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**AN EVALUATION OF PROJECT PEST'S "PEST MANAGEMENT MANUAL" AS
A MEANS FOR TRANSFERRING INTEGRATED PEST MANAGEMENT
INFORMATION TO URBAN HOMEOWNERS**

Michigan State University

PH.D. 1983

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AN EVALUATION OF PROJECT PEST'S PEST MANAGEMENT MANUAL
AS A MEANS FOR TRANSFERRING INTEGRATED PEST MANAGEMENT
INFORMATION TO URBAN HOMEOWNERS

By

Michael Thomas Lambur

A DISSERTATION

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ABSTRACT

AN EVALUATION OF PROJECT PEST'S PEST MANAGEMENT MANUAL AS A MEANS FOR TRANSFERRING INTEGRATED PEST MANAGEMENT INFORMATION TO URBAN HOMEOWNERS

By

Michael Thomas Lambur

In recent years, integrated pest management (IPM) has been recognized as a potential strategy for dealing with pest problems on urban vegetation. While research still needs to be conducted on the technical aspects of applying IPM in urban situations, an additional area of inquiry that has been virtually uninvestigated is the transfer of IPM information to a significant urban pest management decision-maker -- the urban homeowner.

This study represented a response to that need. It was undertaken to evaluate a recent effort to transfer IPM information to homeowners in a Michigan suburban community; Project PEST's Pest Management Manual -- a homeowner's self-help guide to IPM. A model developed to explain the process by which individuals adopt innovations (new ideas and practices), called the innovation-decision process model, was used as the evaluate framework.

A number of independent variables associated with the model were selected and measured. The categories of independent variables included: individual characteristics (socioeconomic, attitudinal, communication behavior, problem vs. innovation orientation); and innovation characteristics (relative advantage, compatibility,

Michael Thomas Lambur

complexity, trialability, observability). The dependent variable was the extent to which the IPM information and practices in the manual had been adopted in the two years since its introduction.

A self-administered mail questionnaire was used to collect data from 41 of the 75 manual owners in Project PEST's target community -- Meridian Charter Township, Michigan. Data were analyzed to determine: (1) the characteristics of manual users; (2) the extent to which these characteristics were associated with use of the manual; and (3) the extent to which the model could be used to characterize other IPM information transfer efforts.

Based on study results, it was concluded that the innovation decision process model was applicable, to a degree, for characterizing the transfer of pest management information (as an innovation) to urban homeowners.

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number of ideas expressed in this dissertation; most notably the extent of adoption of the manual. Without exception, they literally dropped what they were doing to help. For this, and their moral support, I am profoundly grateful.

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CHAPTER 1

INTRODUCTION

In efforts to make their residential surroundings aesthetically pleasing, to enhance property values, and to buffer environmental and development factors (such as wind, noise, and highways), people in urban areas plant trees, shrubs, flowers, gardens, and lawns around their homes. For the most part, selection of these ornamental plants is largely based on aesthetic characteristics such as color, form, and height (Koehler 1979). In addition, many non-native, exotic species are often selected by the urban homeowner. With this proliferation of diverse and exotic plant material, numerous associated pest populations become established in the absence of their natural enemies (Ehler 1979). Compounding these pest problems is the increased density of human inhabitants in local areas, which provide a series of unique urban ecological niches that are invaded and colonized by arthropods and vertebrates (Committee on Urban Pest Management 1980).

Presented first in this introductory chapter is an overview of the actions and orientations of urban homeowners regarding pest problems on the plants in their yard. A pest control profile is developed indicating that, among other things, urban homeowners are quite reliant on pesticides as a means for pest control. The frequent use of these compounds has, however, resulted in a number

of real risks and problems. A discussion of these risks and problems associated with pesticides is presented next. Because of a growing concern about the heavy reliance on pesticides, an alternative pest management strategy, called integrated pest management (IPM), has evolved. While developed and implemented primarily in the agricultural sector, this ecological philosophy of pest management has been recognized as a potential strategy for the urban sector as well. A definition of IPM is given, in addition to an explanation of its underlying principles. Opportunities and constraints facing the establishment of urban IPM programs are discussed next. While research still needs to be conducted on the technical aspects of applying IPM in the urban sector, an additional area of inquiry that has been virtually uninvestigated is the transfer of IPM information to a significant urban decision-maker -- the urban homeowner. Thus, in this last section of Chapter 1, the purpose of this study is revealed: to better understand the transfer of IPM information to urban homeowners.

A Pest Control Profile of Urban Homeowners

What actions do urban homeowners take when confronted with pest problems on plants in their yards? Fortunately, data from a number of studies focusing on pest control in urban areas provide information that can be used to present a profile of urban homeowners and their pest control actions and orientations. This profile consists of information on the use of pesticides, the use of nonchemical

controls, attitudes and behaviors regarding pest control, and sources of pest control information.

Use of Pesticides

Data from one national survey and several local ones indicate that pesticides are used by substantial numbers of homeowners as a pest control method. In a survey conducted by Savage et al. (1979), data were collected on household pesticide usage in the United States. Study data showed that an estimated 90.7% of all households in the U.S. used pesticides. The researchers also investigated where pesticides were applied: 21.4% of the households used pesticides in the garden (on flower beds and vegetable gardens); 38.7% used pesticides in the yard (on trees, shrubs, and lawns).

A number of local studies provide additional information on pesticide use by urban homeowners. In 1972, von Rumker et al. conducted a survey of pesticide use in suburban homes and gardens in three metropolitan areas: Dallas, Philadelphia, and Lansing, Michigan. The authors found that 92.5% of respondents in the three cities reported using pesticides. In fact, data also revealed that these homeowners applied more pesticides per acre than farmers did in the surrounding agricultural lands.

A local study of pesticide use in Allegheny County, Pennsylvania, was conducted by Lande (1975). Of the single family dwelling units studied, 84.6% used pesticides at some time in the previous 12 months. Finklea et al. (1969) also reported similar results of pesticide use in urban households in South Carolina; 89% of 196 families surveyed used pesticides for pest control.

Frankie and Levenson (1978) reported that for homeowners surveyed in Bryan-College Station, Texas, 49%, 50%, and 43% used pesticides on outdoor pest problems in 1974, 1975, and 1976, respectively. For Dallas County, Texas, the figures were 58% in 1975 and 33% in 1976. And more recent survey work was conducted by Frankie et al. (1981) on pest control by urban homeowners in Berkeley, California; Dallas, Texas; and New Brunswick, New Jersey. In this study, the authors reported that 52% of the respondents (average for all cities) used pesticides on outdoor pest problems in 1977-78.

And finally, while specific data on the amount of pesticides applied by urban homeowners is limited, at least one study suggests that the amount is substantial. In a 1979 nationwide study conducted by the U.S. Environmental Protection Agency's Office of Pesticide Programs, an estimated 7.5% of all pesticides used in the United States were used by home dwellers and gardeners. This figure, which amounts to 87 million lbs., is equivalent to approximately two lbs. per household per year (Metcalf et al. 1980).

Use of Nonchemical Controls

While pesticides appear to play a predominant role in the urban homeowner's pest control strategy, the use of nonchemical methods has also been reported. In Frankie and Levenson's (1978) survey of homeowners in Bryan-College Station and Dallas County, Texas, the authors reported that approximately 50% of the Bryan-College Station respondents indicated that they had tried other means besides chemicals for controlling insects in the years 1974-76. Dallas

County results, however, were lower; 38% used nonchemical methods in 1975 and 21% in 1976. (All figures reported were for indoor and outdoor pest problems.) And in this author's more recent survey work (Frankie et al. 1981), an average of 51% of the respondents in three metro areas (Berkeley, California; Dallas, Texas; New Brunswick, New Jersey) indicated they had tried some nonchemical means to control both indoor and outdoor pest problems in 1977-78. However, they also indicated that they were somewhat less satisfied with these means than with pesticides.

Attitudes and Behaviors Regarding Pest Control

While there is some evidence to suggest that homeowners are beginning to change their attitudes toward pesticides and pesticide use, current behaviors indicate that pesticides are still an important means of pest control. For example, even though von Rumker et al. (1972) found that most homeowners wished to reduce their use of pesticides and opposed the application of chemicals by public agencies, a high percentage (84%) reported using pesticides without reservation. Frankie and Levenson (1978) reported similar findings in their Bryan-College Station and Dallas, County survey. Over 70% of respondents in the urban area surveyed (Dallas County) reported that their attitude was more "cautious" regarding the use of pesticides, with over 50% indicating that chemical insecticides should be used in national or state parks only under emergency circumstances. Yet 88% felt that pesticides "did some good"; 87% felt that pesticides "did no harm." Frankie et al. (1981) also reported that on average, for the three metro areas studied, 47%

felt that their attitudes toward pesticides had changed to "more cautious." And of those who mentioned harm associated with these compounds, only 11.8% provided at least one specific example.

In a somewhat different context, Salcedo et al. (1971) surveyed farmers and city dwellers in Champaign County, Illinois to determine their attitudes toward the pesticide industry. Overall, the authors found that while attitudes existed toward the pesticide industry, they were clustered at both ends of the continuum; 43% were favorable, 19% neutral, and 38% unfavorable. A majority in both groups disagreed that the pesticide industry is often to blame for accidents involving pesticide misuse and that it is against restrictions on pesticide use so that it can sell more of its products. A majority also agreed that the pesticide industry should be praised because its products are essential for the production of high quality foods at reasonable cost, that it is at least as concerned as the general public about the inherent dangers of its products, and that it is generally staffed by highly trained scientists. But they also agreed that not enough extensive study has been done regarding the potential harmful effects of pesticides and that the pesticide industry needs to better inform the public of the dangers involved with newer pesticides and chemicals. And in general, it was found that city dwellers were more concerned than farmers about the harmfulness of pesticides.

Sources of Pest Control Information

Finally, the sources that urban homeowners use for information on pesticides and pest control reveal much about their pest control

actions. Data on how pesticides are selected for pest control were reported by Lande (1975). Thirty-three percent of the survey respondents used information from the product label to select a pesticide. In addition, 27.3% relied on advertisements, 18.2% based their decision on cost, and 15.2% purchased pesticides simply from habit. Lande also found that 9.1% of the homeowners in his study based their purchase decision on recommendations from the retail salesperson.

Similar results were reported by Frankie et al. (1981). In their survey, an average of 24.4% of respondents in the three metro areas studied used advertisements as the basis for their pesticide purchase decision, 17.7% used the product label, 17.4% relied on professional advice, and 14.3% indicated previous experience with the product. While Lande (1975) reported that cost was a factor in pesticide purchase, Frankie et al. (1981:46) observed that "Neither price nor safety appears to be a motivating factor in determining which pesticide products will be purchased."

For pest control information, Savage et al. (1979) found that the label was the source of information on pesticide use by 36.7% of surveyed households. This was followed by: the mass media (16.9%); neighbors, friends or relatives (13.3%); retail sales persons (5.7%); and finally the Agricultural Extension Service (3.2%). Interestingly, it was also reported that less than 50% of the respondents had read pesticide labels for information regarding application procedures and preventative measures. Results from the Lande (1975) study were similar: 45.5% used the product label for directions and 27.3% for precautions. And, surprisingly, 21.2% of

the homeowners in this study indicated they had read nothing on the pesticide label.

In the Frankie and Levenson (1978) study, exterminators and nurseries were the sources most consulted for information on both indoor and outdoor pest problems (40% and 26%, respectively) in the urban area. Only 3% of the respondents utilized the services of nearby Texas A&M University. And in their more recent survey work Frankie et al. (1981) found that professional pest control operators were the number one source used by respondents for information on pest control (35%). Additional sources used were: other (unspecified) 16%; university 14%; printed matter 13%; nurserymen 10%; friends 9%; and television/radio 2%.

The Pest Control Profile in Summary

Based on information presented in the preceding four sections, the following pest control profile of urban homeowners emerges:

1. Pesticides are used by large numbers of homeowners for pest control.
2. The amount of pesticides applied in urban areas appears to be substantial.
3. Some homeowners use nonchemical means to control pest problems, in addition to pesticides.
4. While homeowners are beginning to express more concern about the dangers associated with pesticides, their behaviors do not necessarily reflect this orientation.

5. Information on pesticides and pest control is obtained primarily from product labels and professionals involved in pest control.

In summary, it appears that while urban homeowners seem to be more aware of the implications of pesticide use (numbers 3 and 4), these compounds play an important role in their pest control approach (numbers 1, 2 and 5).

Risks and Problems Associated with the Use of Pesticides

While urban homeowners are quite dependent on pesticides, this form of chemical technology presents human and environmental risks that are only beginning to be understood. The use of these compounds also has distinct limitations as a pest control technique. Perhaps Bottrell (1979:4) best puts the issue of pesticides and pest control into perspective:

Ironically, the success of chemical pesticides created a dilemma. On one hand, many of our "necessities" have coevolved with pesticide technology to the extent that we eventually became largely dependent upon the technology. Yet there have been ample warnings -- first issued more than 50 years ago and since amplified many times -- against continuing to rely heavily on pesticide technology, and many pest control scientists are questioning whether this technology can prevent serious pest ravages in the future.

Human Risks from Pesticides

Because pesticides are designed to be biologically active, they present potential hazards to human health (Bottrell 1979). While adverse health effects from pesticides have been debated, no conclusive epidemiological evidence establishing a causal link

between incidental long-term exposure and health problems has been shown (Pimental et al. 1980). However, potential health problems from ingestion of pesticide residues over long periods has yet to be adequately assessed (Rudd 1964). Relatively little information is available on the hazards of pesticides and their residues under field conditions (von Rumker et al. 1975). Although testing of pesticides under controlled laboratory conditions has provided some measure for assigning "acceptable" residue levels in human tissue, as Epstein (1974:2427) observes, "it is not possible to predict safe levels of carcinogens on an arbitrary fraction of the lowest effective animal dose in a particular experimental situation."

