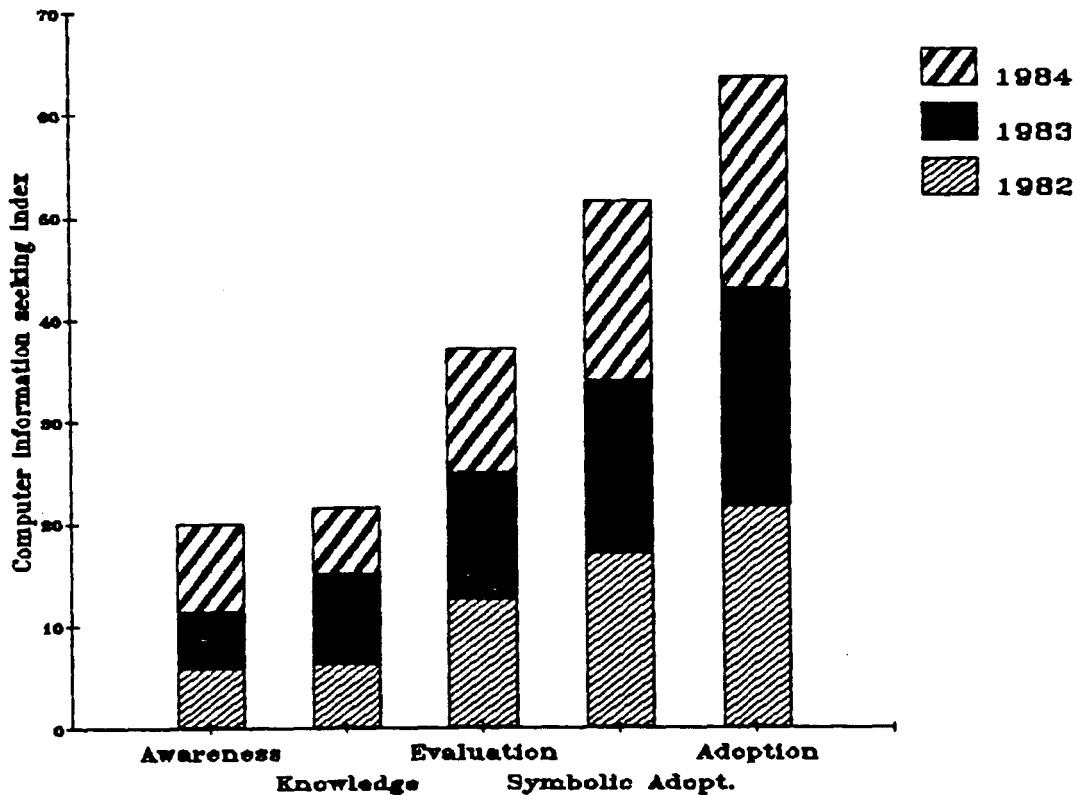


Figure 2. Information seeking level by adoption stage in 1982, 1983 and 1984

Figure 3 illustrates the effect of micro adoption on information seeking. Group 1 represents individuals who adopted micros between 1982



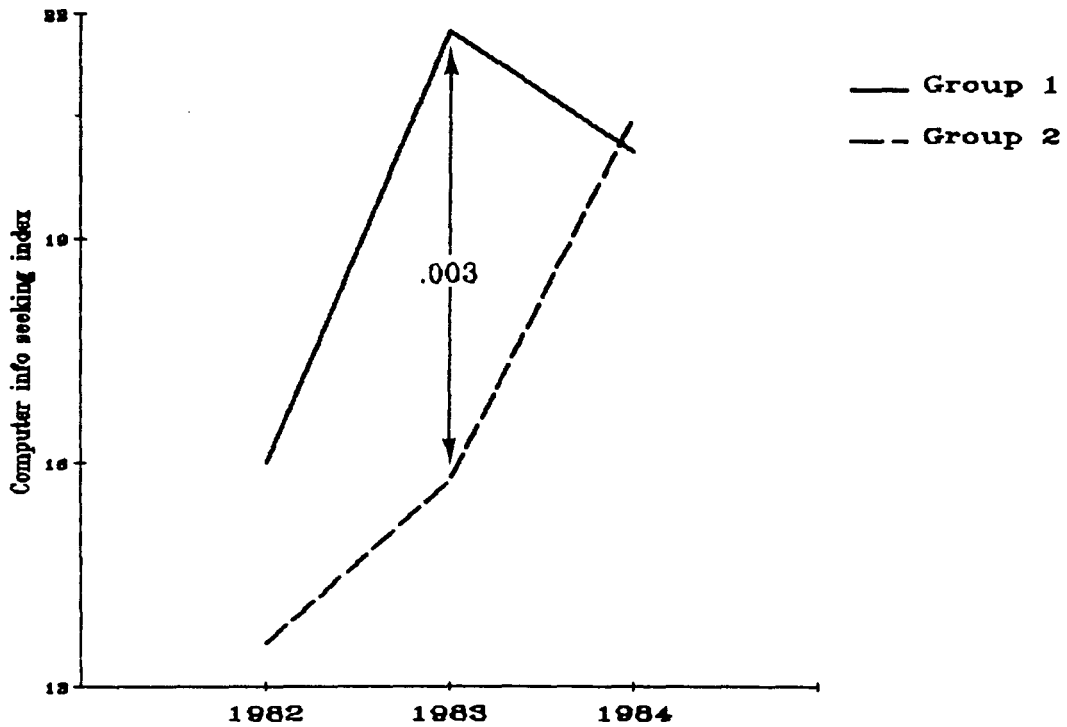


Figure 3. Information seeking behavior of farmers who adopted micros in 1983 and farmers who adopted micros in 1984

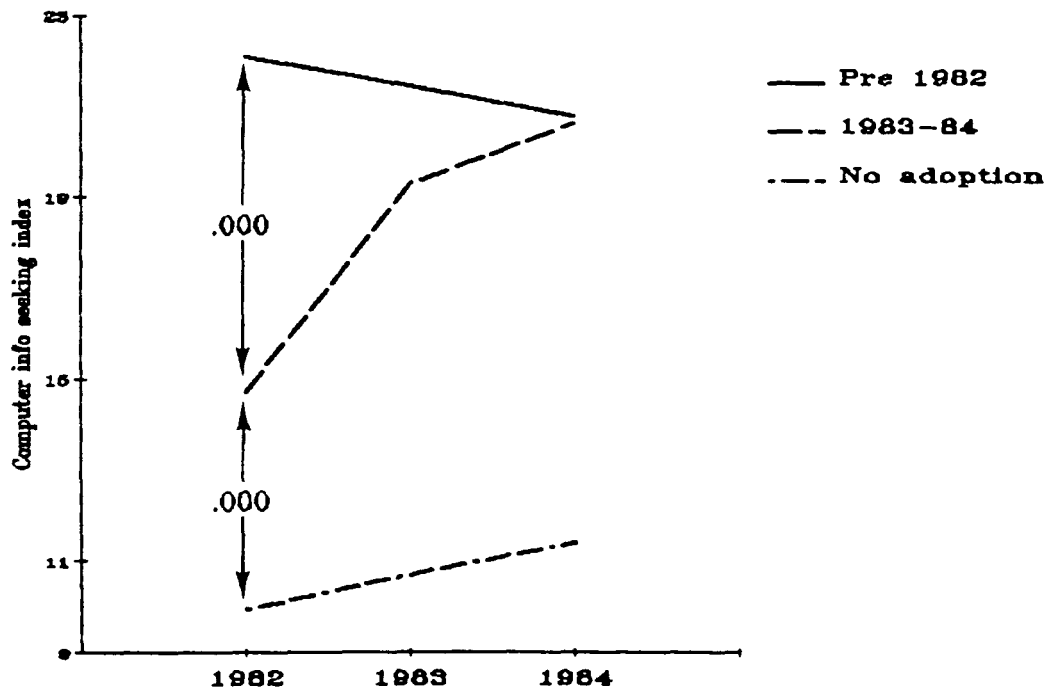


Figure 4. Information seeking behavior of farmers who adopted micros before 1982, farmers who adopted micros between 1982 and 1984, and farmers who did not adopt micros

and 1983 (n=26), group 2 represents individuals who adopted micros between 1983 and 1984 (n=21). As indicated in Figure 3, in 1982 (before either group had adopted a micro), there was not a significant difference (.199) in the information seeking indices between the two groups. By 1983, group 1 had adopted micros and this group's information seeking score jumped from 16.0 to 21.77. Meanwhile, for group 2 (who had not yet adopted micros), information seeking increased by a much smaller degree. As a result, in 1983 there was a significant difference (.003) in the computer information seeking indices of groups 1 and 2. However, in 1984, after group 2 had adopted micros, there was no significant difference again between the two group scores.

At least in the case of microcomputers, increased post-adoption information seeking is a significant phenomenon. Even two years after adoption, computer information seeking remains high. Figure 4 illustrates this. Farmers who adopted micros before 1982 (n=106) are represented by the top line. Farmers who adopted micros between 1982 and 1984 (n=48) are represented by the middle line, and farmers who never adopted micros (n=81) are represented by the bottom line. The information seeking index of farmers who adopted micros before 1982 declined only slightly between 1982 and 1984 (from 22.1 to 20.7).

It is interesting to contrast the information seeking behavior of those who adopted micros during this period with the relatively stable information seeking behavior of both those who had already adopted micros, and those who never adopted micros. In 1982, farmers who adopted micros between 1982 and 1984 had a computer information seeking score that was in between the other two groups, and significantly different from either

group (at a .000 level). But after adoption, their 1984 index score increased so that it became virtually identical to the score of the farmers who adopted micros before 1982 (20.6 vs. 20.7).

#### The Role of Attitudes in the Adoption Process

Hypothesis 4. After the evaluation stage, attitudes about micros will change little.

As indicated in Table 4, two of the three attitudes about micros changed significantly from 1982 to 1984 for those who were at the evaluation stage in 1982. This was contrary to hypothesis 4. Admittedly, there may be some question as to what Robertson et al. (1984) meant when he said attitudes would change little, but in this case, a change in two attitudes that is significant at the .05 level or below is considered to be a sufficiently major change. Therefore, hypothesis 4 is rejected.

Table 4. Test of Hypothesis 4, "After the evaluation stage, attitudes about micros will change little"

|                   | 1982  | 1984  | F     | Significance of F |
|-------------------|-------|-------|-------|-------------------|
| Attitude 1 (n=78) | 17.91 | 17.23 | 4.05  | .048 *            |
| Attitude 2 (n=77) | 14.62 | 15.62 | 15.82 | .000 *            |
| Attitude 3 (n=80) | 8.29  | 8.15  | 1.00  | .320              |

\* Significant change

Hypothesis 5. Attitude change is not likely after micro adoption.

Table 5 indicates that for individuals who had adopted micros in 1982, only one of their three attitudes about micros (Attitude 2) changed significantly from 1982 to 1984.

Table 5. Test of Hypothesis 5, "Attitude change is not likely after micro adoption"

|                    | 1982  | 1984  | F    | Significance of F |
|--------------------|-------|-------|------|-------------------|
| Attitude 1 (n=122) | 19.01 | 18.80 | .51  | .476              |
| Attitude 2 (n=122) | 16.18 | 16.94 | 15.4 | .000 *            |
| Attitude 3 (n=126) | 8.44  | 8.52  | .45  | .504              |

\* Significant change

It is somewhat difficult to determine whether a significant change in one of three attitudes is a sufficient reason to reject hypothesis 5. The precise wording of hypothesis 5 (attitude change is not likely after adoption), which is based on a statement found in Robertson et al. (1984:125), is not really compatible with quantitative measurement. If all three of the attitudes had changed significantly between 1982 and 1984, or even if two of the three had changed significantly (as was the case with hypothesis 4), rejection of hypothesis 5 would seem to be justified.

However, it should be noted that the degree of change among these attitudes is highly variable. Attitudes 1 and 3 showed very small changes over time, while attitude 2 showed a high degree of change ( $F=15.4$ ). Attitude 2 consists of people's beliefs about the overall value of computers, and between 1982 and 1984, micros became cheaper, more readily available, more powerful, and because of better software, more useful tools.

The economic history perspective (discussed in Chapter II) might be useful in understanding these phenomena. This perspective recognizes that

innovations change over time, something the traditional diffusion model has not normally acknowledged (Brown, 1981). The traditional model has instead focused almost exclusively on changes in the responses of adopters to a presumably immutable innovation. However, studies of the diffusion of innovations among industrial firms and public sector organizations have highlighted the importance of changes in innovations over time, changes which may increase the attractiveness of the innovation (through profitability or relative advantage) to a growing number of potential adopters (Brown, 1981).

Therefore, it seems possible that the changes observed in attitude 2 may reflect adopter's responses to changes in the innovation. But why didn't the other two attitudes also change? The subject of attitude 2 might be important. This attitude represents the beliefs people have about the overall value of micros (both economic value and general usefulness), while attitude 1 consists of specific beliefs related to using computers for farm management, and attitude 3 consists of beliefs about the safety of storing records on computers. Perhaps the changes that occurred in micros during this period were better reflected by attitude 2, since this attitude embodies beliefs about the economic cost and overall usefulness of micros.