Environmental Problems from Pesticides

Pesticides have been more readily implicated in environmental contamination. The fate of a number of the more persistent chlorinated hydrocarbons (for example, DDT, DDE and dieldrin) have been shown to accumulate and become biologically magnified in the food chain of wildlife (Bottrell 1979). These compounds have been distributed throughout trophic webs to ultimately contaminate and, in some cases, destroy species at the top of aquatic food chains, particularly species of birds such as eagles, ospreys, peregrin falcons and sparrow hawks (von Rumker et al. 1972; Pimental and Goodman 1974). This impact led to discontinuing the use of these more persistent but less toxic compounds. Instead, the use of compounds more initially toxic to warm blooded species, but less persistent in the environment, has occurred (von Rumker et al. 1972).

Limitations of Pesticides as a Pest Control Technique

One of the most serious limitations of pesticides is that significant groups of pests have developed genetic resistance to these compounds. At the present time, over 300 species of insects, mites and ticks are known to possess strains resistant to one or more chemical pesticides (Glass 1975; Bottrell 1979). And nearly every species of insect is potentially capable of developing resistance to any kind of insecticide (National Academy of Sciences 1975).

Repeated application of a pesticide may thereby result in ineffective pest control and serve to increase the rate at which pest species develop this resistance (van Emden 1974). In addition, unnecessary applications may also intensify existing pest situations and/or create new problems by destroying non-target organisms, such as predators and parasites (Beirne 1970; Smith 1970; Bottrell 1979; Committee on Urban Pest Management 1980).

Integrated Pest Management: A Potential Strategy for Pest Control in the Urban Sector

Because of the growing concern about the heavy reliance on chemical pesticides as a means for controlling pests, the development of alternative pest management strategies has grown (Committee on Urban Pest Management 1980). Rather than relying on a single control technique (such as pesticides), attention is being directed to the use of multiple techniques, an approach called integrated pest management (IPM).

What is IPM?

IPM is an ecological philosophy that advocates using all available and necessary techniques to manage pests as naturally as possible thereby lessening reliance on chemical pesticides. The ultimate outcome sought in this approach is effective, long-term management of pest populations and not necessarily the complete elimination of these organisms. While the concept and practice of IPM was originally pioneered in agriculture, its potential for development and use in the urban sector has been recognized (Bennett 1978; Olkowski et al. 1978; Bottrell 1979; Committee on Urban Pest Management 1980; Metcalf et al. 1980).

Integrated pest management has been defined by many individuals (Stern et al. 1959; Southwood and Way 1970; Glass 1975; Bennett 1978; Olkowski et al. 1978; Bottrell 1979; Bird 1980; Metcalf et al. 1980; Extension Committee on Organization and Policy 1980; Corbet 1981; Flint and van den Bosch 1981; Sawyer and Casagrande 1983). The definition given by Bottrell (1979:v) will be used as a frame-of-reference for discussing this philosophy and approach to pest management:

Integrated pest management (IPM) is the selection, integration, and implementation of pest control based on predicted economic, ecological, and sociological consequences. IPM seeks maximum use of naturally occurring pest controls, including weather, disease agents, predators, and parasites. In addition, IPM utilizes various biological, physical, and chemical control and habitat modification techniques. Artificial controls are imposed only as required to keep a pest from surpassing intolerable population levels predetermined from accurate assessments of the pest damage potential and the ecological, sociological, and economic costs of the control measures.

Principles of IPM

While the above definition is given to facilitate a discussion of IPM, it is nevertheless a difficult thing to "pin down." Perhaps Corbet (1981:185) best summed up this approach to pest management when he wrote, "IPM is as much a statement of philosophy or intent as it is a recipe for action." In addition to a definition of IPM then, a brief discussion of a number of the principles associated with it should further serve to better understand this dynamic pest management philosophy. The principles are taken, in part, from Bottrell (1979:vi-vii).

Potentially harmful organisms will continue to exist at low levels and in fact may be useful. The notion that the presence of pests necessarily justifies action for control is rejected in the IPM philosophy. In fact, in most cases it is nearly impossible to completely eliminate pests. Low levels of pest species often provide vital food sources necessary to support naturally occurring predators and parasites. The practice of pest eradication or elimination then, is contrary to an IPM philosophy. Instead, an acceptance or balance of low levels of pest species is advocated; hence, the term management rather than control is more appropriate.

The ecosystem is the management unit. Because of the relationships between all components in the environment (the ecosystem), a decision to control a pest at one level or time may create unforeseen consequences elsewhere. In practicing IPM, an understanding of the array of components comprising the ecosystem and how they relate and interact is essential. The goal in IPM is

to manage pest populations at tolerable or acceptable levels while avoiding disruptions to the ecosystem.

A variety of management techniques are used. IPM calls for using a variety of management techniques that seek to keep pest populations at or below acceptable levels. These techniques are ideally chosen to minimize economic, ecological and sociological consequences while producing safe, effective long-term pest management consistent with management objectives. In addition, the selection and integration of particular techniques calls for a thorough knowledge of the plant and the biology and ecology of the pest. Preventative measures, which are aimed at the plant and its immediate surroundings (for example, using resistant plant varieties and cultural manipulation) and the encouragement and use of natural control agents (predators and parasites) are stressed first. The application of management techniques to the pest itself (for example, physical, mechanical, and pesticide controls) are given second priority, to be used only when natural regulating factors and other suppressive efforts fail.

Monitoring essential ecosystem components provides information to establish threshold levels for decision-making. Essential to the IPM philosophy is the routine monitoring of ecosystem components, such as pest populations, natural and introduced control agents, environmental conditions and management practices. This monitored information can then be used to determine whether or not the current mix of management techniques should be relaxed, or whether additional ones should be applied. A key concept proposed for making these decisions is the threshold level. The threshold level is that

magnitude of a pest population at which the costs of control are equal to the returns or benefits. Until this level is reached, application of initial or additional management techniques will not produce enough benefit to substantiate their use. (In agriculture these costs and benefits are usually expressed in economic terms, while in urban applications they are typically classified under the somewhat vague term "aesthetic.") Ideally then, the monitoring process provides information about the ecosystem for establishing threshold levels and making management decisions.

IPM in the Urban Sector: Opportunities and Constraints

From a technical standpoint, the IPM philosophy can be applied in the urban sector. The principles from agriculture are the same, as are many of the management techniques (Committee on Urban Pest Management 1980). While appropriate threshold levels need to be developed for different urban situations and adequate biological, behavioral, and ecological information about many urban pests needs to be researched, IPM still offers a viable alternative for pest control in the urban environment. As Bottrell (1979:75) has stated: "It [IPM] has broad application and offers the only known long-term solutions to some of the most severe urban pest problems."

Aside from the technical considerations for implementing IPM in urban settings, its total incorporation is still hampered by a number of obstacles. One of the major difficulties is the relative newness of IPM. Although agricultural IPM has been studied, the

separate and specialized field of "Urban IPM" has only recently been recognized (Committee on Urban Pest Management 1980).

The differences between urban and agricultural pest management, with regard to IPM, are only beginning to be understood. These differences stem from a variety of factors, only some of which are beginning to be addressed. A number of these differences are presented in Table 1.1.

The Need for Urban IPM Information Transfer Efforts

Success in managing pest problems in the urban environment depends heavily on the cooperation of informed homeowners (Farace 1979; Committee on Urban Pest Management 1980). The urban homeowner has been conditioned to primarily use one method (pesticides) when pest problems arise. Therefore, efforts to change and consider alternative strategies for pest control are difficult. Attitudes and behaviors have been shaped and reinforced for over four decades (since the introduction of synthetic pesticides in the 1940's), and efforts to alter current pest control practices are often frustrated by a desire for a pest-free environment. The Extension Committee on Organization and Policy (1980:9) has commented on this situation:

Application of IPM techniques by commercial pest control applicators is made difficult by public expectations and levels of pest populations they frequently encounter. The commercial pest control applicator is usually contacted after a pest problem has occurred, and asked to eliminate the problem. The public's general lack of appreciation for a tolerable pest infestation level, plus the substantial competition among firms for what is perceived to be the highest quality of work with a minimum of pest recurrences, often result in a heavy reliance on pesticides.

Table 1.1. Differences between agricultural and urban pest management

Pest management in the:	
Agricultural sector	Urban sector
1. Pest management is an integral component of crop production.	1. Pest management is more an incident of daily life.
2. Pest management decision-making is based on economic criteria (termed the economic threshold level in IPM).	2. Pest management decision-making can be based on a number of criteria (for example, economic, aesthetic, and public health) depending on the pest and the situation; all have economic aspects, but only some lend themselves to economic decision-making.
3. Pest managers are often trained professionals.	3. Pest managers may be professionals, paraprofessionals, or urban dwellers with no formal or informal training.
4. Information dissemination is easier because managers share common interests and similar values; managers typically use pest management information to make a living.	4. Information dissemination is difficult because of heterogeneous urban populations who are not using the information to make a living.
5. Biological and economic factors drive the system.	5. Factors other than biological and economic drive the system; the system must be viewed in terms of socio-economic and political factors; understanding human attitudes and behaviors is important since many problems involve individual and social psychology.

Source: Committee on Urban Pest Management (1980)

Thus, homeowners, who are primarily responsible for pest management decision-making, become a significant component in determining if urban IPM programs will be effective. In addition, the actions they take and the pest control options they seek will account for a major portion of the success of these programs. Consequently, information transfer activities that "provide motivation to act, courses of action, and reinforcement for successful attempts, all figure importantly in a comprehensive pest management strategy" (Farace 1979:1).

The transfer of information to urban homeowners, however, is a complicated matter since most pest control activity is carried out by individuals with diverse experiences, motivations, and expectations (as noted in Table 1.1). One of the challenges of urban IPM then is to serve the extremely diverse user groups with appropriate IPM information (Bennett 1978; Olkowski et al. 1978; Bottrell 1979; Committee on Urban Pest Management 1980; Extension Committee on Organization and Policy 1980).

The need for studying and understanding such efforts, and indeed the primary reason for this study, is best put forth by the Committee on Urban Pest Management (1980:244-245):

The need to convey information--knowledge and techniques--from those who have it to those who need it is a common problem in almost every field. To be useful, information must be conveyed understandably, and in such a way that it is likely to be used and used effectively. Although public education in urban pest management is urgently needed, the problems of conveying pest management information to urban residents have not been studied sufficiently to permit definitive statements about which methods assure that the message will be received and applied. Hence there is an urgent need for research on how to transfer information on urban pest management effectively.

They go on to state:

A variety of media and messages--many as yet untried--may therefore be necessary to convey useful information on pest control. Methods will also be needed to measure the impact and effectiveness of particular educational efforts so that more effective means can be devised for future use.

Study Purpose and Overview

The purpose of this study represents a response to the needs stated above by the Committee on Urban Pest Management (1980): to better understand the transfer of urban pest management information. More specifically, this study focuses on evaluating one recent effort to transfer integrated pest management information to urban homeowners. In doing so, it is expected that the results will not only provide a better understanding of the factors associated with this particular transfer effort, but will also provide a framework that others can use to better understand and perhaps improve their transfer efforts in urban pest management.

Towards this end, Chapter 2 describes a community development project (Project PEST) conducted in Meridian Charter Township, Michigan that was designed to increase awareness of alternatives to pesticides among urban homeowners. One component of Project PEST was the production of the Pest Management Manual -- a homeowner's self-help approach to IPM. This manual, and the 75 township homeowners who purchased it, represents the transfer effort that is investigated in this study. Consequently, Chapter 2 also provides a detailed description of the Pest Management Manual.

Having described what will be investigated, Chapter 3 is devoted to how the manual will be evaluated. Divided into two parts,

Part I (the theoretical framework) describes a sociological-based model developed to explain the process an individual goes through when deciding to adopt or reject a new idea or practice (labelled an innovation). Considering the manual an innovation, a rationale for using the model and how it will be applied in this study concludes Part I. Part II (the conceptual framework) is devoted to selecting specific variables associated with the model and conceptualizing them for use in this study. In addition to using the model as a means to determine the factors affecting the use of the manual by township homeowners (measured in terms of the extent to which they adopted information and practices from it), its usefulness as a framework for characterizing other transfer efforts will also be determined. This will be accomplished by testing a number of relationships found to exist between the independent and dependent variables in the model. The chapter ends with a list of the 15 hypotheses that will be used to test the model's applicability for urban pest management transfer efforts.

Study methods are presented in Chapter 4. The first four sections describe the approach taken in this investigation: a cross-sectional post-only survey of all manual owners in Meridian Charter Township, Michigan. The fifth section provides a detailed presentation of how each of the variables was measured. Remaining sections include a description of the instrument used to collect survey data (a self-administered mail questionnaire), pre-test procedures and results, how the main survey was conducted (including return results) and the methods used to analyze the data.

Survey results are presented in Chapter 5. Basic distributional characteristics of the data for all variables are presented first. The second part of the chapter describes the results of testing the relationships proposed in the 15 study hypotheses using correlation analysis. In the final section, results of exploring the relationship between the extent of adoption of the manual (the dependent variable) and the entire set of independent variables, using multiple regression analysis, are presented.

The final chapter (Chapter 6) begins with a summary of the reported survey findings. Conclusions regarding the extent to which the manual was used and factors found to be associated with its use are discussed. In addition, the applicability of the innovation-decision process model as a means for characterizing and understanding urban pest management information transfer efforts is also addressed. Finally a number of limitations in the study are described, as well as implications and recommendations for future research.