This question cannot really be answered without more specific investigation into the reasons why only this attitude changed between 1982 and 1984. Based on the available data, it is not known whether a significant change in attitude 2 is cause for accepting or rejecting hypothesis 5.

Hypothesis 6. Prior to their adoption of micros, individuals who will adopt micros during the time span of the farm computer survey will have more positive attitudes towards micros than individuals who never adopt micros.

Figures 5, 6 and 7 illustrate differences between the group of farmers who adopted micros between 1982 and 1984 (the top line in each figure), and farmers who did not adopt micros during this period (the bottom line in each figure). For attitudes 1 and 2 (Figures 5 and 6), there was a significant difference between the two groups in 1982 (.05 level or less), before anyone had adopted micros. For attitude 3 (Figure 7), there was not a significant difference between the two groups in 1982. In two cases out of three, hypothesis 6 is supported. (Further discussion of this hypothesis follows under hypothesis 7.)

Hypothesis 7. Prior to their adoption of micros, individuals who will adopt micros during the time span of the farm computer survey will not have more positive attitudes towards micros than individuals who never adopt micros. Instead, attitudes about micros will become more positive only after micro adoption.

As noted in Chapter IV, this hypothesis appears to be the null hypothesis of hypothesis 6. The levels of significance associated with attitudes 1 and 2 were found to provide support for hypothesis 6. It is, therefore, interesting to discover that hypothesis 7 appears to be supported by post-adoption changes in attitude 3 (Figure 7) and to some degree, by changes associated with attitude 2 (Figure 8).

As indicated in Figure 7, there was no significant difference in 1982 between the two groups for attitude 3, but in 1984, after group 1 had adopted micros, there was a significant difference between the two groups. The differences between the two groups for attitude 3 (which consists of beliefs about the safety of storing records on computers), appear to

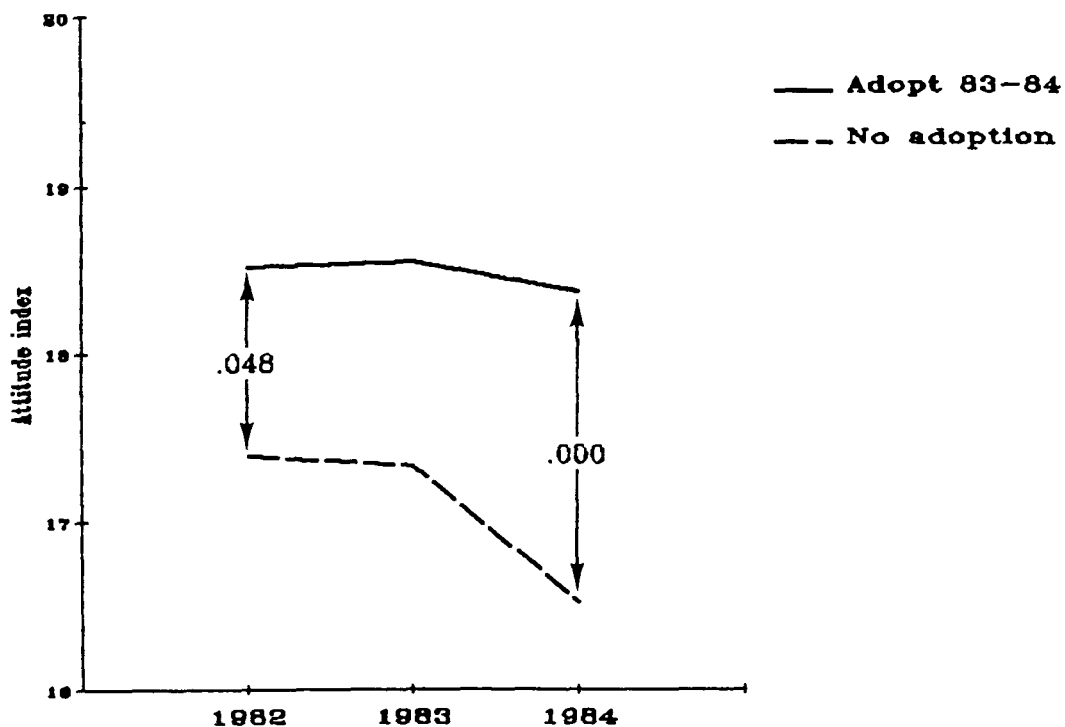


Figure 5. **Attitude 1 (1982-1984):** Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros

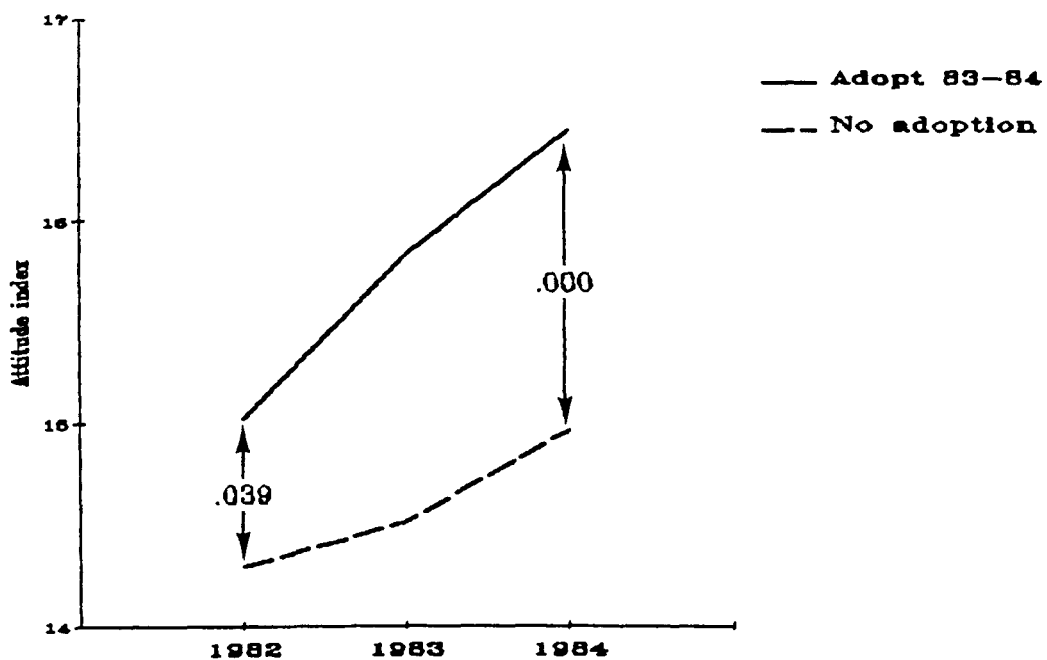


Figure 6. **Attitude 2 (1982-1984):** Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros

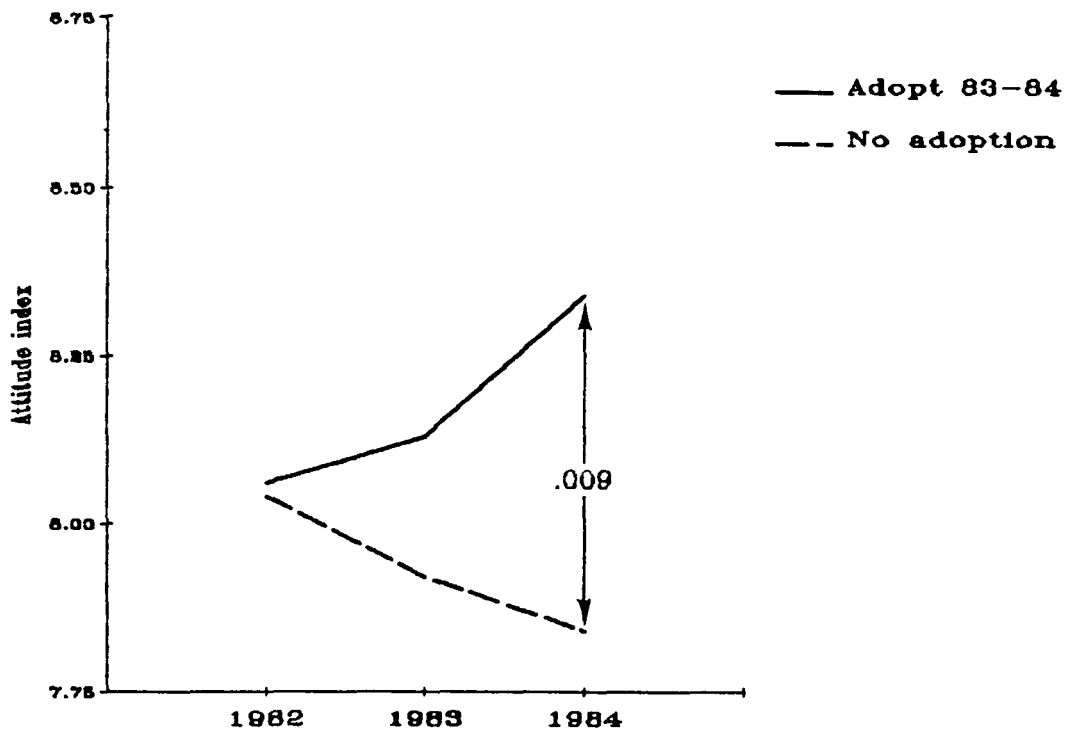


Figure 7. **Attitude 3** (1982-1984): Differences in the attitude index scores of farmers who adopted micros in 1983 and 1984 and farmers who did not adopt micros

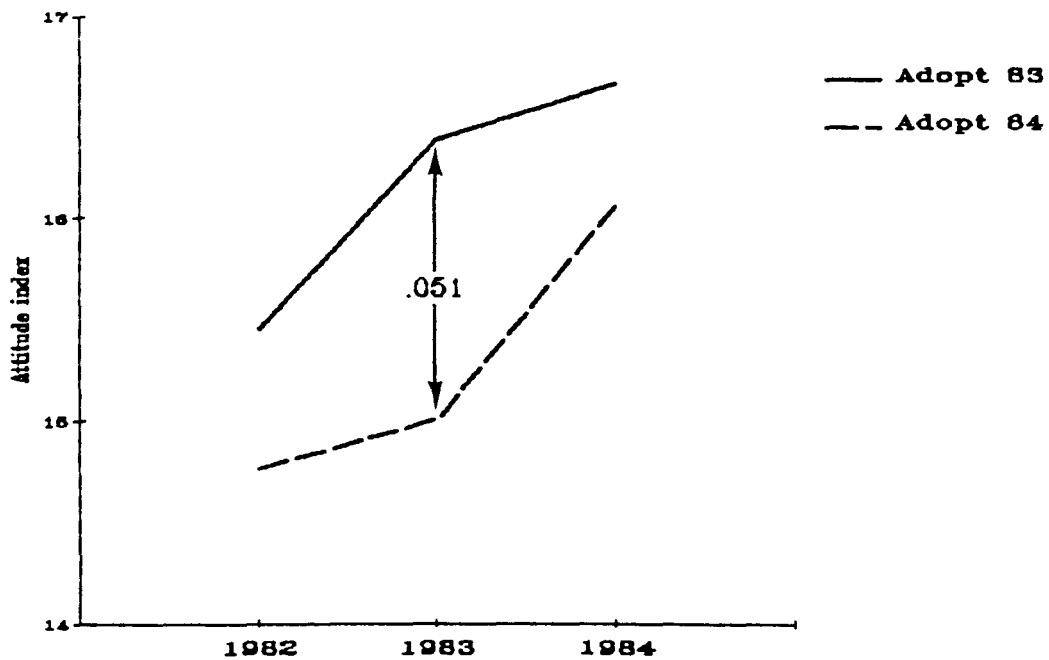


Figure 8. **Attitude 2** (1982-1984): Differences in the attitude index scores of farmers who adopted micros in 1983 and farmers who adopted micros in 1984



become significant only after adoption, as predicted by self perception theory.

Paradoxically, the changes over time associated with attitude 2 provide support for hypothesis 6 and to some degree, for hypothesis 7. As indicated in Figure 6, in 1982 attitude 2 was significantly higher (.039) for the group that adopted micros between 1982 and 1984, when compared to the group that never adopted micros. However, Figure 8 appears to indicate that attitude 2 also changed significantly (.051) as a consequence of micro adoption.

The top line in Figure 8 represents farmers who adopted micros between the 1982 and 1983 surveys. The bottom line represents farmers who adopted micros between the 1983 and 1984 surveys. In 1982, before either group had adopted micros, there was no significant difference between the two groups. By 1983, after the first group had adopted micros, this group's attitude score had increased from 15.45 to 16.38. The second group's attitude score increased slightly from 14.76 to 15.0. As a result, in 1983 the difference in attitude scores of the two groups became extremely close to being significantly different (at a .051 level). In 1984, after both groups had adopted micros, there was again no significant difference between the two groups in their attitude scores. Figure 8 indicates that micro adoption tends to induce change in attitude 2.