CHAPTER 2

PROJECT PEST AND THE PEST MANAGEMENT MANUAL

During the period 1979-81, a community development project was conducted in a Michigan suburban community. The goal of this project (Project PEST) was to increase community awareness of alternatives to pesticides for managing pest problems in the yard. To achieve this goal, a community education program was conducted that included the production and distribution of an integrated pest management manual, titled the Pest Management Manual, to community homeowners. Since the purpose of this study is to evaluate the Pest Management Manual as a means for transferring pest management information to urban homeowners, this chapter includes an overview of Project PEST and a detailed description of the Pest Management Manual.

An Overview of Project PEST

Project PEST represented one approach to transfer IPM information to urban homeowners.* It was designed as a community development project in which urban homeowners joined with Michigan

*Project PEST was funded by the Environmental Education Program of the U.S. Office of Education from October, 1979 to February, 1981. Activities associated with the project were conducted as part of Project 1359H of the Michigan Agricultural Experiment Station, Michigan State University, East Lansing, Michigan.

State University specialists from the fields of entomology, forestry, and community development to design and conduct project activities. The community development approach refers to actions taken within a community to change the economic, social, cultural, or environmental situation (Christenson and Robinson 1980). An important element in conducting effective community development programs is citizen participation; citizens become involved and can control the entire process or work with others (such as change agents) to effect the change. The community development approach helps to insure that the needs of the citizens (with respect to the change) are taken into consideration. This approach also helps to increase commitment to, and a better understanding of, the change because citizens are involved in solving community problems (Fear et al. 1981). Therefore, the community development approach was used in Project PEST to: (1) facilitate a better understanding of the information being transferred; and (2) increase the capacity to design the transfer effort to make it compatible with existing attitudes, beliefs, values, and practices of community homeowners.

Project Goal and Methods

The principal goal of the project was: to increase community awareness about alternatives to pesticides for managing pest problems in the yard.

Several methods used to achieve the goal were proposed at the beginning of the project:

1. Develop and implement a community education program on alternative approaches to urban pest management; and

2. Involve community residents in the process of designing, implementing, and evaluating the project.

The Target Community and Project Co-Sponsor

Meridian Charter Township, Michigan was the target community. The township is located in the north central portion of Ingham County (in the center of Michigan's lower peninsula) and is part of the Lansing metropolitan area. The estimated population of Meridian Township is just over 29,000.

Meridian Township was selected as the study site because: (1) the community includes a high proportion of urban homeowners; (2) a federated homeowners' association was interested in co-sponsoring the project; and (3) the township is contiguous to Michigan State University, which permitted the time-efficient involvement of project staff.

The project co-sponsor was the Liaison for Inter-Neighborhood Cooperation (LINC). LINC functions as a medium for collecting and disseminating information to township residents. Persons in approximately 2300 households were dues paying members at the time of the project. Given their commitment to information transfer and interest in the project, project staff felt that a co-sponsorship would greatly help in achieving the project goal.

Project Plan of Work

The project plan of work included three components: needs assessment, community education, and program evaluation. More specifically:

Assessment of the current urban pest management situation in the township (including types of pest problems experienced, how those problems were managed, extent of pesticide use, attitudes toward the use of alternatives to pesticides);

The design and implementation of a community education program based on the results of the assessment study;

Evaluation of the education program and the community development process used to conduct the project.

Structure of the Citizen Participation Program

The citizen participation program was central to the Project PEST effort. It was important that local residents had an opportunity to participate in project activities. The program was based on the assumption that different residents would want to participate in the project for different reasons, at different levels, and on different topics. With this in mind, a three part program was designed:

One Citizen Steering Committee: A group of residents who would work closely with the staff to design, implement and evaluate all activities. These people would work on the project throughout its duration;

Three Ad Hoc Committees: Residents who would join with the Citizen Steering Committee and staff to work on designing, implementing, and/or evaluating one of the project components (Assessment, Education, Evaluation);

Three Short-Term Volunteer Committees: Residents would perform activities that could be completed in a limited amount of time during one of the project components (Assessment, Education, Evaluation).

Recruiting Citizen Participants

A public meeting was scheduled in early November, 1979 to "kick-off" the project. The meeting was preceded by a publicity campaign mounted to encourage attendance. The campaign involved the use of media and direct mailings to township residents (for example,

a flyer, which included general information about the project, was mailed to over 2,300 households in the township). Thirty-six people attended this first meeting.

At the end of the meeting, a volunteer form was distributed to the audience. Persons indicated on the form if and how they wanted to participate in the project (given the options proposed above). The volunteer form was also distributed, on request, to interested persons who had not attended the meeting. Eight people volunteered for the Citizen Steering Committee and all Ad Hoc Committees; three volunteered for at least one Ad Hoc Committee; and eight signed up as Short-Term Volunteers.

Designing and Conducting the Needs Assessment Study

The assessment study was the first major project activity. The staff, Citizen Steering Committee (CSC), and the Ad Hoc Assessment Committee began working collaboratively on the assessment study in mid-December, 1979. During initial meetings, the staff presented various options regarding assessment topics and data collection methods. In many cases, the advantages and disadvantages of each option were discussed; this procedure proved to facilitate efficient decision-making. After discussing all options, the committee decided upon the assessment study design presented in Table 2.1.

Having made these decisions, the staff and citizen committee members began designing the assessment questionnaire, selecting the survey sample, recruiting Short-Term Volunteers for questionnaire distribution and collection, and planning a Short-Term Volunteer training program. The Dillman (1978) "Total Design Method" was used

Table 2.1. Needs assessment study design for Project PEST

Topic	Decision
Data collection method	Self-administered questionnaire
Questionnaire respondents	Ten percent systematic random sample of township homeowners
How questionnaires would be distributed and collected	Door to door by Short-Term Volunteers
Plant groups on which data would be collected	Ornamental/shade trees, fruit trees, shrubs, flowers, lawn, vegetable garden
Categories of questions	<u>Extent of pest problems</u> (type and extent of pest problems in the yard) <u>Methods of pest management</u> (extent of pesticide and alternative use, types of pesticides and alternatives used, where pesticides were purchased and stored, level of satisfaction with pesticides and alternatives) <u>Pest management issues</u> (willingness to spend time in pest management activities, willingness to accept pest levels, willingness to use resistant plant varieties) <u>Pest management education</u> (if respondents were interested in receiving pest management information, how respondents would prefer to receive the information, on which topics respondents would prefer to receive information, on which plant groups respondents would prefer to receive information) <u>Background information on respondents</u> (age, level of education, income, size of yard)
Data collection period	Late February - early March, 1980

for constructing the survey questionnaire. General principles for conducting a community survey were drawn from a field tested document published by the University of Missouri-Columbia and Missouri Division of Community Betterment (1977).

By early March, the sample of township homeowners had been drawn using township taxpayer rolls. Newspaper articles were used to publicize the impending survey; a survey announcement was mailed to each household selected for inclusion in the sample. In addition to the Short-Term Volunteers, a number of volunteers were recruited to distribute and collect the questionnaire (many volunteers were neighbors of the prospective survey respondents). The volunteers were assembled and trained in the questionnaire distribution/ collection process. Most questionnaires were distributed and collected within a five day period. Of the questionnaires that were delivered to homeowners, 76.1% were collected by the volunteers and returned to project staff (519 questionnaires were delivered, 395 returned). Thirty questionnaires were returned incomplete, therefore 70.1% of the returned questionnaires (365) were useable. Thus, the assessment study was based on a 7% sample of township homeowners.

Assessment Study Findings

Responses to each question were organized in table form and presented to CSC/Ad Hoc Committee members. The following findings were especially relevant for designing the community education program (see Lambur et al. (1982) for a more detailed discussion of survey findings):

1. Seventy-five percent of the respondents reported an interest in receiving pest management information from Project PEST.

2. Those who wanted information expressed a clear preference for information that focused on lawns, ornamental/shade trees, and vegetable gardens and included topics such as prevention of pest problems, proper use of pesticides, and alternatives to pesticides.
3. Eighty percent of the respondents indicated they preferred receiving pest management information in the form of a manual; approximately 50% preferred demonstration yards and workshops.
4. Most survey respondents expressed a favorable attitude to IPM principles: 75% indicated that they would be willing to use less pesticide for pest management even if it would result in their spending more time in the yard dealing with pest problems, 66% reported a willingness to plant vegetation that has been shown to display a greater resistance to pests even if the plants cost more than other varieties, and over 50% indicated that they would be willing to accept pests on plants even if the health and appearance of plants were slightly affected.

Designing and Conducting the Community Education Program

Based on the survey findings, the staff, CSC, Ad Hoc Assessment, and Ad Hoc Education Committees decided to develop a manual and conduct a demonstration yard as the Project PEST community education program. Both educational activities would focus on the following topics: IPM concepts and principles, pest identification and monitoring, pest problem prevention, proper use of alternatives to pesticides, and proper use of pesticides. The plant groups to be covered in the manual included ornamental/shade trees, the lawn, and the vegetable garden. Ornamental/shade trees would receive sole attention in the demonstration yard.

The Demonstration Yard. The demonstration yard program was conceived to include practical application of IPM in a number of homeowners' yards in the township. These demonstration yards would then be "opened up" and guided tours held for the purpose of

demonstrating IPM techniques to community homeowners. However, due to limited time and logistical problems, the demonstration yard program was modified into a "Walking Tour" on the Michigan State University campus. This site was selected because of its accessibility to township residents and because it provided a broad array of ornamental/shade tree species and pest problems. The objectives of the "Walking Tour" were to: (1) show participants what specific tree pest problems looked like; and (2) provide a forum for discussing alternative ways of handling these types of problems (within an IPM framework).

A series of "Walking Tours" were conducted on the campus during August, 1980. A guidebook was prepared for the tour and designed so that participants could return at their leisure and review the trees and problems discussed in the tour. Four 1-1/2 hour tours were eventually conducted (80 persons attended).

The Manual. A manual, titled the Pest Management Manual, was produced and contained IPM information specifically adapted for the needs of urban homeowners. The manual included: (1) an illustrated discussion of IPM principles and guidelines; (2) an introduction to IPM techniques; (3) recommendations for the safe use, storage, and disposal of pesticides and pesticide containers; (4) a damage key and pest identification list by plant group; and (5) pest management alternatives that could be used for each potential pest. The manual was put into a large, loose-leaf notebook to allow for expansion and the inclusion of additional information.

Three hundred copies of the manual were produced. A direct mail announcement of manual availability was sent to almost 2500

households in the township. Articles about the manual appeared in local newspapers and a feature magazine story also publicized its availability. A \$6.00 fee was charged for the manual to help defray a portion of production costs. As of February 1982, 75 Meridian Township homeowners had purchased a copy of the manual.

Evaluation of Project PEST

As a prototypical program, evaluation was an important part of Project PEST. It was decided to evaluate how the project was conducted (process evaluation), as well as to determine what pest management changes had occurred as a result of the education program (impact evaluation). Process evaluation was conceived as an ongoing activity; impact evaluation could only be implemented after educational activities had been conducted.

Process Evaluation. Process evaluation was accomplished by interviewing members of the project staff, CSC, Ad Hoc Assessment Committee, and a random sample of respondents who completed the assessment questionnaire. The Inductive Systems-Process (ISP) model developed by Burton (1978) was selected as the specific evaluation tool and used as a framework for designing evaluation interviews. Evaluation objectives were identified as: (1) determining the extent to which the process contributed to the achievement of the project goal; (2) providing information to make changes or modifications in the process for the remainder of the project; and (3) making recommendations for future projects. While not reported here, the evaluation findings and interpretations given by Rogan (1981) proved to be valuable for understanding the various issues and problems

encountered during the project (to that date) and helping to modify the process so that remaining project activities could be carried out more effectively.

Impact Evaluation. Impact evaluation (to date) consisted of judging the effect of the Walking Tour toward creating awareness of alternatives for managing pest problems on ornamental/shade trees (the Burton ISP model was also used for evaluating the tours). A questionnaire was mailed to each person who had attended one of the four tours. Eighty percent of the participants completed and returned the questionnaire. Key evaluation questions included in the questionnaire were: (1) What expectations did participants have regarding the tour?; (2) To what extent were those expectations met?; (3) Were the most appropriate pest problems and management techniques discussed during the tour (from the participant's perspective)?; (4) What did the participants learn from the tour that they expected to apply in their yards?; (5) What was their overall rating of the tour?; and (6) How could the tour have been improved?

Participants were generally satisfied with the tour and indicated that they had learned a considerable amount from attending. Each respondent listed at least one way that the acquired information had been applied or would be applied in their yard. In addition, expectations of participants had been met. Consequently, the Walking Tour was judged as successful in beginning to increase awareness of alternative approaches for managing pests on ornamental/shade trees. (See Fear et al. (1983) for a more detailed discussion of the Walking Tour evaluation.)

The Pest Management Manual

Because existing publications were judged to be unsuitable "as is" for use as the project manual, project staff and committee members mutually agreed that the best course of action would be to produce a unique IPM publication titled the Pest Management Manual. Given the importance of the manual to the project and because it is the transfer mechanism that is being evaluated in this study, the following sections present a chronicle of how the manual was produced and a detailed description of the finished manual.

Staff and Committee Member Roles in the Manual Planning and Production Process

Work began on the manual in June, 1980. Before production started, the staff and committee members (CSC and Ad Hoc Committees) discussed their roles in the manual production process. Consistent with the approach used to develop the assessment questionnaire, staff members would be responsible for proposing alternatives (regarding format and content) and performing production tasks; committee members would function in helping to make decisions (among the alternatives) and by reviewing sections of the manual as they were developed.