To the extent that hypothesis 7 postulates attitude change after adoption, the behavioral changes associated with attitude 2 provide support for hypothesis 7. However, hypothesis 7 proposes that attitudes will become significantly different only after adoption. For both attitudes 1 and 2, these attitudes were significantly higher before

adoption. But micro adoption does seem to influence beliefs about the overall value of computers (attitude 2), and the safety of storing records on computers (attitude 3). Therefore, both hypothesis 6 and hypothesis 7 are partially supported. Both types of attitude change (pre and post-adoption) seem to be occurring.

Hypothesis 8. Attitudes will vary in the strength of their association with the micro adoption process.

The preceding discussion has already demonstrated that attitudes vary in their strength of association with micro adoption. In the case of attitudes 1 and 2, in 1982, prior to adoption, individuals who adopted micros between 1982 and 1984 had significantly more positive attitudes towards micros than individuals who did not adopt micros. However, this was not true for attitude 3. Hypothesis 8 is supported, attitudes about micros vary in the strength of their association with micro adoption.

Hypothesis 9. An attitude about performing a particular behavior associated with micros will be more highly correlated with the micro adoption process than attitudes about micros as an object.

In each year (1982 through 1984), only one attitude (attitude 2 — an attitude about micros as objects), was significantly related to movement through the adoption stages (Table 6).

Computer information seeking explained much of the variance associated with movement through the adoption stages (48.9% to 37.4%). Attitude 2 explained from 3 to 3.5% of the variance (% variance is determined by multiplying  $R^2 \times 100$ ; see Chapter V, p. 13). The standardized residual scatterplots for these variables indicated that the residuals were randomly distributed, so the assumptions of linearity and

Table 6. The percent of variance in the dependent variable (the adoption process) explained by computer information seeking and attitudes 1, 2 and 3 in 1982, 1983 and 1984<sup>a</sup>

| Independent variables  | 1982<br>(n=250) |       | 1983<br>(n=248) |       | 1984<br>(n=263) |      |
|------------------------|-----------------|-------|-----------------|-------|-----------------|------|
|                        | R <sup>2</sup>  | Beta  | R <sup>2</sup>  | Beta  | R <sup>2</sup>  | Beta |
| Computer info seeking* | .489            | .701  | .408            | .639  | .374            | .612 |
| Attitude 1             |                 | -.045 |                 | -.053 |                 | .06  |
| Attitude 2*            | .035            | .210  | .030            | .189  | .034            | .204 |
| Attitude 3             |                 | .040  |                 | .074  |                 | .11  |

\* Significant at .05 or less all three years

<sup>a</sup>SPSSPC prints only the betas for variables not entered into the stepwise regression.

homogeneity of variance were met (Norusis, 1986:B-207). The R<sup>2</sup> and Betas were very close, although the Betas (when squared) tended to be a little more optimistic than R<sup>2</sup> concerning the percent of variance explained.

The multiple regression model indicated that attitude 2 was the only attitude that explained a significant proportion of the dependent variable. Attitudes 1 and 3 were consistently thrown out of the model by stepwise regression because they did not explain a significant proportion of the variance associated with the adoption process. Attitude 2 was determined to be significant in all three years (significance of the F test was .000 each year). Therefore, hypothesis 9 is rejected. Attitude 1 (an attitude about performing a behavior associated with micros -- using micros for farm management), was not

found to be more highly correlated with movement through the adoption stages than attitude 2 (an attitude about computers as objects -- the overall value of computers).

## CHAPTER VII. CONCLUSIONS

The behavior associated with the two key independent variables of this study (computer information seeking and attitudes towards computers) departs from the model of the adoption process developed from the literature in several ways.

### Computer Information Seeking

One of the most striking features of this study is the relationship between information seeking about micros and movement through the adoption stages. Information seeking about computers increased as individuals moved from one adoption stage to another. During the three years of the study, computer information seeking explained between 37% and 49% of the variance associated with progression through the adoption stages (Table 6, p. 79). After adoption, information seeking jumped to still higher levels. Other examples of this phenomenon of increased information seeking after adoption were not found in the literature. What could account for increased post-adoption information seeking?

One possible reason might have to do with the very high information needs associated with operating a micro. Because of the complexity and rapid evolution of micros, operating a micro tends to require higher levels of information than many other high involvement innovations, such as new corn hybrids or feed additives. Regression analysis indicates that computer information seeking explains far more of the variance associated with movement through the adoption process than do attitudes about computers.

### Attitudes, Information Seeking and the Adoption Process

The relationship of attitudes to movement through the adoption stages is not easy to explain. Data analysis provides a measure of support for both of these claims: a. The formation of attitudes precedes micro adoption (attitudes 1 and 2), and b. attitudes change after micro adoption (attitudes 2 and 3). How can both of these occur at the same time?

Two theories of the attitude-behavior relationship were reviewed in Chapter III:

1. Cognitive dissonance. Attitudes may change after adoption because of a need to reduce cognitive dissonance in the mind of the adopter; to justify the adoption decision.
2. Self-perception theory. Attitudes normally change after adoption not because of cognitive dissonance, but simply as a descriptive response to the adoption of an innovation.

Both of these theories tend to assume that people spend little time thinking about a product prior to adoption. These theories postulate that attitude change after adoption is believed to occur either as a product of dissonance reduction strategies, or merely as a stimulus-response type of phenomena. Neither of these two theories adequately explains how each of the three attitudes in this study can have different relationships with micro adoption.

For example, for those who had already adopted micros and those who adopted micros during the study, attitude 1 was stable over the three year period. This attitude changed (became more negative) only for the group that did not adopt micros. Like attitude 1, in 1982 attitude 2 was significantly more positive for those who had adopted micros and those who

were going to adopt micros than it was for those who did not adopt. However, unlike attitude 1, attitude 2 seemed to become even more positive after adoption.

Unlike the other two attitudes, attitude 3 was not significantly more positive in 1982 for the group that was going to adopt micros. This attitude became significantly different between those who adopted and those who didn't only after adoption.

It is difficult to explain the diverse behavior associated with these three attitudes with either cognitive dissonance or self-perception theory. Why do each of these attitudes have a different, sometimes opposite relationship to the adoption process?

#### **Attitude Salience-Information Seeking Model**

An alternative model to these two theories can be developed from the work of Fishbein and Ajzen (1975). A combination of the concepts of belief (or attitude) salience and attitude change as the product of a cognitively active learning process, may provide a more adequate explanation of the attitude-behavior relationships found in this study.

Fishbein and Ajzen believe that for a given object, respondents usually have a salient belief hierarchy. Some beliefs will likely be perceived to be more important than others (Fishbein and Ajzen, 1975:397). They also say that "...in the final analysis a person can form new beliefs only by performing some behavior" (Fishbein and Ajzen, 1975:511). When these concepts of attitude salience and attitude change as the result of a learning process are combined, a model of information seeking, attitudes and behavior can be developed that is partly based on the assumption that

attitude salience will guide the type of information that is sought about an innovation.

This model assumes the following: the various attitudes individuals have about micros will not all be equally salient to a person. We might expect that some attitudes (such as attitudes about the overall value of computers, or the usefulness of computers for farm management), might be more highly salient to an individual who is evaluating micros than some other attitude (such as fears about the safety of storing records on computers). If some attitudes are more salient than others, we might further expect that individuals would seek information related to the attitude areas they are more concerned with. Having gathered information about the salient attitude subjects, we could expect that the attitude formed in relation to this subject will be more stable and better developed than an attitude about a low salience topic for which there would be a subsequently low level of information seeking. Therefore, the low salience attitude might not be well-formed prior to adoption, but might develop only after adoption, when an individual has learned more about all aspects of the innovation as a result of experience with the innovation.

This attitude salience-information seeking model could conceivably account for the behavior associated with the three attitudes in this study. Attitude 1 was stable over time because this attitude (about using farm computers for management) is presumed to be highly salient to farmers. Before adoption, farmers sought information about this topic and formed a positive, stable attitude that was associated with later adoption. The same may be true for attitude 2. Farmers had already



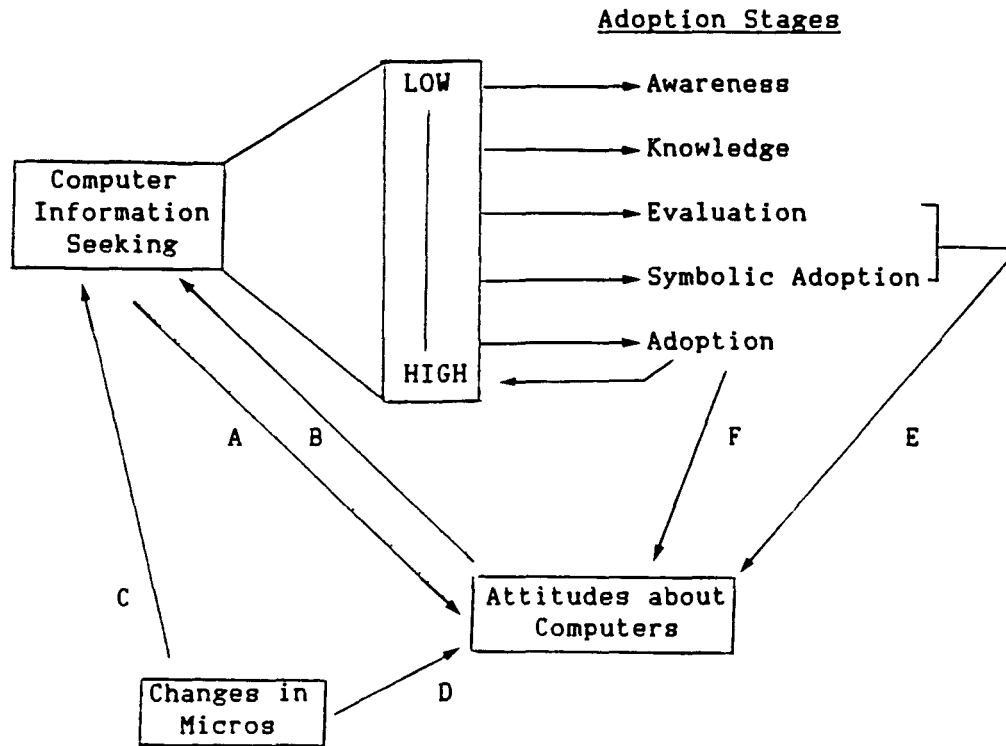
formed a more positive attitude about the value of computers prior to adoption. However, in this case, the attitude became even more positive after adoption. Perhaps this was a result of changes that occurred in the innovation itself (especially with regard to lower prices), combined with the learning process that resulted from actual adoption.

In this model, attitude 3 would then represent a low-salience attitude. Prior to adoption, farmers gathered little information about the safety of storing records on computers because this subject was not perceived to be as important as the subjects of attitudes 1 and 2. Perhaps, farmers only learned about, or considered this subject after adoption, as a byproduct of adopting micros.

Admittedly, this model cannot be supported by the available data. The farm computer study does not directly measure belief salience, nor does it measure what type of information about computers was sought. However, this model has the advantage of being able to explain (at least conceptually), the various attitude-behavior relationships found in the Iowa farm computer study.

Analysis of the Iowa farm computer study indicates that several important phenomena occur during the micro adoption process:

1. Computer information seeking accounts for a high percent of the variance associated with movement through the micro adoption process.
2. Computer information seeking increases after micro adoption and remains high several years after adoption.
3. Attitudes about micros display widely different relationships with the adoption process. The concept of attitude salience may be useful in understanding this behavior.



- A = Computer information seeking helps form attitudes  
 B = Salient attitudes influence type of information sought  
 C = Change in innovation influences type of information sought  
 D = Change in innovation influences attitudes about computers  
 E = Attitudes partially form during the evaluation and symbolic adoption stages (Attitudes play minor role in movement through the adoption stages).  
 F = Attitudes may change as a result of experience with micros.

Figure 9. Attitude salience-information seeking model of the micro adoption process

#### Need for Further Research

In order to learn more about the interrelationships of information seeking, attitudes and the adoption process, future research should be directed towards measuring attitude salience and the kinds of information

that are sought about an innovation.

Factor analysis of the computer information sources may be helpful in learning about how information sources change as individuals move through the adoption stages.

It should be remembered that the factor analysis conducted for this thesis is only exploratory. More sophisticated data analysis such as a confirmatory factor analysis procedure (Lisrel), could reveal more about the relationships of these variables to the adoption process.