During the entire production process, committee members were more actively involved in the initial planning stages. After general format and content decisions were made by the entire group, staff members pursued the writing and production on their own. This arrangement was agreed upon for two reasons: (1) given the technical content of the manual, committee members felt they could not

critically review the material; and (2) since a great amount of staff time was typically spent preparing for committee meetings, it was felt this time would be better spent on producing the manual.

Initial Planning Considerations for the Manual

Data from the assessment questionnaire provided information to begin planning and designing the manual. In addition, a number of considerations concerning the manual were discussed at the first educational planning meeting. These included: (1) it should look good; (2) it should be revisable; (3) the information should be practical and useable; (4) the cost should be moderate; (5) it should be durable; (6) it should address pest problems township homeowners were currently experiencing; and (7) it should be written from an IPM standpoint, to capitalize on survey data indicating an openness or favorable attitude toward this pest management approach. While the manual was not acknowledged to be equivalent to the Walking Tour, it was to be used as the source of pest management information for this and any other educational activities.

Given these initial considerations the following decisions were made concerning the manual. A three-ring binder with tab dividers would be used to hold and organize the pest management information. The binder would be durable and information could be easily referenced with the tab dividers. In addition, new materials could easily be added and outdated materials taken out. The binder format would also offer a place to store other pest management information.

To make the manual "look good", it was decided to have a design silk screened on the cover and spine of the binder. To keep the price

of the manual moderate, a portion of the production costs would be covered by project funds. And it was also decided that where appropriate, existing information (such as Cooperative Extension materials) would be included in the manual, thereby lessening the time and expense of writing and reproducing this information.

Even though the manual was intended to be used as a whole, it was also recognized that some homeowners would probably use only certain parts of the manual. Consequently, the manual had to be written and arranged to accommodate use by a broad array of people -- people with diverse pest management interests and skills. On the one hand, persons unfamiliar with the philosophy and practice of IPM could read about and become familiar with this approach to pest management. Conversely, persons familiar with IPM could proceed to those sections with appropriate information only. In this manner, the flexibility of the manual was enhanced.

Manual sections and their content, as initially proposed, included:

Introduction - this section would acquaint the user with the project, in addition to providing background information on production of the manual.

How to Use the Manual - this section would outline the format of the manual with instructions for its use.

Management vs. Control - the concept of managing pest problems (IPM), rather than attempting to control them, would be outlined in this section.

Management Techniques - general information on techniques for proper plant management, such as pruning, fertilizing, and choosing pest resistant plant varieties would be presented in this section.

Safety Considerations - this section would contain safety considerations primarily associated with the use of pesticides.

Plant Groups - this section would be divided into sub-sections, one for each of the plant groups identified in the assessment questionnaire (that is, ornamental/shade trees, fruit trees, shrubs, flowers, lawn, vegetable gardens, and other vegetation). Within each sub-section, a standard format sheet would include information on plant identification, pest problem identification, and management options (pesticides and alternatives to pesticides).

Monitoring Records - a number of forms for recording appropriate monitored information, adapted for the homeowner, would be contained in this section.

Manual Evaluation - while not proposed as a separate section, an evaluation form to assess the user's reaction to the manual, including recommendations for change and improvement was suggested.

A number of additional pre-production decisions were made regarding the manual. Rather than include material for identifying plants (it was felt that the amount of appropriate plant identification material would be too numerous to include), it was decided to purchase plant identification guides separately and place them on permanent loan in the local library for use by township residents. This idea was also expanded upon; it was decided to purchase additional reference materials on various aspects of pest and plant management that would also be placed in the library (under a special reserve section entitled Project PEST). And for those persons who did not wish, or were unable to purchase a copy of the manual, several copies would be put on reserve at the local libraries for their use.

Given initial estimates for production costs, it was decided to produce 300 copies of the manual. These would be made available on a first-come, first-serve basis, making distribution as simple as possible. Publicity regarding manual availability would include articles in local newspapers, radio spots on area stations, and direct mail announcements. Project staff would also be available for

making presentations at local community association meetings (for example, garden clubs and homeowner associations).

Producing the Manual

The Pest Management Manual was produced in eight months (July, 1980 - February, 1981). During this time, the staff coordinated and performed all production tasks. Citizen committee members were updated on production activities and, at times, asked to help make decisions on particular content and format considerations.

Within the first month of production, three important decisions were made concerning the content and format of the manual. The first decision concerned the inclusion of alternative information from non-scientific sources. After a preliminary review of appropriate alternative (non-pesticide) techniques was conducted, the staff informed committee members that many of these techniques appeared in the so-called "organic" literature. As such, most were not subjected to scientific testing; their efficacy rested on what some referred to as "testimonials." Given the dearth of appropriately tested alternatives, it was decided to include these "organic" techniques, with a caution regarding their "supposed" ability to either kill or repel pests.

The second decision pertained to the number of plant groups that could be addressed in the manual. With an original distribution date of early fall, 1981, it became apparent that pest problems for all plant groups could not be included. After reviewing the survey data, it was decided to include only the more important pest problems of ornamental/shade trees, lawns, and vegetable gardens. The remaining

plant groups and their pest problems could be covered in "updates", if time and/or additional funding became available.

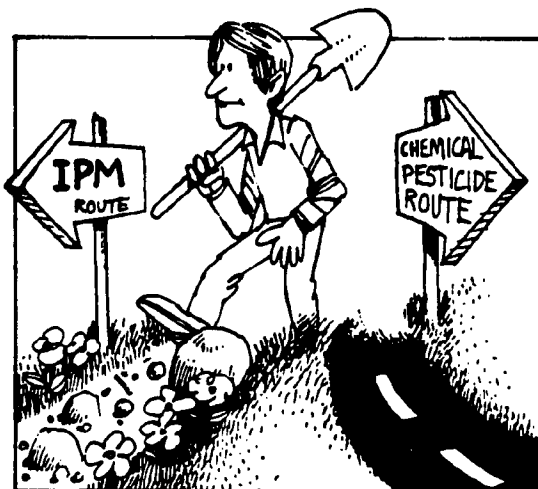
The third decision came about after committee members were asked to review and comment on section drafts as they were prepared. The drafts were typed on 8-1/2" x 11" paper and it was assumed that they would be included "as is" in the manual. However, several committee members commented that if this was how the material would appear in the manual, it would certainly be uninteresting and thus, unlikely that people would even read it. Instead, it was suggested that the material could be made more interesting and appealing, perhaps by including artwork or cartoons. From these comments, it was decided to incorporate cartoons and line drawings into the manual to illustrate relevant concepts and techniques.

While two members of the staff had training and experience in pest management and IPM (one from the Department of Forestry and one from the Department of Entomology), other university specialists with responsibility for pest problems associated with the plant groups reviewed prepared information on specific pests for clarity of technical content. In addition, these specialists were given copies of other manual sections and asked to review and comment on them.

A professional artist was employed to prepare cartoons that would be inserted into the text. After completion of a section, staff members reviewed the section's contents. Where a particular concept could be graphically enhanced, a cartoon was prepared that illustrated the concept. (An example is provided in Figure 2.1.) A number of university graduate students, with pest management background, were also employed to assemble information on the

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management techniques* and a method for selecting among them. Finally, in practicing IPM it is important to remember that pest situations will mean different things to different people. What is a problem for your neighbor may not be a problem for you--only you can judge.



We hope that your manual will provide you with alternative approaches useful in managing pest problems in your yard. We also hope it will gain your enthusiastic acceptance. The IPM approach may not always be as simple as the chemical pesticide approach, and it may involve more preliminary planning and thinking, but it will also provide you with the satisfactions of self-reliance and improved environmental quality.

Pesticide Use: How Perspectives Have Changed

The period immediately following World War II witnessed the increased production of man made (synthetic) chemicals used to control pests. These chemicals, or pesticides, rapidly replaced the time-tested, more traditional forms of handling pest problems such as cultivation, crop rotation, the planting of diverse species and others. With little fear of potential side effects or associated problems, these

*The "Management Strategies" listed on all pest information forms represent methods found by others to be successful. Since many of these methods have not yet been scientifically tested, you may wish to try them and see if they work for you. We make no claims or recommendations regarding their effectiveness or desirability.



Figure 2.1. Example of cartoons in the Pest Management Manual [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

specific pests and management techniques that would be covered in the manual.

Project staff were responsible for authoring approximately 30% of the manual (the remaining 70% consisted of existing material, such as Cooperative Extension bulletins). The presentation of IPM, as a self-help approach, was based on the staff's understanding of the IPM philosophy and their ideas of how it could be practiced by urban homeowners. Most of the procedures are as yet untested. In addition, all format considerations (such as layout, selection of the binder, tab-dividers, front cover design) were coordinated by one staff member who had experience and expertise in graphic arts and publication design.

The Finished Manual

The finished manual included all of the initial format considerations proposed by the staff and committee members. Minor differences occurred from rearranging and renaming several sections; major differences occurred from adding new sections. All changes in format were based on enhancing the practicality and useability of the manual.

For example, two empty tab dividers were included. Users could label these, perhaps for additional information, or for a plant group not contained in the manual. Also, a "Miscellaneous" section was added to store information not falling under any of the other pre-labeled sections.

Information on all pests was put into a standardized format to facilitate quick and easy reference. And a "Quick Pest Reference

Guide" preceded each of the three plant group sections. This guide included condensed information, in table form, on: (1) the development stage of the damage causing pest; (2) when plant symptoms or damage appeared; and (3) suitable host plants for the pest. The intent was to provide a list of pests covered in the section with sufficient information to make a preliminary pest identification.

The evaluation form was modified into a return post card, which was included at the beginning of the manual. The post card asked for comments or suggestions regarding the manual. This format was selected to deemphasize any academic connotations that a formal evaluation questionnaire might elicit. Three pre-addressed, metered post cards were included in each manual.

In addition to the cartoons that were used to enhance understanding of the material, originally authored sections were written in a personal style. Where appropriate, personal pronouns (for example, you, yours, we, us) were used. And when the manual was purchased, each person registered their name and address (through a receipt). This information would be used for contacting manual owners regarding manual updates and future installments.

In as much as the formatting of the manual presented a challenge to the staff and committee members, so did the presentation of IPM. As mentioned, no existing material was located that incorporated the principles and techniques of IPM into a practical, self-help guide for homeowners. Indeed, it was felt that to simply offer alternatives to pesticides would not be sufficient. On the other hand, it must also be acknowledged that the added task of preparing a guide to IPM may have exceeded the bounds of the project. Nevertheless, the

manual contained both. A description of the manual, section by section, follows. (The front cover and table of contents are reproduced in Appendix A.)

Background of Project PEST. This short section preceded the pre-labeled tab dividers. The decision to include this section was based on information obtained from the evaluation interviews conducted from a sample of respondents to the assessment questionnaire. Approximately 25% of those interviewed had not heard of, nor were familiar with Project PEST before receiving the assessment questionnaire. This finding was significant since these homeowners had been sent two direct mail pieces concerning the project. In addition, a publicity effort, which included newspaper articles and radio spots, was conducted throughout the project to inform township residents of current project status and upcoming events.

Based on this finding, a brief discussion of the project was included in the manual. This section, written in a question and answer format, described the project and included how the manual related to other educational activities and the entire project.

Manual Focus. This section introduced and explained the IPM approach taken in the manual. To be used successfully, the manual was presented as a source of information and a decision-making guide. Consistent with the dynamic nature of IPM, the manual provided a range of management techniques and a method for selecting among them, rather than prescribing treatments for use by homeowners.

A brief discussion followed on how perspectives have changed regarding the predominant use of pesticides for pest control. Readers were advised that while the use of pesticides has increased,

many have questioned this form of pest control. One response to this situation has been IPM. While originally developed in agriculture, IPM is being modified and used to manage urban pest problems. In addition, problems associated with pesticides were presented and discussed under the headings: "Creating Health Hazards", "Promoting Pest Resistance", and "Reducing Helpful Organisms."

A definition of IPM was then given. IPM was defined as a decision-making process by which: (1) pest problems are prevented or their severity reduced by deliberately selecting appropriate plants and caring for them wisely; (2) plants are observed on a regular basis, noting pest problems that are already present or indications of those that may appear; (3) a decision is made as to whether or not a significant pest problem is present, using information gained from observations in number 2 above; and (4) a decision is made on how to best manage significant pest problems by drawing from a range of management techniques.

Following the definition, principles and objectives of IPM were presented to further clarify and operationalize this pest management approach. Principles of IPM would help readers understand this philosophy of pest management; objectives served as the general procedural "steps" of the IPM approach. Principles of IPM are presented in Table 2.2; objectives are presented in Table 2.3.

How to Use the Manual. This section outlined how the manual could best be used. The idea that the manual was meant to be flexible was stressed. Readers were also encouraged to add their own pest management materials. A short summary of the contents of each

Table 2.2. Principles of IPM presented in the Pest Management Manual

Principle	Brief explanation
1. Keeping numbers of pests low is more practical than trying to completely eliminate them.	1. It may be impossible and undesirable to completely eliminate species of pests. Small populations of pests are needed to provide vital food sources necessary to sustain beneficial organisms.
2. You live, work and manage your pests within ecosystems.	2. All living and non-living components of the environment are interrelated. A decision to control a pest in one place or at one time may create an unforeseen problem in another place or at another time.
3. More than one management technique will provide a better chance of success.	3. IPM calls for using a variety of techniques rather than just one. The first step is to prevent pest problems by manipulating either the plant or its immediate surroundings to discourage pests. A combination of direct pest control techniques may be needed, which may include the use of pesticides. Chemical controls, however, are to be used as a last rather than first choice.
4. You must be willing to consider revising your decisions of how much plant injury you will "accept."	4. Managing pests at tolerable levels is more appropriate than trying to eliminate them. The point or pest level at which it is reasonable to take action is called the "injury acceptance level." The injury acceptance level is dynamic and changes, depending upon the plant and the pests associated with them.

Table 2.3. Objectives of IPM presented in the Pest Management Manual

Objective	Brief explanation with locations where further information could be found in the manual
1. Try to prevent or minimize your pest problems.	1. Selecting plants that are more resistant to pests and/or maintaining them in proper condition can prevent or at least minimize pest problems. Readers were referred to the "Management Techniques" section.
2. Establish your own monitoring program.	2. Monitoring involves the regular observation and recording of changes in plant condition, abundance of pests and plant damage, and management activities. The purpose of monitoring is to supply recent, accurate information for making appropriate pest management decisions. Readers were referred to the "Monitoring/Records" section.
3. Establish your own injury acceptance levels for pests.	3. Injury acceptance levels are dynamic because they may change for different pest situations and will necessarily be different for each individual homeowner. Using the injury acceptance level concept allows better pest management decisions to be made. Readers were referred to the "Monitoring/Records" section.
4. Select and use the "best" management techniques.	4. Selecting any combination of management techniques will depend on the specific plant, the pest, the injury acceptance level, and materials or resources available to the homeowner. Preventing or minimizing pest problems (Objective 1) is the first line of defense. If direct control techniques are needed, those that cause the least amount of harm to the ecosystem are considered first (such as mechanical, manual, and biological control methods). The last resort is the use of pesticides. With appropriate

Table 2.3. (Continued)

Objective	Brief explanation with locations where further information could be found in the manual
5. Evaluate your actions.	4. (continued) monitoring information, these compounds may be applied more sparingly. Readers were referred to the "Management Techniques" section and the individual pest forms in the "Pest Information and Strategy Selection" section. 5. Judging the outcomes of pest management actions can provide useful information for increasing the success of future pest management activities. Readers were referred to the "Monitoring/Records" section.

section was provided giving an overview of the contents of the manual.

Also included in this section was a heading entitled, "Five Steps to Using the Manual." The "steps" illustrated how the manual could be used to begin an IPM program in the yard. Following each step, readers were directed to a section of the manual where further information could be found (see Table 2.4).

The section ended with an example illustrating how the manual could be used in the yard. The appropriate "steps" (given by number) were printed on the right hand margin of the page, corresponding to their use in the example. The example traced the actions of a "typical" homeowner, Alice, as she used the manual to deal with Tomato Hornworms in her garden.

Monitoring/Records. This section provided a guide for establishing the monitoring component of the IPM program. Of the information presented in the manual, the ideas and techniques presented in this section were the most theoretical. It was felt, however, that providing a monitoring approach that was too general or conceptual might create more confusion than clarity. Despite the scarcity of appropriate information in this area, a guide to monitoring and decision-making was developed by the staff. While the components are sound, their combination and application have not been tested.

The section began with a discussion of the purpose of monitoring. Monitoring was performed to supply recent, accurate information for making appropriate pest management decisions that "fit" the reader's IPM program. Monitoring included the regular observation and recording of:

Table 2.4. Five steps for using the Pest Management Manual

Steps for using the manual	Manual sections where additional information could be found
1. Become familiar with the plants and other organisms in your yard.	1. "Pest Information and Strategy Selection" (for pest information); "Appendix" (for information on beneficial organisms, plants and further references)
2. Establish your monitoring program.	2. "Monitoring/Records"
3. Select management techniques.	3. "Management Techniques"; "Pest Information and Strategy Selection"
4. Evaluate your actions after practicing management techniques.	4. "Monitoring/Records"
5. Continue monitoring.	5. "Monitoring/Records"

(1) the condition of plants (their vigor and appearance); (2) the abundance of pests and plant damage; and (3) the management activities performed and their effects on the plants.

These three items were selected because they represent major components of pest and plant interaction, and serve as general indicators of the extent of pest situations. Awareness of these items can help to anticipate conditions or changes that may lead to pest problems. And in some cases, monitoring will allow pest problems to be prevented or alleviated before they become serious.

To determine the condition of the plant and the abundance of pests and plant damage, two charts were provided (reproduced in Figures 2.2 and 2.3). The charts were presented as guides for developing a quantitative rating that could be used for deciding to either take action or continue monitoring.

A short section followed that recommended monitoring on a regular basis. It was stressed that through regular inspection of plants, observations could be compared to provide a more reliable picture of the situation over time. Because different pest species are more active or inactive at different times of the day, readers were also urged to inspect plants at various times of the day -- depending on the existing or potential pest problem. Readers were referred to "Pest Information and Strategy Selection" section, which contained this information.

The next part of the monitoring section outlined a procedure for deciding upon a course of action, after monitoring information was collected. Each time plants were monitored, readers were directed to answer two questions that addressed the significance of the pest

CHART 1**PLANT CONDITION RATING**

PLANT CONDITION RATING ↓	INDICATORS OF PLANT CONDITION			
	Leaf Color	Amount of Dead Plant Parts	Amount/Size of Growth	Presence of Pest Problems
EXCELLENT	Good	None	Adequate	No Major Ones
GOOD	Good	Few	Slightly Reduced	Few Minor Ones
FAIR	Poor	Many	Much Reduced	Major or Minor Ones Occurring Frequently
POOR	Poor	Innumerable	Severely Reduced	Both Major and Minor Ones Occurring Frequently

Note: The Plant Condition Rating Chart is presented as a guide only. When determining plant condition, your selected indicators may fall in several different Plant Condition Rating categories. If this occurs, you will have to decide which Plant Condition Rating category best approximates or describes the plant's condition.

(SEE LEGEND ON BACK OF THIS PAGE)

Figure 2.2. Plant condition rating chart [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

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EXPLANATION OF INDICATORS

LEAF COLOR:

good leaf color refers to a deep green

poor leaf color refers to shades from pale green to yellow

Note: Some ornamental trees and shrubs (like the purple-leaf plum) *do not have green leaves.*

DEAD PLANT PARTS:

few, many or innumerable dead plant parts refers to varying amounts of dead twigs, branches, leaves, stems, flowers or fruit

Note: When observing plants remember to examine *all* of their parts. This would include the plant's leaves, stems, flowers, fruit and, if possible, its roots. Some of the more important evidence you might find could include plant parts that are spotted, discolored, wilted, rotted, dead or even missing. You should also examine the ground for dead plant parts and insects. Some small plants can be shaken to dislodge insects onto the ground.

AMOUNT/SIZE OF GROWTH:

amount of growth refers either to the *length* of new growth that the plant puts on in the year or the *number* of new leaves or foliage added.

Note: Different plants put on different amounts of growth. For example, an oak tree doesn't put on as much growth in one year as a maple tree.

size of growth refers to the *size* of leaves, flowers or fruits (not numbers of each)

PRESENCE OF PEST PROBLEMS:

Presence of pest problems refers to whether or not a pest problem occurred or is occurring. If so, then:

a major pest problem is one that *requires* management and has seriously affected or injured the plant

a minor pest problem is one that *may or may not require* management and may or may not affect or injure the plant

Figure 2.2. (Continued)

CHART 2**PEST & PLANT DAMAGE ABUNDANCE RATING**

ABUNDANCE RATING	INDICATORS OF ABUNDANCE
FEW	-Organisms or plant damage <i>occasionally</i> found - but only after <i>much</i> searching
COMMON	-Organisms or plant damage <i>easily</i> found - during <i>typical</i> searching
ABUNDANT	-Organisms or plant damage found in <i>large</i> numbers - obvious <i>without</i> searching
EXTREME	-Organisms or plant damage <i>extremely numerous</i> (found on all plants in large numbers) - obvious <i>without</i> searching

Figure 2.3. Pest and plant damage abundance rating chart
[reproduced from the Pest Management Manual
(Lambur and Parks 1980)]

situation and the management techniques that would be most appropriate (if any).

The first question was: "Am I really faced with a significant problem?" If the answer to this question was "No", there was no need to ask the second -- readers were advised to continue monitoring the situation. If the answer to this question was "Yes", readers were directed to answer the second question. The second question was: "Which management techniques might be most appropriate, if any?" At this point, readers were directed to proceed to the "Management Techniques" section for a general discussion of management techniques or to the "Pest Information and Strategy Selection" section for specific pest management techniques.

An aid for answering the first question (is the problem significant?) was presented in a chart titled, "Injury Acceptance Levels" (reproduced in Figure 2.4). This chart was prepared as a guide to establish, for each instance, a level at which the pest situation was important enough to take action -- the injury acceptance level. Until a reading in "Zone #3 Control Probably Needed" was reached, readers were encouraged to tolerate the situation. An example was provided, illustrating how the "Injury Acceptance Levels" chart should be used.

While the "Injury Acceptance Levels" chart presented discrete categories for decision-making, the accompanying description stressed using it only as a guide. The staff decided to use this type of graphic presentation (including the two charts for monitoring items) to increase the readers' understanding of monitoring and facilitate its use in their IPM programs.

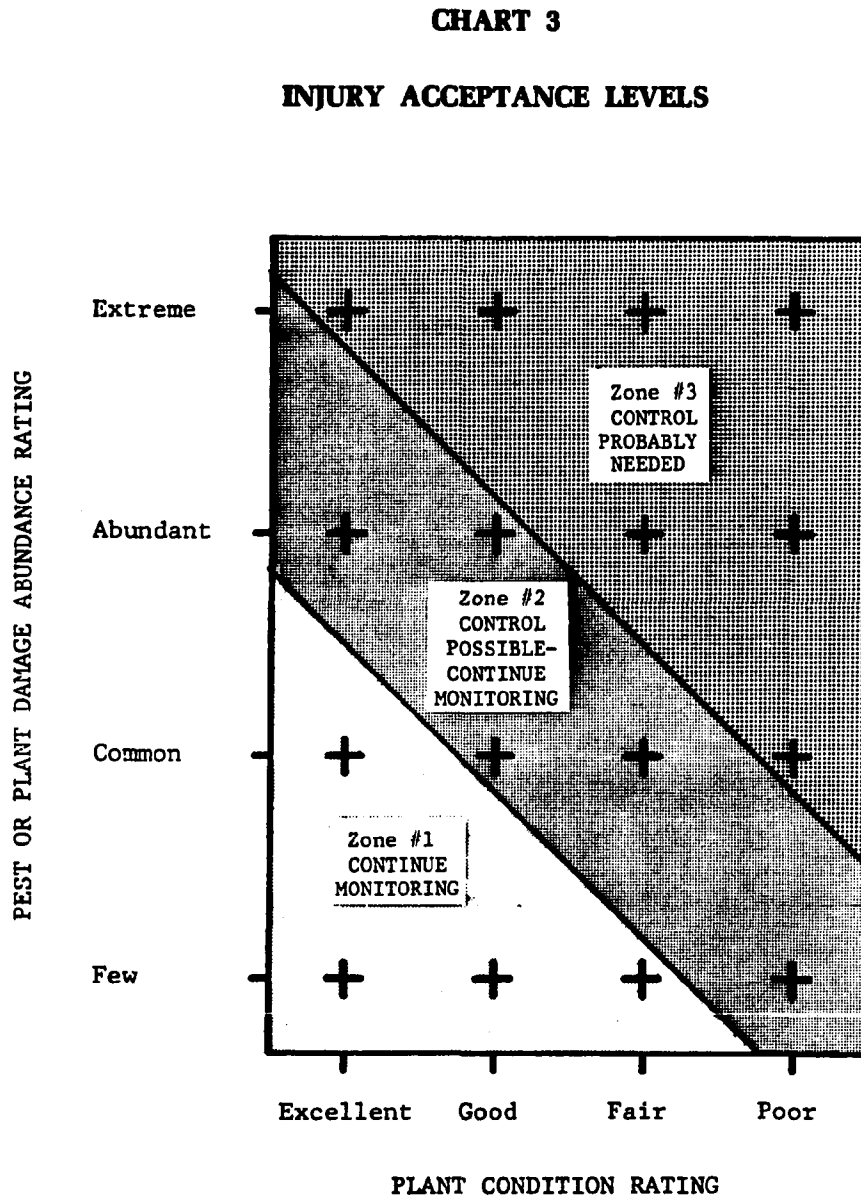


Figure 2.4. Injury acceptance levels chart [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

A guide for evaluating or judging management actions was presented next. Each time management activities were performed, readers were urged to evaluate: (1) what they did; (2) how well they did it; and (3) how effective it was. The intent was to help them improve future pest management activities by labeling past actions as satisfactory or unsatisfactory. By repeating satisfactory actions and rejecting or modifying unsatisfactory ones, their IPM program could improve. Five evaluation questions were listed:

- (1) Was I faced with a significant problem?
- (2) Were management techniques really called for or might the problem have gotten better even if I had left it alone?
- (3) Did the management technique I chose adequately solve the problem--did it improve my reading on Chart 3, Injury Acceptance Levels?
- (4) Could I manage the problem better next time -- if so, how?
- (5) Will I need more or better information to make future decisions?

The final portion of the monitoring section included several blank monitoring forms. Readers were encouraged to use these forms for recording monitored information. One form was completed, as an example, for a particular pest problem (reproduced in Figure 2.5). Readers were urged to reproduce and use these forms "as is", or modify them to fit their preferences for recording information.