## REFERENCES

- Ajzen, Icek and Martin Fishbein  
1977 "Attitude-behavior relations: A theoretical analysis and review of Empirical Research." Psychological Bulletin 84:888-918.
- Allport, G. W.  
1935 "Attitudes." Pp. 798-844 in C. Murchison (ed.), A Handbook of Social Psychology. Worcester, Massachusetts: Clark University Press.
- Audirac, Ivonne and Lionel J. Beaulieu.  
1984 "Diffusion/adoption of microelectronic technology in farming." Gainesville, Florida: Institute of Food and Agricultural Sciences, University of Florida. (Mimeograph.)
- Bagozzi, Richard P. and Robert E. Burnkrant  
1975 "Attitude organization and the attitude-behavior relationship." Journal of Personality and Social Psychology 37:913-929.
- Belk, Russel W.  
1975 "Situational variables and consumer behavior." Journal of Consumer Research 2 (Dec):157-164.
- Beltran, S.  
1976 "Alien premises, objects and methods in Latin American communication research." Pp. 15-42 in E. M. Rogers (ed.), Communication and Development: Critical Perspectives. Beverly Hills: Sage Publications.
- Bem, Daryl J.  
1967 "Self-perception: an alternative interpretation of cognitive dissonance phenomena." Psychological Review 74:183-200.
- Bordenave, J. D.  
1976 "Communication of agricultural innovations in Latin America: the need for new models." Pp. 43-62 in E. M. Rogers (ed.), Communication and Development: Critical Perspectives. Beverly Hills: Sage Publications.
- Brown, Lawrence A.  
1981 Innovation Diffusion: A New Perspective. New York: Methuen and Company.
- Bultena, Gordon and Eric Hoiberg  
1983 "Farmers adopting computers bit by bit." Agri Marketing 21(2):13-16.

- Cacioppo, J. T., Harkins, S. G. and R. E. Petty  
 1981 "Repetition, cognitive responses, and persuasion." In R. E. Petty, T. M. Ostrom, and T. C. Brock (eds.), *Cognitive Responses in Persuasion*. Hillsdale: Erlbaum.
- Calder, Bobby J.  
 1979 "When attitudes follow behavior -- A self perception/dissonance interpretation of low involvement." Pp. 25-49 in John C. Maloney and Bernard Selverman (eds.), *Attitude Research Plays for High Stakes*. Chicago: American Marketing Association.
- Camboni, Silvana M. and Ted L. Napier  
 1984 "The adoption and continued use of consumer farm technologies: A test of a diffusion-economic constraint model." Paper presented at the annual Rural Sociological Society meetings, College Station, Texas.
- Cialdini, Robert B., Richard E. Petty and John Cacioppo  
 1981 "Attitude and attitude change." *Annual Review of Psychology* 32:366-404.
- Day, George S. and Terry Deutscher  
 1982 "Attitudinal predictions of choices of major appliance brands." *Journal of Marketing Research* 19 (May):192-198.
- Dilman, Donald  
 1978 *Mail and Telephone Surveys*. New York: John Wiley and Sons.
- Dowdy, Shirley and Stanley Wearden  
 1983 *Statistics for Research*. New York: John Wiley and Sons.
- Downs, G. and L. Mohr  
 1976 "Conceptual issues in the study of innovation." *Administration Science Quarterly* 21:700-714.
- Edwards, A. L.  
 1957 *Techniques of Attitude Scale Construction*. New York: Appleton-Century-Crofts.
- Feller, Irwin  
 1981 "Three coigns on diffusion research." Part II in Robert Rich (ed.), *The Knowledge Cycle*. Beverly Hills, California: Sage Publications.
- Fishbein, Martin and Icek Ajzen  
 1975 *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, Massachusetts: Addison-Wesley.
- Fishbein, Martin  
 1967 *Attitude and the prediction of behavior*. in M. Fishbein (ed), *Readings in Attitude Theory and Measurement*. New York: Wiley.

- Fiske, Susan T. and Shelley E. Taylor  
1984 Social Cognition. New York: Random House.
- Flinn, W. L. and F. H. Buttel  
/ 1980 "Sociological aspects of farm size: ideological and social consequences of scale in agriculture." Paper presented at the annual American Economics Association Meetings, University of Illinois.
- Gergen, K.  
1974 Social Psychology: Explorations in Understanding. Del Mar, California: CRM Books.
- / Goss, Kevin F.  
1979 "Consequences of diffusion of innovations." Rural Sociology 44(4):754-772.
- Hagerstrand, T.  
/ 1967 Innovation Diffusion as a Spatial Process. Chicago: University of Chicago Press.
- Hainard, F. and F. H. Buttel  
1983 "Ou va donc la sociologie rurale nord-Américaine?" Sociologica Ruralis 23(2):145-157.
- Havens, A. E., and W. L. Flinn  
1976 "Green revolution technology and community development: the limits of action programs." Economic Development and Cultural Change 23 (3):469-481.
- Hill, Richard J.  
1981 "Attitudes and behavior." Pp. 347-377 in Morris Rosenberg and Ralph Turner (ed.), Social Psychology. New York: Basic Books, Inc.
- Hooks, Gregory M., Ted L. Napier, and Michael V. Carter  
1983 "Correlates of adoption behaviors: The case of farm technologies." Rural Sociology 48 (2):308-323.
- Jaccard, James, Richard Knox and David Brinberg  
1979 "Prediction of behavior from beliefs: An extension and test of a subjective probability model." Journal of Personality and Social Psychology 37(7):1239-1248.
- Jaccard, James, G. W. King and R. Pomasal  
1977 "Attitudes and behavior: An analysis of specificity of attitudinal predictors." Human Relations 30:817-824.
- Kahle, Lynn R.  
1984 Attitudes and Social Adaptation. Oxford, England: Pergamon Press.

Katz, D.

- 1960 "The functional approach to the study of attitudes." *Public Opinion Quarterly* 24:163-177.

Kelman, Herbert C.

- 1974 "Attitudes are alive and well and gainfully employed in the sphere of action." *American Psychologist* 29:310-324.

Kim Jae-On and Charles W. Mueller

- 1985 *Introduction to Factor Analysis: What It Is and How To Do It.* Beverly Hills, California: Sage Publications.

✓ Kivlin, Joseph and Frederick Fliegel

- 1967 "Differential perceptions of innovations and rate of adoption." *Rural Sociology* 32:78-91.

Kotler, P.

- 1972 *Marketing Management: A Model Building Approach.* Englewood Cliffs: Prentice-Hall.

Krugman, Herbert E.

- 1965 "The impact of television advertising: Learning without involvement." *Public Opinion Quarterly* 29 (Fall):349-356.

Lionberger, Herbert F.

- 1960 "A method of measuring the communication potential of interpersonal communication networks." Paper presented at the annual Rural Sociological Meetings, University Park, Pennsylvania.

✓ Mason, Robert G.

- 1963 "The use of information sources by influentials in the adoption process." *Public Opinion Quarterly* 27:455-457.

Moscovici, Serge

- 1976 *Social Influence and Social Change.* London: Academic Press.

Norusis, Marija J.

- 1986 *SPSS/PC+ Advanced Statistics.* Chicago, Illinois: SPSS Inc.

Otway, H. J., D. Maurer and K. Thomas

- 1978 "Nuclear power: The question of public acceptance." *Futures* 10:109-118.

Quine, W. V. and J. S. Ullian

- 1970 *The Web of Belief.* New York: Random House.

✓ Radnor, M., I. Feller and E. Rogers

- 1978 "Research on the diffusion of innovations by organizations: a reappraisal." Pp. 1-16 in M. Radnor et al. (eds.), *The Diffusion of Innovations: An Assessment.* Evanston, Illinois: Northwestern University.

Regan, D. T. and R. H. Fazio

- 1977 "On the consistency between attitudes and behavior: Look to the method of attitude formation." *Journal of Experimental Social Psychology* 13:28-45.

Robertson, Thomas S., Joan Zielinski and Scott Ward

- 1984 *Consumer Behavior*. Glenview, Illinois: Scott, Foresman and Company.

Rogers, Everett M.

- 1962 "Characteristics of agricultural innovators and other adopter categories." In Wilbur Scramm (ed.), *Studies of Innovation and Communication to the Public*. Palo Alto, California: Stanford University, Institute for Communication Research.
- 1971 *Communication of Innovations: A Cross-cultural Approach*. 2nd edition. New York: Free Press.
- 1976 "Communication and development: The passing of the dominant paradigm." *Communication Research* 3:213-240.
- 1978 "The rise and fall of the dominant paradigm." *Journal of Communication* (Winter):64-69.
- 1983 *Diffusion of Innovations*. New York: The Free Press.

Rokeach, Milton

- 1970 *Beliefs, Attitudes and Values*. San Francisco: Jossey-Bass Inc.

Roling, Neil G., Joseph Ascroft, and Fred Wa Chege

- 1976 "The diffusion of innovations and the issue of equity in rural development." *Communication Research* 3 (2):155-170.

Rosenberg, N.

- 1976 "On technological expectations." *Economic Journal* 86:523-535.

Sawyer, Alan G.

- 1981 "Repetition, cognitive responses, and persuasion." In R. E. Petty, T. M. Ostrom, and T. C. Brock (eds.), *Cognitive Responses in Persuasion*. Hillsdale: Erlbaum.

Scherer, Clifford and J. Paul Yarbrough

- 1984 "An Examination of the Adoption of Microcomputers by Farmers in Iowa and New York." In *The Application of Computer Technology to Communication Processes*. NCR-90 Research Conference Proceedings, 1984.

Wicker, Allan W.

- 1969 "Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects." *Journal of Social Issues* 25(4):41-78.



ACKNOWLEDGEMENTS

I would like to thank Dr. Eric Abbott, Dr. Clifford Scherer and Dr. J. Paul Yarbrough for allowing me to have access to the Iowa Farm Computer Survey data set and for their support and encouragement.

I also wish to express my appreciation to the graduate students and faculty who have greatly enriched my graduate school experience. I consider myself fortunate to have known such people as Connie Tanczo, Celia Shapland, Daniel Brinkmeier, Charles Schlosser and many others.

\* \* \* \* \*

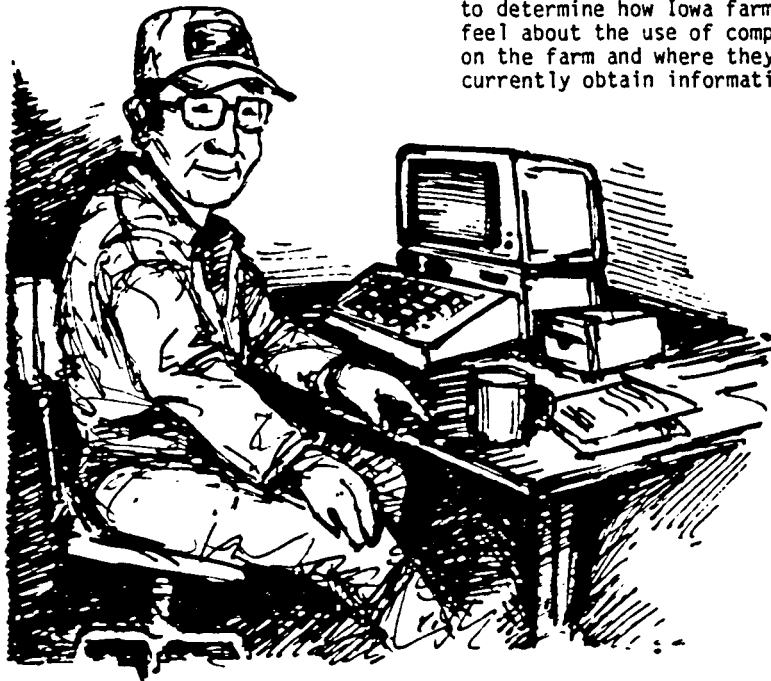
The data collection process for this study was reviewed and approved by the Iowa State University Committee on the Use of Human Subjects in Research. The committee members concluded that the rights and welfare of the human subjects were adequately protected, informed consent was obtained, social risks were not significant, and the confidentiality of the data provided by respondents was insured.

APPENDIX A: 1984 IOWA FARM COMPUTER QUESTIONNAIRE

# COMPUTERS and AGRICULTURE

## A SURVEY OF IOWA FARMERS-1984

The purpose of this survey is to determine how Iowa farmers feel about the use of computers on the farm and where they currently obtain information.