Management Techniques. An overview of techniques used to manage pest problems was presented in this section. Six categories of management techniques were classified into two types: preventative techniques and control techniques. This classification scheme was consistent with the definition (and philosophy) of IPM presented in the manual. A general explanation of the six categories of management

MONITORING RECORD							
Name of Plant	Date	Condition of Plant	Presence of Helpful Organisms	Abundance of Pests	Abundance of Plant Damage	Management Activities	Evaluation Remarks
BLUE SPRUCE	6/5/80	GOOD	NONE	COMMON / (DOVEY SPRUCE GALL APHID)	COMMON	PRUNED GALLS OUT OF TREE (MANUAL CONTROL)	REMOVED ABOUT 80% OF GALLS
BLUE SPRUCE	6/29/80	GOOD	NONE	FEW / (SAME)	FEW	FERTILIZED TREE WITH TREE SPRINKS (PLANT MANAGEMENT)	PRUNING OF GALLS IS WORKING (MANUAL CONTROL)
BLUE SPRUCE	7/12/80	GOOD	A FEW LADYBUGS	FEW / (SAME)	FEW / GALLS LOOK 'DRIED-UP'	NONE	KEEP MONITORING. TREE LOOKS MUCH BETTER.
BLUE SPRUCE	7/24/80	GOOD	A FEW LADYBUGS	FEW / (SAME)	FEW	NONE	KEEP MONITORING.
BLUE SPRUCE	8/12/80	EXCELLENT	NONE	FEW / (SAME)	FEW	NONE	FERTILIZATION IS GIVING EXCELLENT RESULTS - TREE LOOKS GOOD.
BLUE SPRUCE	8/24/80	EXCELLENT	A FEW LADYBUGS	FEW / (SAME)	FEW (GALLS SEEM TO BE OPENING)	NONE	TREE LOOKS GOOD. PRUNE GALLS AGAIN NEXT YEAR!

EXAMPLE

Figure 2.5. Example pest monitoring form [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

techniques was presented in this section; specific techniques were listed in the "Pest Information and Strategy Selection" section.

Before considering techniques aimed directly at pests, measures to prevent or minimize pest problems were stressed. These first two categories of management techniques were Plant Selection and Plant Management (see Table 2.5). Should these techniques fail to minimize or prevent pest problems, more direct control techniques might need to be used (see Table 2.5). To aid in correctly choosing from among (and within) the techniques, four questions were presented (see Table 2.6). The intent of the first three questions was to insure that before taking any action, readers identified the pest and the plant on which it occurred, and the stage of the pest's life cycle in which application of a control technique would produce the best results. The fourth question reintroduced and emphasized the injury acceptance level concept for making a decision to apply a control technique.

The order in which the six categories of management techniques were presented was intentional. Preventative techniques were to be given the highest priority; direct control techniques were to be selected and used, if possible, from the order in which they were presented. Consequently, chemical control techniques received the lowest priority -- to be used only when other techniques were not appropriate or did not effectively manage the problem. This intent was emphasized at the end of the section. Five guidelines for selecting management techniques were presented:

- (1) Consider first those management techniques that are least likely to do harm to your family, neighbors, and environment.
- (2) Choose those management techniques that are least likely to do harm to helpful organisms.

Table 2.5. Six categories of management techniques presented in the Pest Management Manual

Management techniques	Definition
<u>Preventative Techniques</u>	
1. Plant selection	1. Using plant species resistant or less susceptible to pest problems. Using plants that are well suited to local climate and soil conditions.
2. Plant management	2. Actions taken to alter a pest's environment, thereby rendering the pest less harmful to the plant. Actions are aimed at the plant itself, or the environment around the plant. Actions aimed at the plant are for the purpose of maintaining the plant in a vigorous state, making it less susceptible to pest problems or better able to sustain or recover from severe problems. Examples include: fertilizing, pruning, mulching, and watering. Actions aimed at the environment around the plant are done to make it less attractive to the pest and/or more attractive to the pest's natural enemies. Examples include: thinning plants, properly spacing plants, rotating plants, tilling soil, maintaining a diverse number of plant species, and using plants that either attract beneficial organisms or repel pests.
<u>Direct Control Techniques</u>	
3. Manual pest control	3. Using hand methods or mechanical devices that require physical operation either to destroy pests or make an environment unsuitable for the pest's survival. Examples include: removing insects by hand, washing pests off plants, swatting insects, removing pest-ridden plant parts, and shooting larger pests.

Table 2.5. (Continued)

Management techniques	Definition
4. Mechanical pest control	4. Using mechanical devices that do not require constant physical operation either to destroy pests or to make the environment unsuitable for the pest's survival. Examples include: fencing to protect plants, and traps that either catch or destroy pests.
5. Biological pest control	5. Using or encouraging natural enemies to destroy pests. Encouraging common predacious species such as ladybugs, birds, and toads was emphasized rather than attempting to introduce and establish predators and parasites.
6. Chemical pest control	6. Using any kind of substance to prevent, destroy, or repel pests (not including previously mentioned control techniques). This control technique refers primarily to synthetic organic pesticides.

Table 2.6. Four questions to answer before choosing and applying control techniques presented in the Pest Management Manual

Question	Brief explanation
1. Have I correctly identified the cause of the problem?	1. Pest control techniques applied to the wrong pest will produce poor results. The situation may even be worsened by destroying beneficial organisms that are mistaken for pests.
2. Have I correctly identified the plant which has the pest problem?	2. Pest species often associate themselves with particular species or groups of plants. Correctly identifying the plant can often help in correctly identifying the pest responsible for the damage.
3. Do I know the pest's life cycle?	3. Certain pest species can be controlled more effectively while in a particular stage of their life cycle. Knowing this you can determine if you can control the pest, when to take action, and what techniques can be used.
4. Have I considered and decided whether the damage is now serious enough to apply control techniques, or can I expect it to become serious enough later on?	4. The final decision to apply a particular control technique depends on an understanding of the injury acceptance level concept.

- (3) Attempt to prevent or at least minimize pest problems by using recommended plant selection and plant management techniques.
- (4) Select only pest control techniques that are aimed specifically at the pest you are attempting to control.
- (5) Choose those management techniques that are easy to use but those which still satisfy the above guidelines.

Safety. The "Safety" section contained material from Cooperative Extension Service bulletins, organized in two sub-sections: "Pesticides" and "Equipment." Because homeowners frequently use pesticides, a large amount of information on them was included. This, however, did not constitute an endorsement for their use, but was done to emphasize that the proper use of these compounds entails many considerations. Material in the "Pesticide" sub-section included: "Pesticides and Safe Use"; "Pesticide Classifications and Formulations"; "Dormant Oils: What They Are and How They Are Used"; "What Is On The Pesticide Label"; "Factors Affecting Pesticide Activity"; "Protecting the Environment"; "Protecting Man--Using Pesticides Safely"; and "First Aid for Pesticide Poisoning." Two pieces were included in the "Equipment" sub-section: "Equipment for Pest Control"; and "What You Should Know About Safe Chain Saw Operation."

Pest Information and Strategy Selection. This section contained pest information forms on specific pest species for the plant groups covered in the manual (Lawns, Vegetable Gardens, and Ornamental/Shade Trees). In addition to these three plant groups, pre-printed tab-dividers for the following plant groups were also included (these sections were left empty): "Flowers"; "Small Fruits"; "Shrubs"; "Fruit Trees"; and "Nut Trees." Two empty tab-dividers were provided

for plant group classifications not represented in the eight pre-labeled plant group sections (these could be labeled by readers).

Preceding the plant group sections was an Extension publication titled, "Pests: An Introduction to Their Identification." This was included to provide a general outline of the different pest groups and their identifying characteristics.

The eight plant group sections followed. To facilitate easy reference, organization of material within each of the three plant groups was standardized. A "Quick Pest Reference Guide" was included at the beginning of each section (an example is reproduced in Figure 2.6). The guide provided a list of pests covered in the section, with sufficient information to make preliminary pest identifications. Within the sections, heavy bond, color paper dividers organized the material by pest group and management techniques. These dividers were pre-labeled as: (1) for pest groups - "Insects", "Diseases", "Weeds", "Environmental", and "Vertebrates"; and (2) for management techniques - "Plant Selection", "Plant Management", "Manual Pest Control", "Mechanical Pest Control", "Biological Pest Control", and "Chemical Pest Control."

Information on each pest was presented in a standardized format called a "Pest Information Form." The format was used to facilitate easily locating pertinent information. In addition, information for practicing IPM (such as pest life cycles, suitable host plants, and plant symptoms/damage) was included. The organization and description of information on the pest information forms is presented in Table 2.7; an example form is reproduced in Figure 2.7.

QUICK PEST REFERENCE GUIDE

PLANT GROUP: Ornamental/Shade Trees

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<u>NAME OF PEST</u>	<u>DEVELOPMENT STAGE OF PEST CAUSING DAMAGE</u>	<u>WHEN PLANT SYMPTOMS/ DAMAGE APPEARS*</u>	<u>PLANT SYMPTOMS/DAMAGE</u>	<u>SUITABLE HOSTS</u>
<u>Insects</u>				
Aphids, Aphis, Plant Lice	Nymph, Adult	May - September	Stunted, deformed or curled buds, flowers and leaves. Presence of honeydew on leaves and/or ants on trees.	All trees
Birch Leaf Miner	Larva	Late May - early June Late July - early August	Brown blotches on new leaves	Grey, cut-leaf and paper birch
Bronze Birch Borer	Larva	May - September	Dieback at top of tree. Swelling at main stem.	European white birch, grey birch
Cooley Spruce Gall Aphid	Nymph, Adult	Late May - Early June	Galls on branch tips	Colorado blue spruce, Sitka spruce, Englemann spruce, Douglas-fir
Elm Leaf Beetle	Larva	Early - Late June	Leaves with tissue missing between the veins	American, English, Scotch, Siberian and Camperdown elms
Maple Bladder- Gall Mite	Nymph, Adult	May - Late July	Galls on upper sur- face of leaves	Silver maple

*The listed times when plant symptoms/damage will appear are estimates only. They will vary depending upon weather conditions and the vigor of a suitable host plant.

Figure 2.6. Quick pest reference guide for ornamental/shade trees [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

Table 2.7. Organization and description of information on "Pest Information Forms" in the Pest Management Manual

Item	Description
Name of pest	Common and scientific name given.
Illustration of pest or plant symptoms/damage	Black and white line drawings were included to aid in pest identification. Drawings were of: larval and adult forms for insects; plant symptoms/damage for diseases and environmental; the plant itself for weeds; adult forms for vertebrates.
"Pest identification"	A description of the pest forms was given for insects, weeds, and vertebrates to further aid in their identification.
"Life cycle"	A bar chart was used to graphically present the approximate monthly appearance of the stages in the life cycle of insects and weeds. Life cycle descriptions were also given for insects, diseases, and weeds.
"Plant symptoms/damage"	A description of plant symptoms/damage caused by the pest was given. When available, specific information on pest monitoring was also given.
"Suitable hosts"	Plants susceptible to infestation or damage by the pest were listed.
"Management strategies"	Specific management techniques were organized and listed according to the six categories of management techniques defined in the manual.

common name: Aphids, Aphis,
Plant Lice
scientific name: Aphididae spp.



THE ROSY APHID

WINGLESS
FORMWINGED
FORMPEST IDENTIFICATION:

Adults: Adult aphids are small, soft-bodied insects about 1/16 inch in length. There are numerous species ranging in color from milky white to green to black. Aphids are pear-like in shape, have long antennae and a pair of tube-like structures (cornicles) that project from the rear of the abdomen. There are winged and wingless forms depending upon the species. Wings, if present, are clear and held roof-like over the body.

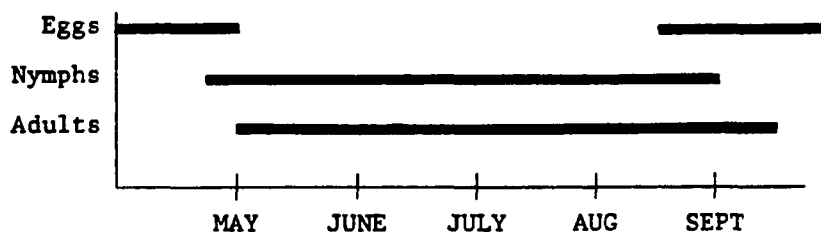
LIFE CYCLE:

Figure 2.7. Pest information form for aphids on ornamental/shade trees [reproduced from the Pest Management Manual (Lambur and Parks 1980)]

Aphids, Aphis, Plant Lice
2 of 4

Aphids overwinter as eggs or young females on plant parts. In early spring the eggs hatch and all aphids develop into females, some of which may be winged. There may be as many as 10 generations. Most of these generations consist of females. Males are only produced in the fall, when they mate with females to produce the overwintering eggs.

Aphids have a high reproductive capacity with each female capable of having 80-100 offspring.

PLANT SYMPTOMS/DAMAGE: Trees infested with aphids may have stunted, deformed or curled buds, flowers and leaves. This results from the aphids sucking sap from these tender plant parts. If aphid populations are high, they may be found clustered together on tender shoots, buds, flowers and leaves.

Aphids produce and excrete a sticky fluid, high in sugars, called honeydew. This substance is often found coating leaves. While harmless, it may create a nuisance problem when it collects on parked cars and lawn furniture sitting under infested trees.

Numerous ants in the trees may also indicate the presence of aphids. Ants "tend" the aphids so they can feed on the honeydew and may protect aphids from predators.

Aphids may also transmit the bacterial disease, fireblight, from an infected plant to a healthy one.

SUITABLE HOSTS: Almost all trees.

MANAGEMENT STRATEGIES:

<u>Plant Management:</u>	-Maintain trees in a vigorous state by proper watering and fertilizing. However, do not fertilize heavily with nitrogen. This may promote excessive shoot growth which is more susceptible to attack by aphids (see <u>Fertilizing Shade and Ornamental Trees</u>, Extension Bulletin E-786, in this section under <u>Plant Management</u>).
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Figure 2.7. (Continued)

Aphids, Aphis, Plant Lice
3 of 4

- Manual Pest Control: -If just one or two growing tips are affected they can be removed and destroyed (see Pruning Shade and Ornamental Trees, Extension Bulletin E-804, in this section under Plant Management).
- Aphids can be knocked off of plants by water spray from a hose.
- Mechanical Pest Control: -If ants are tending aphids, a band of sticky material (Tanglefoot) can be placed around the stem of the tree to trap the ants.
- Biological Pest Control: -A wide variety of naturally occurring organisms feed upon aphids. Encouragement of these insects may help keep aphid populations in check: predators - ladybugs, soldier beetles, damsel bugs, big-eyed bugs, pirate bugs, assassin bugs, syrphid flies, lacewings and spiders; parasites - braconid wasps and chalcid wasps. Some of these insects are commercially available (see Sources of Biological Control Agents For Home Gardeners, Insect & Nematode Special Report No. 79-11, in the Appendix).
- Chemical Pest Control: -There are a variety of "homemade" sprays that have been used for control of aphids. While most of these substances have not been scientifically tested for their effectiveness, you may wish to experiment on your own. It is always a good idea to test these substances on a small portion of the plant first, to see if any plant damage occurs. If damage does occur, do not use the substance on that plant. These sprays can be applied when the aphids are numerous enough to warrant control. These sprays include:
- A 1% soap solution (not detergent) in water. Plants should be rinsed with clean water afterwards.
 - A strong lime and water solution.
 - An onion and water solution mixed as 50% onion juice and 50% water.

Figure 2.7. (Continued)

Aphids, Aphis, Plant Lice
4 of 4

- Boil 3 pounds of rhubarb leaves in 3 quarts of water for one-half hour. When cool mix with one quart of water in which one ounce of soap flakes has been added. Caution: Rhubarb leaves are very poisonous and boiling concentrates the toxic materials in them. Be very careful in using this solution.
- Melt $\frac{1}{2}$ lb. of water soluble glue in 1 gal. of warm water and let it stand over night. Apply as a spray the following day. When it dries, the glue will flake off with the suffocated aphids.
- A spray application of an insecticide to the affected plant parts will aid in control of the adults and nymphs. These can be applied when the aphids are numerous enough to warrant control.
- For proper chemical recommendations see Pesticides For Control of Landscape Ornamental Insect Pests, Insect & Nematode Special Report No. 79-15, in this section under Chemical Pest Control.
- See the Safety section for information on proper pesticide use.

Figure 2.7. (Continued)

Where appropriate material on specific management techniques was available, it was presented after the pest information forms (organized by the labeled dividers). For example, one management strategy for aphids on ornamental/shade trees is to maintain trees in a vigorous state by properly watering and fertilizing (listed as a plant management technique on the pest information form). An Extension publication, "Fertilizing Shade and Ornamental Trees" (Michigan State University Extension bulletin E-786) was included under the divider labeled "Plant Management." Readers were referred to this publication for specific information on using this management technique.

Thirty-four pests were included in the manual for the three plant groups (see Table 2.8). Their selection was based on information from two sources: (1) the needs assessment questionnaire; and (2) Extension specialists at Michigan State University. Respondents to the needs assessment questionnaire were asked to list pest problems that they had experienced on specific plant groups in their yard the previous year (1979). These data were tabulated for the three plant groups to be covered in the manual. Extension specialists at the university were then asked to review these results and comment on their validity and priority.

Appendix. The "Appendix" contained a variety of materials, organized by management techniques (with heavy bond, color paper dividers). This material was intended to supplement the material contained in other sections of the manual. For example, under the "Plant Management" divider, Extension publications on sampling soils, composting, and designing landscapes to conserve energy were

Table 2.8. Plant groups and pest species and problems covered in the Pest Management Manual

Plant group	Pest species or problem	Plant group	Pest species or problem
Lawns	<u>Insects</u> 1. Sod Webworm, Bluegrass Webworm (<u>Crambus teterrelus</u>) 2. White Grubs, June Beetles, May Beetles (<u>Phyllophaga</u> spp.) <u>Diseases</u> 1. Fusarium Blight (<u>Fusarium roseum</u>) 2. Melting out, Leaf spot, Root rot, Crown rot (<u>Helminthosporium</u> spp.) <u>Weeds</u> 1. Dandelion (<u>Taraxacum officinale</u>) 2. Crabgrass (<u>Digitaria sanguinalis</u> , <u>D. ischaenum</u>) <u>Vertebrates</u> 1. Moles (<u>Scalopus aquaticus</u> , <u>Condylura cristata</u>)	Vegetable Gardens	<u>Insects</u> (continued) 3. Imported Cabbage Worm/Butterfly (<u>Pieris rapae</u>) 4. Mexican Bean Beetle (<u>Epilachna varivestis</u>) 5. Tomato Hornworm, Tobacco Hornworm (<u>Manduca quinquemaculata</u> , <u>M. sexta</u>) <u>Diseases</u> 1. Club Root (<u>Plasmodiophora brassicae</u>) 2. Corn Smut (<u>Ustilago maydis</u>) 3. Powdery Mildew (many varieties) <u>Environmental</u> 1. Tomato Blossom-End Rot <u>Vertebrates</u> 1. Rabbits (<u>Sylvalagus floridanus</u>)
Vegetable Gardens	<u>Insects</u> 1. Aphids, Aphis, Plant Lice (<u>Aphididae</u> spp.) 2. Cutworms (many varieties)	Ornamental/ Shade Trees	<u>Insects</u> 1. Aphids, Aphis, Plant Lice (<u>Aphididae</u> spp.) 2. Birch Leaf Miner (<u>Fenusa pusilla</u>)

Table 2.8. (Continued)

Plant group	Pest species or problem	Plant group	Pest species or problem
Ornamental/ Shade Trees	<u>Insects (continued)</u>	Ornamental/ Shade Trees	<u>Environmental</u>
	3. Bronze Birch Borer (<u>Agrilus anxius</u>)		1. Iron Chlorosis
	4. Colley Spruce Gall Aphid (<u>Adelges cooleyi</u>)		2. Leaf Scorch
	5. Elm Leaf Beetle (<u>Pyrrhalta luteola</u>)		<u>Vertebrates</u>
	6. Maple Bladder-Gall Mite (<u>Vasates quadripedes</u>)		1. Rabbits (<u>Sylvalagus floridanus</u>)
	7. Pine Needle Scale (<u>Phenacaspis pinifoliae</u>)		
	<u>Diseases</u>		
	1. Anthracnose (<u>Gnomonia</u> spp.)		
	2. Apple Scab (<u>Venturia inaequalis</u>)		
	3. Cedar-Hawthorn/Apple Rust (<u>Gymnosporangium juniperi-virginianae</u>)		
	4. Cytospora Canker (<u>Cytospora kunzei</u>)		
	5. Diplodia Tip Blight (<u>Diplodia pinea</u>)		
	6. Fire Blight (<u>Erwinia amylovora</u>)		
	7. Wetwood (<u>Erwinia nimipressuralis</u>)		

included. The divider labeled "Biological Pest Control" contained an Extension bulletin on how to identify beneficial insects and where biological control agents could be purchased. Also included in the "Appendix" was material detailing how homeowners should collect, prepare, and send samples of organisms and plants to the local Cooperative Extension office for proper identification. The section ended with a list of all reference material that was purchased and put on reserve at the local public library.

Glossary. A 35-page glossary, defining over 300 pest and vegetation management terms, was compiled from numerous sources. Each term and definition was reviewed and edited for appropriateness and clarity of expression.

CHAPTER 3

THE THEORETICAL AND CONCEPTUAL FRAMEWORK FOR THE STUDY

This chapter presents the theoretical and conceptual framework that will be used to evaluate the Pest Management Manual as a means for transferring IPM information to urban homeowners. The chapter is divided into two parts. Part I is devoted to a theoretical discussion of a model, called the innovation-decision process model, that will be used in this study. Part I ends with a discussion of specifically why this model was chosen and how it will be applied in this investigation. Part II focuses on identifying and conceptualizing a select set of variables and relationships from the model. The chapter concludes with a listing of the hypotheses that will be tested in this investigation.

PART I: THE THEORETICAL FRAMEWORK

The Innovation-Decision Process Model

The theoretical framework that will be used in this study is the innovation-decision process model, a simplified heuristic device used to describe "the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt

or reject, to implementation of the new idea, and to confirmation of this decision" (Rogers 1983:163). The model is one of the central components of the broader theoretical area called diffusion of innovations. Diffusion theory seeks to explain the process by which innovations are communicated to members of a social system over time (Rogers 1983). While the definition of these two processes appears to be the same, there is nevertheless a subtle but significant difference. The innovation-decision process, also called the adoption process, is differentiated from the diffusion process by its focus; adoption occurs at the individual level, whereas diffusion occurs among individuals at the social system level. Consequently, the adoption process is a component of the diffusion process, with the extent of diffusion being dependent, in part, on the extent of adoption by individuals within the social system. Zaltman and Lin (1971:653) put these two processes into perspective when they wrote, "It (diffusion) is a phenomenon which emerges from the adoption of an innovation by potential adopter units and is usually a partial result of interaction among these units."

The innovation-decision process model (hereafter referred to as the model) was first proposed by Joe M. Bohlen in the 1950's and was based on "assumptions about the process by which human personality develops and about how the entity known as man responds to stimuli when he receives them" (Bohlen 1967:113). Since that time the model has appeared in various but similar forms in publications by Lionberger (1960), Rogers (1962), Rogers with Shoemaker (1971) and Rogers (1983). The model -- and the whole area of diffusion -- is essentially a multidisciplinary one that has evolved from theoretical

and empirical research in a variety of disciplines. For example, Rogers (1983) identifies anthropology, early sociology, rural sociology, education, public health and medical sociology, communication, marketing, geography and general sociology as the nine major disciplines that have contributed to the evolution of adoption and diffusion theory. (For additional information on the historical development of adoption and diffusion see Rogers 1962; Katz et al. 1963; King 1966; Rogers with Shoemaker 1971; and Goss 1976.)

The particular form of the model that will be used in this study is taken from Rogers' 1983 book, Diffusion of Innovations. In this, the most recent edition of Rogers' books on diffusion, the author has compiled and synthesized over 3,000 diffusion publications from a wide variety of disciplines. This form of the model was chosen because it is one of the most widely used and because it has been acknowledged by many that the work of Rogers offers perhaps the most exhaustive treatment on this subject thus far (Valkonen 1970; Taylor and Miller 1978). Consequently, the following discussion is adapted from Rogers (1983); additional information from other sources is added and cited where appropriate.

The Innovation

Rogers (1983:11) defines an innovation as, "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." The most important term in the definition is the word "perceived." From the standpoint of the individual, the innovation's objective or actual newness makes little difference. Even if the idea, practice or object has existed for many years, it would still

be considered an innovation, in this context, if it were perceived as new by the individual.

In addition to the above definition, an innovation, technology or technological innovation (Rogers uses these terms synonymously) usually consists of two components: (1) a hardware component; and (2) a software component. (In past diffusion terminology these widely recognized components have typically been referred to as the object or material component and the idea component, respectively (Lionberger 1960; Klonglan and Coward 1970; Rogers with Shoemaker 1971).) The hardware component refers to the "tool that embodies the technology as material or physical objects"; the software component refers to the "information base for the tool" (Rogers 1983:12). While all innovations include or possess a software component, not all will necessarily have a hardware component. Examples cited by Rogers (1983) of innovations that are almost entirely comprised of a software component, or information, are a political philosophy, a religious idea, a news event, a rumor, assembly-line production and management by objective (MBO).

Two final concepts concerning the innovation also need to be addressed. In some instances, an innovation may actually consist of a number of closely related innovations. The term "technology cluster" is used to define those innovations that "consist of one or more distinguishable elements of technology that are perceived as being closely interrelated" (Rogers 1983:14). The second concept concerns the "degree to which an innovation is changed or modified by a user in the process of its adoption and implementation." (Rogers 1983: 16-17). Termed "re-invention", this concept was developed to explain

the fact that innovations were often modified when put into use. It was recognized that an innovation was not necessarily invariant during its diffusion, nor did adopters simply exhibit passive behavior by just implementing a standard template of the technology. And because individuals may adopt the same innovation for a variety of different reasons and needs, these differences may only be observed in how the actual innovation is adopted. Rogers (1983: 180-181) provides six reasons why innovations may be re-invented:

1. Innovations that are relatively more complex and difficult to understand are more likely to be re-invented (Larsen and Agarwala-Rogers, 1977a, 1977b).*
2. Re-invention can occur owing to the adapter's lack of detailed knowledge about the innovation, such as when there is relatively little direct contact between the adapter and change agents or previous adopters (Rogers et al., 1977a; Eveland et al., 1977; Larsen and Agarwala-Rogers, 1977a, p. 38).
3. An innovation that is a general concept or a tool (like a computer) with many possible applications is more likely to be re-invented (Rogers, 1978).
4. When an innovation is implemented in order to solve a wide range of user's problems, re-invention is more likely to occur.
5. Local pride of ownership of an innovation may also be a cause of re-invention.
6. Finally, re-invention may occur because a change agency influences its clients to modify or adapt an innovation.

Stages of the Model

The model consists of five main stages that represent the activities an individual passes through when deciding to adopt or

*All citations in this list are from the original text. Full citations can be found in the list of references.

reject an innovation (presented in Figure 3.1). As Rogers (1983:163) states, "The process consists of a series of actions and choices over time through which an individual or an organization evaluates a new idea and decides whether or not to incorporate the new idea into ongoing practice."