Agricultural and Home Economics Experiment Station Project 2514  
in cooperation with  
Iowa State University Cooperative Extension Service

Conducted by  
The Department of Journalism and Mass Communication  
Iowa State University  
Ames, Iowa 50011

1. Within the past year how often have you used the following sources to obtain information about computers?

How often within the past year have you used this source for computer information?  
(Please circle your answer)

- |   | NEVER | ONCE | TWO<br>TIMES | THREE<br>TIMES | FOUR OR<br>MORE TIMES |
|---|-------|------|--------------|----------------|-----------------------|
| a. How often have you read articles about computers in magazines or newspapers.....                     |       |      |              |                |                       |
| b. Read books or manuals about computers or computer operations.....                                    |       |      |              |                |                       |
| c. Written or telephoned for information from computer manufacturers or dealers....                     |       |      |              |                |                       |
| d. Visited a computer dealer.....   |       |      |              |                |                       |
| e. Attended a computer exhibit at a fair or expo.....   |       |      |              |                |                       |
| f. Taken a computer short course or workshop from a computer dealer, college or other organization..... |       |      |              |                |                       |
| g. Taken a course in computer operation or programming from a college or trade school.....              |       |      |              |                |                       |
| h. Attended an Extension meeting where at least part of the program was about computers.....            |       |      |              |                |                       |
| i. Talked with Extension staff about computers.....   |       |      |              |                |                       |
| j. Talked with college or high school teachers about computers.....                                     |       |      |              |                |                       |
| k. Talked about computers with other farmers who are using them.....                                    |       |      |              |                |                       |
| l. Talked about computers with non-farm users.....  |       |      |              |                |                       |

2. Do you receive any of the following kinds of computer publications or newsletters?  
(Please circle "yes" or "no" for each type)

- |  |    |     |
|--|----|-----|
| a. FARM COMPUTER PUBLICATIONS (such as Farm Computer News-- published by Successful Farming; Agricultural Computing Newsletter-- published by Doane's.)..... | NO | YES |
| b. GENERAL COMPUTER PUBLICATIONS (such as BYTE Magazine, Personal Computing, Kilobaud, etc.).....  | NO | YES |
| c. MAGAZINES OR NEWSLETTERS PUBLISHED BY COMPUTER MANUFACTURERS OR DEALERS.....  | NO | YES |

3. Some farmers believe computers will be useful in managing a farm. Others disagree. Please indicate to what extent you agree or disagree with the following statements.

|    |   | HOW STRONGLY DO YOU AGREE OR DISAGREE?<br>(Please circle your answer) |       |         |          |                      |
|----|---|---|-------|---------|----------|----------------------|
|    |   | STRONGLY<br>AGREE   | AGREE | NEUTRAL | DISAGREE | STRONGLY<br>DISAGREE |
| a. | By using a computer I would be able to solve many of my own problems without relying on others.....             | AGREE   |       |         |          | DISAGREE             |
| b. | Owning a computer will give me far greater control over my farm management decisions.....                       | AGREE   |       |         |          | DISAGREE             |
| c. | The kinds of computers being sold to farmers are just toys.....   | AGREE   |       |         |          | DISAGREE             |
| d. | It will be very difficult to develop or modify computer programs to fit my farming operation.....               | AGREE   |       |         |          | DISAGREE             |
| e. | In order to use a computer you must be smart in math.....   | AGREE   |       |         |          | DISAGREE             |
| f. | Farm computers won't be economically feasible for at least five years.....                                      | AGREE   |       |         |          | DISAGREE             |
| g. | It will be easier to keep my records on a computer than it is in my usual way.....                              | AGREE   |       |         |          | DISAGREE             |
| h. | Until computer programs for use on the farm are improved computers won't be worth using.....                    | AGREE   |       |         |          | DISAGREE             |
| i. | I'm afraid the IRS or government could get access to my farm records if I use a computer.....                   | AGREE   |       |         |          | DISAGREE             |
| j. | A computer will allow me to keep records that I can't keep now.....   | AGREE   |       |         |          | DISAGREE             |
| k. | I would have a computer now, but they are too difficult to operate.....   | AGREE   |       |         |          | DISAGREE             |
| l. | Computers will make it easy to get information I need for farm management.....                                  | AGREE   |       |         |          | DISAGREE             |
| m. | I am afraid I'll lose my records if I put them into a computer.....   | AGREE   |       |         |          | DISAGREE             |
| n. | If a computer is to be useful for my farm, it will be necessary to write my own programs (or hire it done)..... | AGREE   |       |         |          | DISAGREE             |
| o. | Computers are just for the big farmers.....   | AGREE   |       |         |          | DISAGREE             |

Please Turn to Page 3

4. Which statement below best describes your knowledge of, or experience with, farm computer equipment which you operate yourself? Such equipment may be either purchased or leased. The system may be entirely on your own farm, or you may have a terminal which ties into another system. (Please circle one number)

- 1 HAVE NOT HEARD ABOUT THEM
- 2 HAVE HEARD ABOUT, BUT KNOW FEW DETAILS
- 3 KNOW DETAILS, BUT HAVE NOT CONSIDERED ACQUIRING
- 4 CONSIDERED ACQUIRING, BUT HAVE MADE NO DECISION
- 5 HAVE DEFINITELY DECIDED TO ACQUIRE ONE
- 6 HAVE DEFINITELY DECIDED NOT TO ACQUIRE ONE
- 7 HAVE ACQUIRED COMPUTER EQUIPMENT

→ GO TO QUESTION 25  
(On Page 7)

5. How frequently do you use your own computer equipment for the following?  
(Please circle one response for each item)

- a. To keep general farm accounting records (such as income and expenses).... NEVER MONTHLY WEEKLY DAILY
- b. To keep enterprise accounts (such as separate records for a beef feedlot operation or a corn crop)..... NEVER MONTHLY WEEKLY DAILY
- c. To run decision-aid programs for management (such as analyzing cropping and fertilizer options)..... NEVER MONTHLY WEEKLY DAILY
- d. To obtain market, weather or other information..... NEVER MONTHLY WEEKLY DAILY
- e. To send and receive electronic mail..... NEVER MONTHLY WEEKLY DAILY
- f. To play computer games..... NEVER MONTHLY WEEKLY DAILY
- g. To do word processing..... NEVER MONTHLY WEEKLY DAILY
- h. To run a cash flow analysis..... NEVER MONTHLY WEEKLY DAILY

6. What type of computer equipment do you own or lease? (Circle one response)

- 1 A MINI OR MICRO COMPUTER LOCATED ON THE FARM
- 2 A TERMINAL CONNECTED TO A COMPUTER OFF THE FARM
- 3 OTHER (PLEASE SPECIFY) \_\_\_\_\_

7. What is the make and model of your equipment?

\_\_\_\_\_

8. What peripheral equipment do you own or lease?(Please circle all that apply)

- 1 CASSETTE RECORDER (for use with computer)
- 2 DISK DRIVE
- 3 TELEPHONE MODEM
- 4 PRINTER

- 4 -

9. Approximately how much would you say you have invested in your computer including equipment, software, and maintenance?

- 1 LESS THAN \$1,000
- 2 BETWEEN \$1,000 AND \$2,999
- 3 BETWEEN \$3,000 AND \$5,999
- 4 BETWEEN \$6,000 AND \$8,999
- 5 BETWEEN \$9,000 AND \$11,999
- 6 MORE THAN \$12,000

10. Considering the cost of your computer system, would you say it has helped pay for itself or not? (Please circle one number)

- 4 HAS DEFINITELY PAID FOR ITSELF
- 3 HAS NOT PAID FOR ITSELF YET, BUT I EXPECT IT WILL
- 2 HAS NOT PAID FOR ITSELF AND PROBABLY WON'T
- 1 HAS NOT PAID FOR ITSELF AND DEFINITELY WON'T

11. Overall how satisfied are you with your present computer system? (Please circle one)

- 1 EXTREMELY SATISFIED
- 2 GENERALLY SATISFIED
- 3 SOMEWHAT SATISFIED
- 4 GENERALLY DISSATISFIED
- 5 EXTREMELY DISSATISFIED

12. Whether or not your computer system has paid for itself, would you say that the cost of the system was worth the investment? (Please circle one number)

- 5 DEFINITELY YES
- 4 PROBABLY YES
- 3 NOT SURE
- 2 PROBABLY NOT
- 1 DEFINITELY NOT

13. Which of the following was most helpful to you in making your decision to purchase a computer? (Please circle one number)

- 1 COMPUTER DEALER
- 2 EXTENSION PERSONNEL, OR EXTENSION MEETING
- 3 FRIEND OR NEIGHBOR WHO OWNS A COMPUTER
- 4 BOOKS, MAGAZINES OR ARTICLES ABOUT COMPUTERS
- 5 COMPUTER SHORT COURSE OR WORKSHOP
- 6 OTHER (please specify) \_\_\_\_\_

14. To what extent were the interests of other members of the household an important factor in your decision to acquire computer equipment? (Please circle one)

- 5 VERY IMPORTANT
- 4 IMPORTANT
- 3 SOMEWHAT IMPORTANT
- 2 NOT VERY IMPORTANT
- 1 NOT AT ALL IMPORTANT

Please Turn to Page 5

15. How many farmers do you personally know who are using a computer in some way?  
(Please circle one number)

- 0 I DON'T KNOW OF ANY
- 1 ONE
- 2 TWO
- 3 THREE
- 4 FOUR
- 5 FIVE OR MORE

16. Who is the primary computer operator and who are other persons in your household who also use it? (Circle one response for each person)

- a. SELF..... PRIMARY OPERATOR ALSO USE DON'T USE
- b. SPOUSE..... PRIMARY OPERATOR ALSO USE DON'T USE
- c. CHILDREN..... PRIMARY OPERATOR ALSO USE DON'T USE

17. Approximately how many hours each week is your computer used?

- 1 LESS THAN 5 HOURS
- 2 5 TO 9 HOURS
- 3 10 TO 14 HOURS
- 4 15 TO 19 HOURS
- 5 20 HOURS OR MORE

18. Approximately how many of these hours of computer use are directly related to your farm operation? (Please circle one answer)

- 1 ALMOST NONE
- 2 LESS THAN ONE-FOURTH
- 3 ABOUT ONE-FOURTH
- 4 ABOUT ONE-HALF
- 5 ABOUT THREE-FOURTHS
- 6 NEARLY ALL

19. How likely do you think you will be to seek the following types of assistance during the next year?

How likely are you to seek this type of help  
(Please circle one response for each item)

- |   |   |             |        |          |          |               |
|---|---|-------------|--------|----------|----------|---------------|
| 1 | Help in getting and keeping computer equipment operating.....               | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |
| 2 | Help in locating farm related computer programs.....                        | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |
| 3 | Help in writing computer programs appropriate for your farm operation....   | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |
| 4 | Help in using your computer to make decisions about your farming operation. | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |
| 5 | Help in using your computer for farm record keeping.....                    | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |
| 6 | Other types of help (Please specify)...                                     | VERY LIKELY | LIKELY | NOT SURE | UNLIKELY | VERY UNLIKELY |

-----



20. About how many different farm related computer programs have you or some member of your family written, purchased or had written for you? (Please circle one response for each item)

- a. Written by you or a family member..... NONE ONE OR TWO THREE OR FOUR FIVE OR MORE
- b. Purchased..... NONE ONE OR TWO THREE OR FOUR FIVE OR MORE
- c. Written for you by someone else..... NONE ONE OR TWO THREE OR FOUR FIVE OR MORE

21. To what extent have you experienced the problems listed below? (Please circle one answer for each item)

- a. Finding a computer dealer who understands your farming problems..... MAJOR PROBLEM SOME PROBLEMS NO PROBLEMS AT ALL
- b. Obtaining prompt service when computer equipment fails..... MAJOR PROBLEM SOME PROBLEMS NO PROBLEMS AT ALL
- c. Finding computer programs which match my needs..... MAJOR PROBLEM SOME PROBLEMS NO PROBLEMS AT ALL
- d. Getting useful advice on how to use computer equipment and/or programs... MAJOR PROBLEM SOME PROBLEMS NO PROBLEMS AT ALL

22. Overall, how satisfied are you with the farm-related software (programs) which you now have? (Please circle one answer)

- 1 VERY SATISFIED
- 2 SATISFIED
- 3 SOMEWHAT SATISFIED
- 4 DISSATISFIED
- 5 VERY DISSATISFIED

23. Are you a member of a computer users group or another organization with a primary objective of discussing or learning about computers?

- 1 YES → How long have you been a member? (circle one number)
  - 1 LESS THAN A YEAR
  - 2 BETWEEN 1 AND 2 YEARS
  - 3 MORE THAN 2 YEARS
- 2 NO

24. About how long ago did you purchase your computer? (Please circle one)

- 1 LESS THAN ONE YEAR AGO
- 2 BETWEEN ONE AND TWO YEARS AGO
- 3 BETWEEN TWO AND THREE YEARS AGO
- 3 MORE THAN THREE YEARS AGO

Please Turn to Page 7

25. Which statement below best describes your knowledge of, or experience with computer services you pay for which keep your records or help you analyze farming problems? In this case you provide information about your farm operation and the service compiles, summarizes and analyzes the information using a computer. Examples include PCA's "AGRIFAX", DHIA records, Farm Bureau, and some accountants and crop management firms. (Circle one number)

- 1 HAVE NOT HEARD ABOUT THEM \_\_\_\_\_
  - 2 HAVE HEARD ABOUT, BUT KNOW FEW DETAILS \_\_\_\_\_
  - 3 KNOW DETAILS, BUT HAVE NOT CONSIDERED ACQUIRING \_\_\_\_\_
  - 4 CONSIDERED ACQUIRING, BUT HAVE MADE NO DECISION \_\_\_\_\_
  - 5 HAVE DEFINITELY DECIDED TO ACQUIRE THIS SERVICE \_\_\_\_\_
  - 6 HAVE DEFINITELY DECIDED NOT TO ACQUIRE THIS SERVICE \_\_\_\_\_
  - 7 HAVE ACQUIRED THIS COMPUTER SERVICE \_\_\_\_\_
- GO TO QUESTION 27

26. How frequently do you use computerized services you pay for to do the following? (Please circle one response for each item)

- a. To keep general farm accounting records (such as income and expenses).... NEVER MONTHLY WEEKLY DAILY
- b. To keep enterprise accounts (such as separate records for a beef feedlot operation or a corn crop)..... NEVER MONTHLY WEEKLY DAILY
- c. To run decision-aid programs for management (such as analyzing cropping and fertilizer options)..... NEVER MONTHLY WEEKLY DAILY
- d. To obtain market, weather or other information..... NEVER MONTHLY WEEKLY DAILY

27. Which statement below best describes your knowledge of, or experience with computer services provided free or at a nominal charge such as those offered by Cooperative Extension Service, Co-ops and some farm supply firms? In this case you provide information about your farm operation and someone else uses a computer to compile, summarize or analyze your records, but there is either no charge or a very nominal charge for the service. (Circle one number)

- 1 HAVE NOT HEARD ABOUT THEM \_\_\_\_\_
  - 2 HAVE HEARD ABOUT, BUT KNOW FEW DETAILS \_\_\_\_\_
  - 3 KNOW DETAILS, BUT HAVE NOT CONSIDERED ACQUIRING \_\_\_\_\_
  - 4 CONSIDERED ACQUIRING, BUT HAVE MADE NO DECISION \_\_\_\_\_
  - 5 HAVE DEFINITELY DECIDED TO ACQUIRE THIS SERVICE \_\_\_\_\_
  - 6 HAVE DEFINITELY DECIDED NOT TO ACQUIRE THIS SERVICE \_\_\_\_\_
  - 7 HAVE ACQUIRED THIS COMPUTER SERVICE \_\_\_\_\_
- GO TO QUESTION 29  
(On page 8)

28. How frequently do you use free or nominal charge computerized services to do the following? (Please circle one response for each item)

- a. To keep general farm accounting records (such as income and expenses).... NEVER MONTHLY WEEKLY DAILY
- b. To keep enterprise accounts (such as separate records for a beef feedlot operation or a corn crop)..... NEVER MONTHLY WEEKLY DAILY
- c. To run decision-aid programs for management (such as analyzing cropping and fertilizer options)..... NEVER MONTHLY WEEKLY DAILY
- d. To obtain market, weather or other information..... NEVER MONTHLY WEEKLY DAILY

29. Now we would like to know something about where you currently obtain information. Below is a list of sources which you may use for information about farm management, weather and marketing. Please indicate how frequently you use each source to obtain information which helps you do a better job of farming.

How often do you use this source to obtain helpful information about farming?  
(Please circle your response)

- |  |       |           |       |            |
|--|-------|-----------|-------|------------|
| a. General farm magazines (such as Wallace's, Farm Journal, Successful Farming, etc.).....                       | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| b. Specialized farm magazines (such as Feed Stuffs, Hog Farm Management, Crops and Soils, etc.).....             | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| c. Dealer's Magazines (such as the Furrow, Ford Farming, Farm Profit, etc.).....                                 | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| d. Farm organization publications (such as Farm Bureau Spokesman, NFO Reporter, Farmer's Union, etc.).....       | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| e. University Extension Bulletins and newsletters.....   | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| f. Private information and management services (such as Doane's or Pro Farmer)..                                 | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| g. Television programs about farming.....  | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| h. Radio programs about farming.....   | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| i. Newspapers.....   | NEVER | SOMETIMES | OFTEN | VERY OFTEN |
| j. Computer services (where you use a computer to obtain information, such as The Source or Instant Update)..... | NEVER | SOMETIMES | OFTEN | VERY OFTEN |

30. In addition to using mass media, you probably talk to other people about farming. In an average month, about how many times do you talk on a face-to-face basis with each of the following types of people?

Times each month you talk on a face-to-face basis about farming? (Please circle your response)

- |   |              |              |              |               |            |
|---|--------------|--------------|--------------|---------------|------------|
| a. How often do you talk with other farmers who live in your county.....          | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| b. Other farmers who live outside your county.....                                | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| c. Extension personnel in your county.....  | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| d. Extension personnel outside your county.....                                   | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| e. Farm equipment or supply dealers, elevator personnel, salesmen or buyers..     | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| f. Professionals such as farm management consultants, veterinarians or bankers... | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |
| g. Researchers at a University or in a private business.....                      | ALMOST NEVER | 1 or 2 TIMES | 3 to 6 TIMES | 7 to 14 TIMES | 15 OR MORE |

Please Turn to Page 9

Finally, we need to know a little about you and your farm operation.

31. Did you use a formalized record keeping system for your 1983 farm financial information? (This might have been a record book, such as Iowa State's Better Farm Accounting, or a service such as PCA's "AGRIFAX" or Iowa Farm Bureau's Farm Record Service.)

- 1 NO
- 2 YES → Who kept those records? (Circle ALL that apply)

- 1 I DID
- 2 SPOUSE DID
- 3 OTHER FAMILY MEMBER
- 4 PROFESSIONAL
- 5 OTHER (please specify) \_\_\_\_\_

32. How frequently do you make, or have made for you, a cash flow analysis for your farm operation? (Please circle one number)

- 1 NEVER
- 2 LESS THAN ONCE EACH YEAR
- 3 AT LEAST ONCE EACH YEAR
- 4 2 TO 4 TIMES EACH YEAR
- 5 MORE THAN 4 TIMES EACH YEAR

33. How important are the following reasons for keeping farm records?

|  |
|--|
| How important is each reason for keeping records?<br>(Circle your responses) |
|--|

|   |           |           |           |            |
|---|-----------|-----------|-----------|------------|
|   | VERY      |           | NOT VERY  | NOT AT ALL |
| a. To apply for loans.....              | IMPORTANT | IMPORTANT | IMPORTANT | IMPORTANT  |
| b. To do my taxes.....                  | VERY      |           | NOT VERY  | NOT AT ALL |
|   | IMPORTANT | IMPORTANT | IMPORTANT | IMPORTANT  |
| c. To keep track of production costs... | VERY      |           | NOT VERY  | NOT AT ALL |
|   | IMPORTANT | IMPORTANT | IMPORTANT | IMPORTANT  |
| d. To make decisions about production.. | VERY      |           | NOT VERY  | NOT AT ALL |
|   | IMPORTANT | IMPORTANT | IMPORTANT | IMPORTANT  |
| e. To know when to market.....          | VERY      |           | NOT VERY  | NOT AT ALL |
|   | IMPORTANT | IMPORTANT | IMPORTANT | IMPORTANT  |

34. Do you practice enterprise accounting? That is, do you maintain separate records on different farm operations? Such records might include a swine enterprise record book, a beef feedlot record book, or records on specific crops such as corn or soybeans.

- 1 NO
- 2 YES → I KEEP ENTERPRISE RECORDS ON:  
(Circle the numbers of ALL that apply)

- 1 BEEF
- 2 DAIRY
- 3 SWINE
- 4 CORN
- 5 SOYBEANS
- 6 OTHER (Please Specify) \_\_\_\_\_

35. How often do you make forward contracts? (Forward contracting is when you agree to sell a commodity ahead of time, but don't take the risk that you would on the futures market.) (Circle one number)

- 0 NEVER
- 1 OCCASIONALLY
- 2 OFTEN
- 3 VERY OFTEN

36. How often do you use hedging? (Hedging involves making multiple transactions on the futures market so as to minimize your risks.) (Circle one number)

- 0 NEVER
- 1 OCCASIONALLY
- 2 OFTEN
- 3 VERY OFTEN

37. Excluding woodlands, ditches and lanes, how many acres did you own or rent in 1983?

\_\_\_\_\_ ACRES OWNED                      \_\_\_\_\_ ACRES RENTED

38. Approximately how many acres of each of the following crops did you have in 1983?

CORN..... \_\_\_\_\_ ACRES  
 SOYBEANS..... \_\_\_\_\_ ACRES  
 OTHER GRAINS..... \_\_\_\_\_ ACRES

39. Approximately how many of each of the following types of livestock did you sell in 1983?

FED CATTLE..... \_\_\_\_\_ HEAD SOLD  
 MARKET HOGS..... \_\_\_\_\_ HEAD SOLD  
 FEEDER PIGS..... \_\_\_\_\_ HEAD SOLD

40. Approximately how many of each of the following types of livestock did you have in your herd during 1983?

DAIRY COWS..... \_\_\_\_\_ HEAD IN HERD  
 BEEF COWS..... \_\_\_\_\_ HEAD IN HERD  
 SOWS..... \_\_\_\_\_ HEAD IN HERD

41. Which of the income categories below best estimates your average **gross** income from the sale of farm products during the past three years--that is, the average for 1981, 1982, and 1983? (This is the figure called "gross profit" on line 31, Schedule F of the IRS 1040 form.)

- 1 Under \$20,000
- 2 \$20,000 to 39,999
- 3 \$40,000 to 99,999
- 4 \$100,000 to 199,999
- 5 \$200,000 or more

Please Turn to Page 11

42. About how many different visitors have you had on your farm during the past month? These might be people who came just to talk to you, or those who came to deliver materials or services. (Please circle one)

- 1 5 VISITORS OR LESS
- 2 6 TO 15
- 3 16 TO 25
- 4 26 OR MORE

43. Within the past two years, have you been or are you now a member or an officer of any of the following types of organizations?

(Circle all that apply)

- a. Farm or commodity organization such as  
Iowa Corn Growers or Farm Bureau..... MEMBER OFFICER
- b. Civic or service group such as  
JC's, Rotary or Lions.....MEMBER OFFICER
- c. Farm cooperative..... MEMBER OFFICER

44. During the last year were you employed off the farm?

- 1 NO
- 2 YES

45. Did you operate a small business in addition to farming during 1983? (Such as selling seed corn or fertilizer, or another business.)

- 1 NO
- 2 YES

46. In what county do you reside? \_\_\_\_\_

47. How many years of formal schooling did you complete?

- 1 1-8 YEARS (Elementary School)
- 2 9-11 YEARS (Attended Some High School)
- 3 12 YEARS (Graduated High School)
- 4 13-15 YEARS (Attended College)
- 5 16 OR MORE YEARS (Graduated College)

48. How old were you on your last birthday? \_\_\_\_\_ YEARS OLD

49. Are you: \_\_\_\_\_ MALE \_\_\_\_\_ FEMALE

---

S-MARCH 1984

THANK YOU FOR YOUR COOPERATION

Please return your completed questionnaire in the enclosed postage free envelope.

**APPENDIX B: FACTOR ANALYSIS RESULTS**

The variable names used in the factor analysis results for 1982, 1983 and 1984 correspond to the items found in question 3 of the questionnaire (Appendix A, page 96) as follows:

| <u>Variable</u> | <u>Item</u> |
|-----------------|-------------|
| TOYS            | 3c          |
| SMART           | 3e          |
| LINECON         | 3f          |
| NOWORTH         | 3h          |
| BIGFARM         | 3o          |
| OWNPROB         | 3a          |
| DIFFMOD         | 3d          |
| IRS             | 3i          |
| DIFFOP          | 3k          |
| LOSEREC         | 3m          |
| WRITEOW         | 3n          |
| CONTROL         | 3b          |
| EASYKEE         | 3g          |
| CANKEEP         | 3j          |
| EASYMGT         | 3l          |

Three extraction techniques (PC, MC, PAF) were used for each year's data. There was some deviation from 1982 to 1984 in the factor loadings, but three factors (or attitudes) tended to emerge. These were:

Factor 1 = OWNPROB, CONTROL, EASYKEE, CANKEEP AND EASYMGT

Factor 2 = TOYS, LINECON, NOWORTH AND WRITEOW

Factor 3 = IRS AND LOSEREC

---

### 1982 Factor Analysis Results

```

FACTOR VARIABLES=TOYS2 SMART2 LINECON2 NOWORTH2 BIGFARM2
OWNPROB2 DIFFMOD2 IRS2 DIFFOP2 LOSEREC2 WRITEOW2
CONTROL2 EASYKEE2 CANKEEP2 EASYMGT2/
MISSING=PAIRWISE/
CRITERIA=FACTORS(3)/
EXTRACTION=pc/
ROTATION=VARIMAX/
CRITERIA=FACTORS(3)/
EXTRACTION=ML/

```



ROTATION=VARIMAX/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=PAF/  
 ROTATION=VARIMAX/.

## Initial Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
|          |             | * |        |            |            |         |
| TOYS2    | 1.00000     | * | 1      | 3.93964    | 26.3       | 26.3    |
| SMART2   | 1.00000     | * | 2      | 1.52108    | 10.1       | 36.4    |
| LINECON2 | 1.00000     | * | 3      | 1.18565    | 7.9        | 44.3    |
| NOWORTH2 | 1.00000     | * | 4      | .99452     | 6.6        | 50.9    |
| BIGFARM2 | 1.00000     | * | 5      | .94461     | 6.3        | 57.2    |
| OWNPROB2 | 1.00000     | * | 6      | .86926     | 5.8        | 63.0    |
| DIFFMOD2 | 1.00000     | * | 7      | .85132     | 5.7        | 68.7    |
| IRS2     | 1.00000     | * | 8      | .75326     | 5.0        | 73.7    |
| DIFFOP2  | 1.00000     | * | 9      | .73442     | 4.9        | 78.6    |
| LOSEREC2 | 1.00000     | * | 10     | .67966     | 4.5        | 83.2    |
| WRITEOW2 | 1.00000     | * | 11     | .60922     | 4.1        | 87.2    |
| CONTROL2 | 1.00000     | * | 12     | .56924     | 3.8        | 91.0    |
| EASYKEE2 | 1.00000     | * | 13     | .50342     | 3.4        | 94.4    |
| CANKEEP2 | 1.00000     | * | 14     | .46614     | 3.1        | 97.5    |
| EASYMGT2 | 1.00000     | * | 15     | .37856     | 2.5        | 100.0   |

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

PC Extracted 3 factors.

## Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
|          |             | * |        |            |            |         |
| TOYS2    | .39394      | * | 1      | 3.93964    | 26.3       | 26.3    |
| SMART2   | .21963      | * | 2      | 1.52108    | 10.1       | 36.4    |
| LINECON2 | .51306      | * | 3      | 1.18565    | 7.9        | 44.3    |
| NOWORTH2 | .52221      | * |        |            |            |         |
| BIGFARM2 | .45348      | * |        |            |            |         |
| OWNPROB2 | .54891      | * |        |            |            |         |
| DIFFMOD2 | .32638      | * |        |            |            |         |
| IRS2     | .46280      | * |        |            |            |         |
| DIFFOP2  | .44416      | * |        |            |            |         |
| LOSEREC2 | .55637      | * |        |            |            |         |
| WRITEOW2 | .40072      | * |        |            |            |         |
| CONTROL2 | .61997      | * |        |            |            |         |
| EASYKEE2 | .34439      | * |        |            |            |         |
| CANKEEP2 | .41460      | * |        |            |            |         |
| EASYMGT2 | .42573      | * |        |            |            |         |

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 6 iterations.

Rotated Factor Matrix: (PC)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS2    | <u>.40810</u> | .47534        | -.03801       |
| SMART2   | <u>.21069</u> | .37612        | .18377        |
| LINECON2 | <u>.51090</u> | .40686        | .29412        |
| NOWORTH2 | <u>.68215</u> | .23569        | .03642        |
| BIGFARM2 | <u>.61301</u> | .27622        | .03755        |
| OWNPROB2 | .50200        | -.14558       | <u>.52508</u> |
| DIFFMOD2 | .33636        | .44952        | <u>.10571</u> |
| IRS2     | .07671        | <u>.67484</u> | .03887        |
| DIFFOP2  | .54988        | <u>.36259</u> | .10163        |
| LOSEREC2 | -.03563       | <u>.73730</u> | .10720        |
| WRITEOW2 | <u>.62298</u> | -.09972       | .05172        |
| CONTROL2 | .30918        | .17958        | <u>.70152</u> |
| EASYKEE2 | .01109        | .05736        | <u>.58393</u> |
| CANKEEP2 | -.15742       | .17206        | <u>.60018</u> |
| EASYMGT2 | .12763        | .03805        | <u>.63874</u> |

ML Extracted 3 factors. 8 Iterations required.

Chi-square Statistic: 76.7403, D.F.: 63, Significance: .1144

Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS2    | .26678      | * | 1      | 3.27432    | 21.8       | 21.8    |
| SMART2   | .14352      | * | 2      | .90997     | 6.1        | 27.9    |
| LINECON2 | .45686      | * | 3      | .50306     | 3.4        | 31.2    |
| NOWORTH2 | .39552      | * |        |            |            |         |
| BIGFARM2 | .35821      | * |        |            |            |         |
| OWNPROB2 | .57465      | * |        |            |            |         |
| DIFFMOD2 | .23195      | * |        |            |            |         |
| IRS2     | .35270      | * |        |            |            |         |
| DIFFOP2  | .36705      | * |        |            |            |         |
| LOSEREC2 | .22498      | * |        |            |            |         |
| WRITEOW2 | .14226      | * |        |            |            |         |
| CONTROL2 | .62384      | * |        |            |            |         |
| EASYKEE2 | .13146      | * |        |            |            |         |
| CANKEEP2 | .16057      | * |        |            |            |         |
| EASYMGT2 | .25700      | * |        |            |            |         |

Varimax Rotation 1, Extraction 2, Analysis 1 - Kaiser Normalization.

Varimax converged in 6 iterations.

## Rotated Factor Matrix: (ML)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS2    | <u>.49431</u> | .06735        | .13383        |
| SMART2   | <u>.29519</u> | .18610        | .14749        |
| LINECON2 | <u>.56316</u> | .31438        | .20218        |
| NOWORTH2 | <u>.60384</u> | .08750        | .15247        |
| BIGFARM2 | <u>.59064</u> | .07610        | .05967        |
| OWNPROB2 | .41502        | <u>.50442</u> | -.38467       |
| DIFFMOD2 | .40341        | <u>.12985</u> | .22881        |
| IRS2     | .25311        | .12799        | <u>.52178</u> |
| DIFFOP2  | .55585        | .15767        | <u>.18227</u> |
| LOSEREC2 | .27002        | .12060        | <u>.37085</u> |
| WRITEOW2 | <u>.36924</u> | .07687        | .00213        |
| CONTROL2 | <u>.29041</u> | <u>.73162</u> | .06504        |
| EASYKEE2 | .08773        | <u>.34988</u> | .03667        |
| CANKEEP2 | -.01128       | <u>.38445</u> | .11240        |
| EASYMGTZ | .10374        | <u>.49160</u> | .06757        |

Extraction 3 for Analysis 1, Principal Axis Factoring (PAF)

## Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS2    | .27110      | * | 1      | 3.30304    | 22.0       | 22.0    |
| SMART2   | .14841      | * | 2      | .86159     | 5.7        | 27.8    |
| LINECON2 | .45565      | * | 3      | .48395     | 3.2        | 31.0    |
| NOWORTH2 | .42562      | * |        |            |            |         |
| BIGFARM2 | .35315      | * |        |            |            |         |
| OWNPROB2 | .42817      | * |        |            |            |         |
| DIFFMOD2 | .24087      | * |        |            |            |         |
| IRS2     | .29938      | * |        |            |            |         |
| DIFFOP2  | .36513      | * |        |            |            |         |
| LOSEREC2 | .30819      | * |        |            |            |         |
| WRITEOW2 | .16892      | * |        |            |            |         |
| CONTROL2 | .61570      | * |        |            |            |         |
| EASYKEE2 | .14674      | * |        |            |            |         |
| CANKEEP2 | .16788      | * |        |            |            |         |
| EASYMGTZ | .25364      | * |        |            |            |         |

Varimax Rotation 1, Extraction 3, Analysis 1 - Kaiser Normalization.

Varimax converged in 7 iterations.

## Rotated Factor Matrix: (PAF)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS2    | <u>.40514</u> | .04813        | .32349        |
| SMART2   | .23449        | .17689        | .24928        |
| LINECON2 | <u>.49867</u> | .30270        | .33965        |
| NOWORTH2 | <u>.61741</u> | .07487        | .19702        |
| BIGFARM2 | .54838        | .08636        | .21207        |
| OWNPROB2 | .40889        | <u>.49109</u> | -.14073       |
| DIFFMOD2 | .33915        | <u>.12917</u> | .33040        |
| IRS2     | .16481        | .07494        | <u>.51634</u> |
| DIFFOP2  | .51744        | .13954        | <u>.27913</u> |
| LOSEREC2 | .12010        | .10748        | <u>.53124</u> |
| WRITEOW2 | <u>.40029</u> | .09215        | .01405        |
| CONTROL2 | <u>.27207</u> | <u>.72006</u> | .15232        |
| EASYKEE2 | .06914        | <u>.37141</u> | .06339        |
| CANKEEP2 | -.03681       | <u>.38749</u> | .12797        |
| EASYMGT2 | .11093        | <u>.48536</u> | .07588        |

1983 Factor Analysis Results

FACTOR VARIABLES=TOYS SMART LINECON NOWORTH BIGFARM  
 OWNPROB DIFFMOD IRS DIFFOP LOSEREC WRITEOWN CONTROL  
 EASYKEEP CANKEEP EASYMGT/  
 MISSING=PAIRWISE/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=pc/  
 ROTATION=VARIMAX/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=ML/  
 ROTATION=VARIMAX/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=PAF/  
 ROTATION=VARIMAX/.

## Initial Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS     | .24048      | * | 1      | 3.87292    | 25.8       | 25.8    |
| SMART    | .20288      | * | 2      | 1.68458    | 11.2       | 37.0    |
| LINECON  | .43136      | * | 3      | 1.14884    | 7.7        | 44.7    |
| NOWORTH  | .34364      | * | 4      | 1.07478    | 7.2        | 51.9    |
| BIGFARM  | .27640      | * | 5      | .96218     | 6.4        | 58.3    |
| OWNPROB  | .29154      | * | 6      | .85767     | 5.7        | 64.0    |
| DIFFMOD  | .13873      | * | 7      | .82074     | 5.5        | 69.5    |
| IRS      | .25262      | * | 8      | .76523     | 5.1        | 74.6    |
| DIFFOP   | .31508      | * | 9      | .71696     | 4.8        | 79.4    |
| LOSEREC  | .35070      | * | 10     | .69427     | 4.6        | 84.0    |

|          |        |   |    |        |     |       |
|----------|--------|---|----|--------|-----|-------|
| WRITEOWN | .28228 | * | 11 | .59192 | 3.9 | 87.9  |
| CONTROL  | .38402 | * | 12 | .51628 | 3.4 | 91.4  |
| EASYKEEP | .17553 | * | 13 | .45325 | 3.0 | 94.4  |
| CANKEEP  | .15818 | * | 14 | .43575 | 2.9 | 97.3  |
| EASYMGT  | .20230 | * | 15 | .40464 | 2.7 | 100.0 |

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS     | .40415      | * | 1      | 3.87292    | 25.8       | 25.8    |
| SMART    | .34917      | * | 2      | 1.68458    | 11.2       | 37.0    |
| LINECON  | .53432      | * | 3      | 1.14884    | 7.7        | 44.7    |
| NOWORTH  | .43074      | * |        |            |            |         |
| BIGFARM  | .37341      | * |        |            |            |         |
| OWNPROB  | .53442      | * |        |            |            |         |
| DIFFMOD  | .50604      | * |        |            |            |         |
| IRS      | .46278      | * |        |            |            |         |
| DIFFOP   | .54462      | * |        |            |            |         |
| LOSEREC  | .47767      | * |        |            |            |         |
| WRITEOWN | .35776      | * |        |            |            |         |
| CONTROL  | .60795      | * |        |            |            |         |
| EASYKEEP | .35039      | * |        |            |            |         |
| CANKEEP  | .37365      | * |        |            |            |         |
| EASYMGT  | .39926      | * |        |            |            |         |

Varimax Rotation 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 6 iterations.

Rotated Factor Matrix: (PC)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3 |
|----------|---------------|---------------|----------|
| TOYS     | <u>.45016</u> | -.06969       | .44345   |
| SMART    | <u>.23018</u> | -.13327       | .52766   |
| LINECON  | <u>.61308</u> | .13777        | .37347   |
| NOWORTH  | <u>.51576</u> | .16710        | .36988   |
| BIGFARM  | <u>.53359</u> | .13496        | .26546   |
| OWNPROB  | .04527        | <u>.72956</u> | .01065   |
| DIFFMOD  | -.00803       | <u>.10238</u> | .70391   |
| IRS      | <u>.66865</u> | -.12429       | -.01556  |
| DIFFOP   | <u>.71197</u> | .16893        | -.09582  |
| LOSEREC  | <u>.62096</u> | .29843        | .05492   |
| WRITEOWN | <u>.39411</u> | .25888        | .36800   |
| CONTROL  | .28342        | <u>.72625</u> | .01359   |
| EASYKEEP | .00602        | <u>.57433</u> | .14316   |
| CANKEEP  | -.07842       | <u>.41961</u> | .43752   |
| EASYMGT  | .18128        | <u>.60221</u> | -.06124  |

Extraction 2 for Analysis 1, Maximum Likelihood (ML)

ML Extracted 3 factors. 18 Iterations required.

Chi-square Statistic: 94.2042, D.F.: 63, Significance: .0066

Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS     | .25413      | * | 1      | 1.86316    | 12.4       | 12.4    |
| SMART    | .15351      | * | 2      | 2.20809    | 14.7       | 27.1    |
| LINECON  | .57445      | * | 3      | .99528     | 6.6        | 33.8    |
| NOWORTH  | .37451      | * |        |            |            |         |
| BIGFARM  | .29358      | * |        |            |            |         |
| OWNPROB  | .39497      | * |        |            |            |         |
| DIFFMOD  | .07896      | * |        |            |            |         |
| IRS      | .23644      | * |        |            |            |         |
| DIFFOP   | .99900      | * |        |            |            |         |
| LOSEREC  | .33792      | * |        |            |            |         |
| WRITEOWN | .26622      | * |        |            |            |         |
| CONTROL  | .54496      | * |        |            |            |         |
| EASYKEEP | .17372      | * |        |            |            |         |
| CANKEEP  | .14323      | * |        |            |            |         |
| EASYMGT  | .24112      | * |        |            |            |         |

Varimax Rotation 1, Extraction 2, Analysis 1 - Kaiser Normalization.

Varimax converged in 5 iterations.

Rotated Factor Matrix: (ML)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3 |
|----------|---------------|---------------|----------|
| TOYS     | <u>.48735</u> | .02908        | .12564   |
| SMART    | <u>.39106</u> | -.01676       | -.01756  |
| LINECON  | <u>.72848</u> | .20626        | .03460   |
| NOWORTH  | <u>.56443</u> | .21072        | .10734   |
| BIGFARM  | .48491        | .20380        | .13005   |
| OWNPROB  | -.00885       | <u>.62302</u> | .08199   |
| DIFFMOD  | .25847        | <u>.10578</u> | .03122   |
| IRS      | .42333        | -.02052       | .23819   |
| DIFFOP   | .28035        | .14573        | .94824   |
| LOSEREC  | .38557        | .31375        | .30122   |
| WRITEOWN | <u>.42419</u> | .24967        | .15474   |
| CONTROL  | .18335        | <u>.71065</u> | .07956   |
| EASYKEEP | .06147        | <u>.40977</u> | .04499   |
| CANKEEP  | .17264        | <u>.32754</u> | -.07819  |
| EASYMGT  | .10297        | <u>.47198</u> | .08807   |

Extraction 3 for Analysis 1, Principal Axis Factoring (PAF)

PAF Attempted to extract 3 factors.

More than 25 iterations required. Convergence = .00186

Final Statistics:

| Variable | Communality | * Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|----------|------------|------------|---------|
| TOYS     | .27250      | * 1      | 3.24644    | 21.6       | 21.6    |
| SMART    | .15079      | * 2      | 1.02323    | 6.8        | 28.5    |
| LINECON  | .52881      | * 3      | .48781     | 3.3        | 31.7    |
| NOWORTH  | .37520      | *        |            |            |         |
| BIGFARM  | .28948      | *        |            |            |         |
| OWNPROB  | .39402      | *        |            |            |         |
| DIFFMOD  | .11326      | *        |            |            |         |
| IRS      | .26093      | *        |            |            |         |
| DIFFOP   | .57604      | *        |            |            |         |
| LOSEREC  | .40017      | *        |            |            |         |
| WRITEOWN | .27795      | *        |            |            |         |
| CONTROL  | .53306      | *        |            |            |         |
| EASYKEEP | .18330      | *        |            |            |         |
| CANKEEP  | .16636      | *        |            |            |         |
| EASYMGT  | .23562      | *        |            |            |         |

Varimax Rotation 1, Extraction 3, Analysis 1 - Kaiser Normalization.

Varimax converged in 5 iterations.

Rotated Factor Matrix: (PAF)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS     | <u>.47993</u> | .01397        | .20486        |
| SMART    | .38130        | -.02590       | .06874        |
| LINECON  | <u>.67381</u> | .18126        | .20480        |
| NOWORTH  | <u>.54541</u> | .19807        | .19619        |
| BIGFARM  | .44466        | .17679        | .24597        |
| OWNPROB  | .01882        | <u>.62589</u> | .04389        |
| DIFFMOD  | .31561        | .11593        | .01455        |
| IRS      | .32278        | -.04535       | <u>.39331</u> |
| DIFFOP   | .19251        | .16611        | <u>.71512</u> |
| LOSEREC  | .29820        | .29304        | <u>.47473</u> |
| WRITEOWN | <u>.42403</u> | .25475        | .18234        |
| CONTROL  | .15513        | <u>.69472</u> | .16235        |
| EASYKEEP | .06270        | <u>.41756</u> | .07081        |
| CANKEEP  | .22845        | <u>.32463</u> | -.09370       |
| EASYMGT  | .08252        | <u>.46504</u> | .11199        |

---

1984 Factor Analysis Results

FACTOR VARIABLES=TOYS4 SMART4 LINECON4 NOWORTH4 BIGFARM4  
 OWNPROB4 DIFFMOD4 IRS4 DIFFOP4 LOSEREC4 WRITEOW4  
 CONTROL4 EASYKEE4 CANKEEP4 EASYMGT4/  
 MISSING=PAIRWISE/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=pc/  
 ROTATION=VARIMAX/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=ML/  
 ROTATION=VARIMAX/  
 CRITERIA=FACTORS(3)/  
 EXTRACTION=PAF/  
 ROTATION=VARIMAX/.

## Initial Statistics:

| Variable | Communality | *<br>* | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|--------|--------|------------|------------|---------|
| TOYS4    | 1.00000     | *      | 1      | 4.41034    | 29.4       | 29.4    |
| SMART4   | 1.00000     | *      | 2      | 1.49843    | 10.0       | 39.4    |
| LINECON4 | 1.00000     | *      | 3      | 1.07291    | 7.2        | 46.5    |
| NOWORTH4 | 1.00000     | *      | 4      | 1.02021    | 6.8        | 53.3    |
| BIGFARM4 | 1.00000     | *      | 5      | .93731     | 6.2        | 59.6    |
| OWNPROB4 | 1.00000     | *      | 6      | .89209     | 5.9        | 65.5    |
| DIFFMOD4 | 1.00000     | *      | 7      | .78812     | 5.3        | 70.8    |
| IRS4     | 1.00000     | *      | 8      | .73551     | 4.9        | 75.7    |
| DIFFOP4  | 1.00000     | *      | 9      | .65830     | 4.4        | 80.1    |
| LOSEREC4 | 1.00000     | *      | 10     | .62338     | 4.2        | 84.2    |
| WRITEOW4 | 1.00000     | *      | 11     | .56412     | 3.8        | 88.0    |
| CONTROL4 | 1.00000     | *      | 12     | .54613     | 3.6        | 91.6    |
| EASYKEE4 | 1.00000     | *      | 13     | .48829     | 3.3        | 94.9    |
| CANKEEP4 | 1.00000     | *      | 14     | .41430     | 2.8        | 97.7    |
| EASYMGT4 | 1.00000     | *      | 15     | .35056     | 2.3        | 100.0   |

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

PC Extracted 3 factors.

## Final Statistics:

| Variable | Communality | *<br>* | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|--------|--------|------------|------------|---------|
| TOYS4    | .42093      | *      | 1      | 4.41034    | 29.4       | 29.4    |
| SMART4   | .57009      | *      | 2      | 1.49843    | 10.0       | 39.4    |
| LINECON4 | .50480      | *      | 3      | 1.07291    | 7.2        | 46.5    |



|          |        |   |
|----------|--------|---|
| NOWORTH4 | .66163 | * |
| BIGFARM4 | .41232 | * |
| OWNPROB4 | .56390 | * |
| DIFFMOD4 | .19686 | * |
| IRS4     | .40343 | * |
| DIFFOP4  | .48019 | * |
| LOSEREC4 | .45967 | * |
| WRITEOW4 | .39514 | * |
| CONTROL4 | .58733 | * |
| EASYKEE4 | .49344 | * |
| CANKEEP4 | .38177 | * |
| EASYMGT4 | .45017 | * |

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 5 iterations.

Rotated Factor Matrix: (PC)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS4    | <u>.64774</u> | -.00641       | -.03638       |
| SMART4   | -.01969       | -.07894       | .75065        |
| LINECON4 | <u>.57947</u> | .21701        | .34918        |
| NOWORTH4 | <u>.76389</u> | .22490        | .16593        |
| BIGFARM4 | .44334        | .08071        | .45745        |
| OWNPROB4 | .21678        | <u>.71817</u> | .03369        |
| DIFFMOD4 | .34642        | <u>.12076</u> | .24954        |
| IRS4     | .36392        | .10161        | <u>.51056</u> |
| DIFFOP4  | .31900        | .20247        | <u>.58089</u> |
| LOSEREC4 | .21825        | .40819        | <u>.49541</u> |
| WRITEOW4 | <u>.55391</u> | .20471        | .21543        |
| CONTROL4 | .30507        | <u>.68561</u> | .15557        |
| EASYKEE4 | -.23726       | <u>.59603</u> | .28617        |
| CANKEEP4 | .13955        | <u>.57994</u> | -.16113       |
| EASYMGT4 | .13100        | <u>.63070</u> | .18770        |

Extraction 2 for Analysis 1, Maximum Likelihood (ML)

ML Extracted 3 factors. 16 Iterations required.

Chi-square Statistic: 84.3428, D.F.: 63, Significance: .0376

Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS4    | .17253      | * | 1      | 3.48240    | 23.2       | 23.2    |
| SMART4   | .18027      | * | 2      | 1.02370    | 6.8        | 30.0    |

|          |        |   |   |        |     |      |
|----------|--------|---|---|--------|-----|------|
| LINECON4 | .41061 | * | 3 | .70961 | 4.7 | 34.8 |
| NOWORTH4 | .87844 | * |   |        |     |      |
| BIGFARM4 | .29608 | * |   |        |     |      |
| OWNPROB4 | .54189 | * |   |        |     |      |
| DIFFMOD4 | .15000 | * |   |        |     |      |
| IRS4     | .32541 | * |   |        |     |      |
| DIFFOP4  | .38158 | * |   |        |     |      |
| LOSEREC4 | .40119 | * |   |        |     |      |
| WRITEOW4 | .29391 | * |   |        |     |      |
| CONTROL4 | .58881 | * |   |        |     |      |
| EASYKEE4 | .17425 | * |   |        |     |      |
| CANKEEP4 | .13913 | * |   |        |     |      |
| EASYMGT4 | .28166 | * |   |        |     |      |

Varimax Rotation 1, Extraction 2, Analysis 1 - Kaiser Normalization.

Varimax converged in 5 iterations.

Rotated Factor Matrix: (ML)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS4    | .04393        | .19302        | <u>.36516</u> |
| SMART4   | -.00787       | .41377        | .09487        |
| LINECON4 | .25511        | .44627        | <u>.38257</u> |
| NOWORTH4 | .20915        | .18527        | <u>.89463</u> |
| BIGFARM4 | .16657        | .43170        | .28631        |
| OWNPROB4 | <u>.71286</u> | .05615        | .17484        |
| DIFFMOD4 | .11831        | .20990        | .30322        |
| IRS4     | .14278        | <u>.50211</u> | .23002        |
| DIFFOP4  | .24463        | .51324        | .24150        |
| LOSEREC4 | .34241        | <u>.51757</u> | .12672        |
| WRITEOW4 | .19134        | .34090        | <u>.37561</u> |
| CONTROL4 | <u>.70546</u> | .17156        | .24840        |
| EASYKEE4 | <u>.39110</u> | .14385        | -.02426       |
| CANKEEP4 | <u>.35860</u> | .03825        | .09527        |
| EASYMGT4 | <u>.46629</u> | .21841        | .12858        |

Extraction 3 for Analysis 1, Principal Axis Factoring (PAF)

PAF Attempted to extract 3 factors.

More than 25 iterations required. Convergence = .00122

Final Statistics:

| Variable | Communality | * | Factor | Eigenvalue | Pct of Var | Cum Pct |
|----------|-------------|---|--------|------------|------------|---------|
| TOYS4    | .15843      | * | 1      | 3.82514    | 25.5       | 25.5    |
| SMART4   | .18869      | * | 2      | .85458     | 5.7        | 31.2    |

|          |        |   |   |        |     |      |
|----------|--------|---|---|--------|-----|------|
| LINECON4 | .42190 | * | 3 | .47860 | 3.2 | 34.4 |
| NOWORTH4 | .78422 | * |   |        |     |      |
| BIGFARM4 | .30598 | * |   |        |     |      |
| OWNPROB4 | .49280 | * |   |        |     |      |
| DIFFMOD4 | .14319 | * |   |        |     |      |
| IRS4     | .31478 | * |   |        |     |      |
| DIFFOP4  | .38840 | * |   |        |     |      |
| LOSEREC4 | .42201 | * |   |        |     |      |
| WRITEOW4 | .29476 | * |   |        |     |      |
| CONTROL4 | .55333 | * |   |        |     |      |
| EASYKEE4 | .21114 | * |   |        |     |      |
| CANKEEP4 | .16368 | * |   |        |     |      |
| EASYMGT4 | .31501 | * |   |        |     |      |

Varimax Rotation 1, Extraction 3, Analysis 1 - Kaiser Normalization.

Varimax converged in 5 iterations.

Rotated Factor Matrix: (PAF)

|          | FACTOR 1      | FACTOR 2      | FACTOR 3      |
|----------|---------------|---------------|---------------|
| TOYS4    | .04879        | <u>.35791</u> | .16718        |
| SMART4   | -.00508       | .10486        | .42150        |
| LINECON4 | .22590        | <u>.46051</u> | .39850        |
| NOWORTH4 | .19715        | <u>.84955</u> | .15364        |
| BIGFARM4 | .13287        | .34579        | .41080        |
| OWNPROB4 | <u>.66822</u> | .20817        | .05429        |
| DIFFMOD4 | .12833        | .29530        | .19879        |
| IRS4     | .12978        | .28625        | <u>.46476</u> |
| DIFFOP4  | .21769        | .27561        | .51483        |
| LOSEREC4 | .36799        | .15656        | <u>.51194</u> |
| WRITEOW4 | .19697        | <u>.41843</u> | .28439        |
| CONTROL4 | <u>.66416</u> | .29999        | .14909        |
| EASYKEE4 | <u>.42471</u> | -.05520       | .16649        |
| CANKEEP4 | <u>.39133</u> | .10203        | .01134        |
| EASYMGT4 | <u>.50306</u> | .15951        | .19105        |