Having acknowledged the existence of an innovation, the innovation-decision process is conceived as beginning with the knowledge stage. In this stage the individual becomes aware of the innovation's existence and gains some understanding of how it functions. On one hand, awareness may come about from the innovation's ability to satisfy a need that already exists for the individual. On the other hand, it is also acknowledged that in many cases awareness or knowledge of an innovation may actually create the need for the new idea, practice or object. While there seems to be no clear-cut answer to the awareness of a need vs. awareness of an innovation question -- also referred to as a problem vs. innovation orientation, respectively (Reynolds 1971) -- there does appear to be agreement that awareness is not just a passive activity. Rogers (1983:166) points out that, "The predispositions of individuals influence their behavior toward communication messages and the effects that such messages are likely to have. Individuals generally tend to expose themselves to ideas that are in accordance with their interests, needs, or existing attitudes."

Movement into the persuasion state is characterized by the individual seeking more complete information about the innovation, mentally "weighing" that information, and consequently forming either a favorable or unfavorable attitude toward the innovation. The main

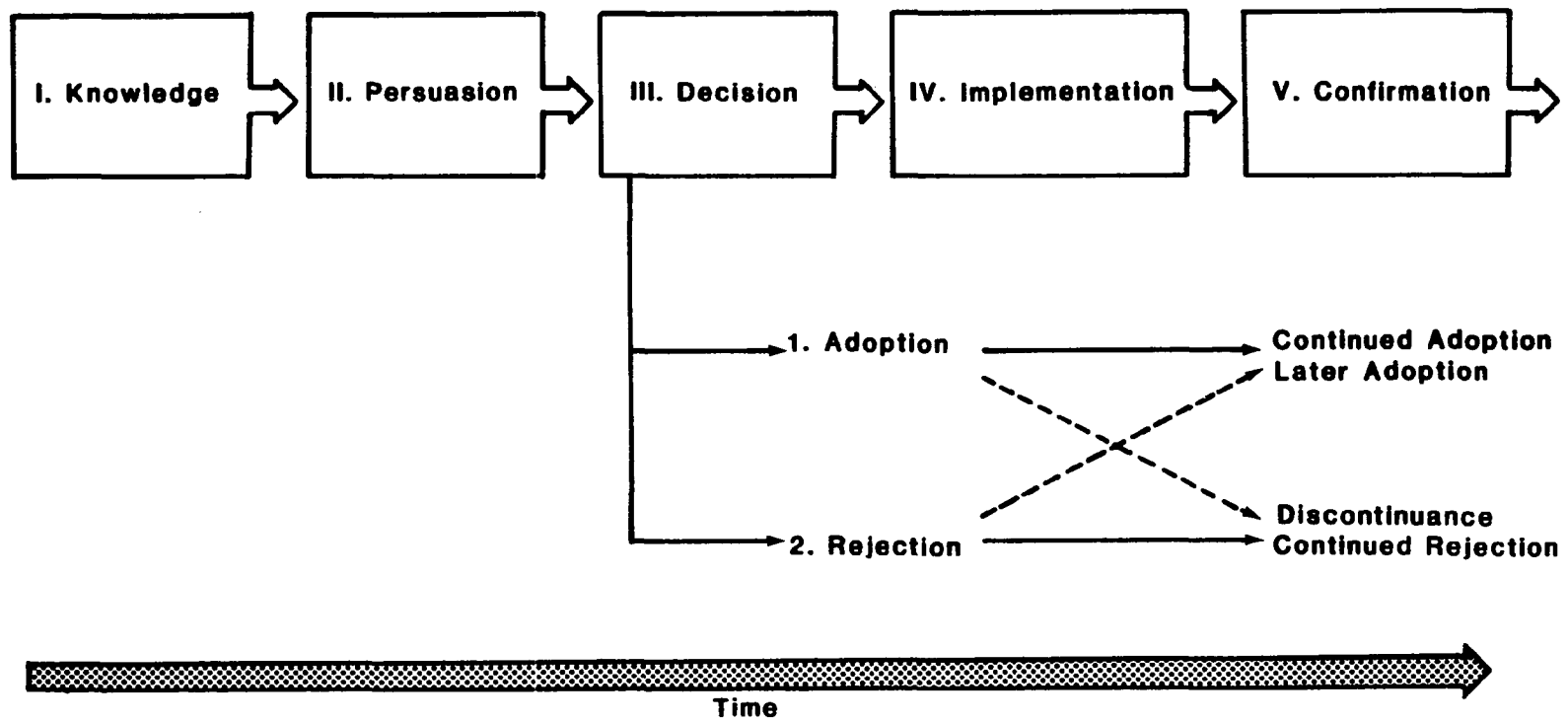


Figure 3.1. A model of the innovation-decision process (adapted from Rogers 1983:165)

outcome of this stage is the direction of the attitude toward the innovation. If the attitude is favorable, then it is assumed this will lead to a subsequent change in overt behavior (that is, adoption of the innovation). On the other hand, an unfavorable attitude would lead to a rejection decision. And even though research on attitude-behavior consistency is generally far from conclusive on this point, for purposes of the model it is assumed that there is a tendency for attitudes and behavior to become consistent.

At the decision stage, "An individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation. Adoption is a decision to make full use of an innovation as the best course of action available. Rejection is a decision not to adopt an innovation" (Rogers 1983:172).

The implementation stage occurs when the individual actually puts the innovation into use. While the previous three stages are mental activities, the implementation stage is characterized by, or involves, overt behavior (assuming the outcome of the decision stage was an adoption decision). Since the implementation stage is a new addition to the model (it did not appear in the 1971 conceptualization of the model by Rogers with Shoemaker), Rogers (1983:174) provides a rationale for its inclusion by explaining:

It is often one thing for an individual to decide to adopt a new idea, and quite a different thing to put the innovation into use. Problems in exactly how to use the innovation may crop up at the implementation stage. Implementation usually follows the decision stage rather directly unless it is held up by some logistical problem, like the temporary unavailability of the innovation.

The length of the implementation stage will vary depending on the nature of the innovation. A relatively complex innovation would

probably require a longer time to put into use than a simple one. It is also at this stage that re-invention of the innovation occurs. The point that marks the end of implementation is when, "the new idea becomes an institutionalized and regularized part of the adopter's ongoing operations" (Rogers 1983:175).

The confirmation stage finds the individual seeking reinforcement for the innovation-decision that was made. The inclusion of this stage in the model emphasizes the dynamic nature of the process, in that the individual may reverse his previous decision if later exposed to conflicting information about the innovation. An individual may later decide to reject the innovation he had previously adopted (termed a discontinuance) or adopt an innovation he had previously rejected. As can be seen, the confirmation stage can continue for an indefinite period of time.

While not expressed as a stage of the model, the final outcome or the consequences of the process deserve mention at this point. Rogers (1983:371) defines consequences as "the changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation." In diffusion and adoption studies, researchers have given scant attention to consequences primarily because they often assume that adoption of an innovation will produce only beneficial results (labelled the pro-innovation bias). Instead, the main focus of most research in this area is on what variables are related to innovative behavior. Rogers (1983) offers two additional reasons why consequences have not been studied sufficiently: usually survey research methods are inappropriate for investigating consequences, and consequences are simply difficult to measure.

In an effort to promote and improve the study of the effects of adoption or rejection of an innovation, Rogers (1983:380-388) has proposed the following classification system as a way to view and conceptualize consequences to an individual or a social system:

1. Desirable consequences - the functional effects of an innovation.
Undesirable consequences - the dysfunctional effects of an innovation.
2. Direct consequences - changes that occur in immediate response to an innovation.
Indirect consequences - changes that occur as a result of the direct consequences.
3. Anticipated consequences - changes that are recognized and intended.
Unanticipated consequences - changes that are neither intended nor recognized.

Flexibility of the Model

The presentation of these discrete, sequential stages is not meant to imply that the innovation-decision process always occurs in this manner for all individuals. Depending on the individual and the type of innovation, the exact order of events may vary. For example, Rogers (1983) cites a case where the sequence of stages in the model was actually knowledge - decision - persuasion, when applied to studying contraceptives in a Korean village. It is also important to recognize that each stage in the model is a potential rejection point. Rogers (1983:173) points out, "it is possible to reject an innovation at the knowledge stage by simply forgetting about it after initial awareness." More importantly, the model emphasizes that the adoption process is the result of a sequence of events and not just random behavior, nor an instantaneous act (Campbell 1966; Bohlen 1967). Bohlen (1967:118) commented on the intended flexibility of the model when he wrote:

I do not wish to leave the impression that the adoption process is one composed of stages through which the adopter passes in an irrevocable manner and that he passes through each stage completely prior to entering the next succeeding stage. The process is portrayed in stages for heuristic purposes and those not deeply involved in the empirical research frequently conclude that the actual process duplicates the heuristic. Such conclusions are not warranted by the data.

From a theoretical perspective the model serves to simplify and represent, in a useful way, a very complex social psychological process describing a relatively continuous sequence of events that intervene between initial knowledge of an innovation and the final decision to adopt or reject it (Lionberger 1960; White 1967). From an analytical perspective the model provides "a conceptual framework for organizing and analyzing information related to a person's adoption or rejection of an innovation" (Reynolds 1971:215).

Variables Affecting the Innovation-Decision Process

A large number and variety of variables have been investigated and found to be associated with, and consequently affect, an individual's activities and movement through the process model. The four general categories of variables are individual characteristics, social system characteristics, communication channels and perceived characteristics of the innovation. Their association with the stages in the model is depicted in Figure 3.2. For clarity, a number of the variables from the Rogers with Shoemaker (1971) and Rogers (1983) text are combined and slightly modified for this study.

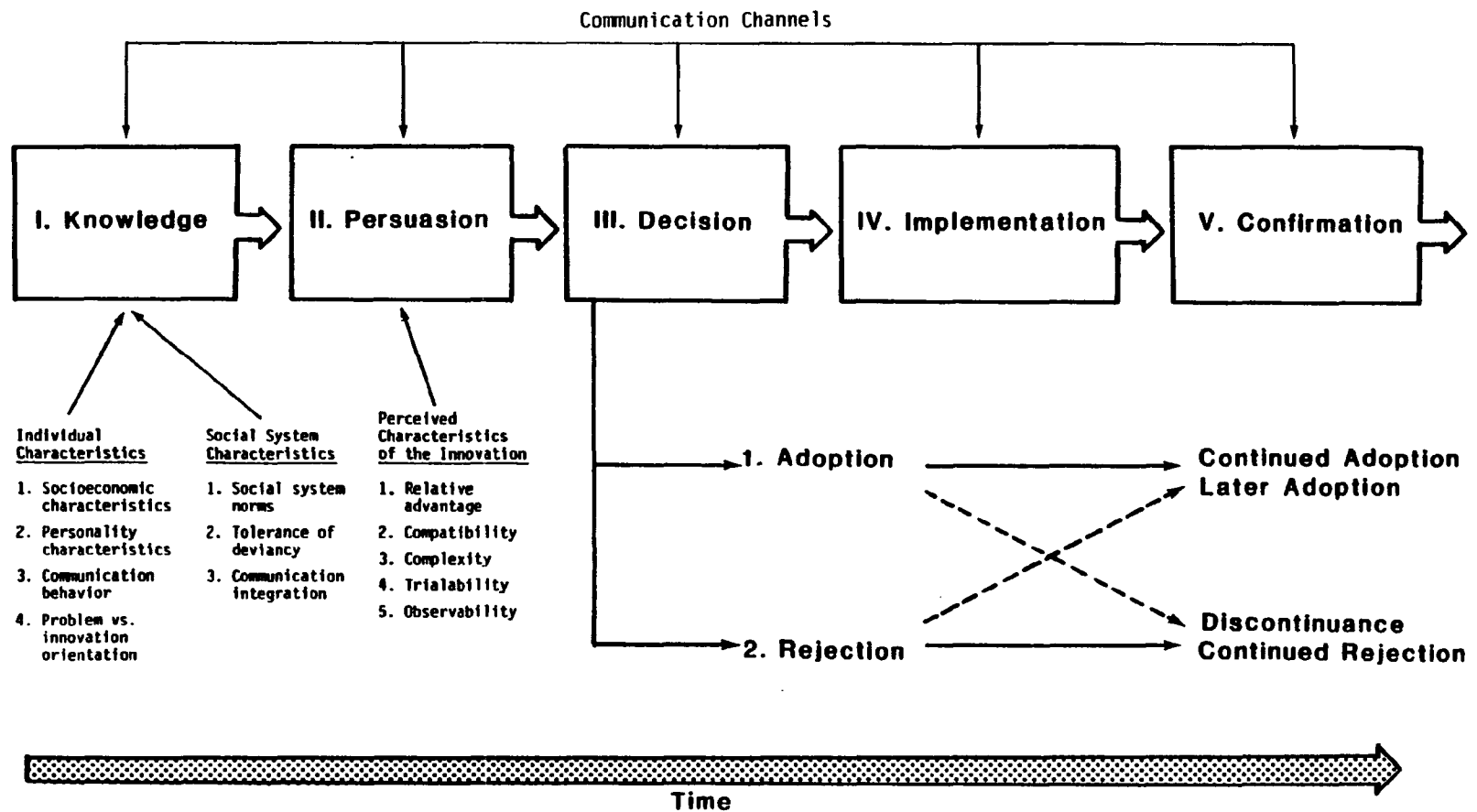


Figure 3.2. Variables associated with the innovation-decision process model (adapted from Rogers with Shoemaker 1971:102 and Rogers 1983:165)

Individual Characteristics

The significance of individual characteristics in the adoption process is based on the fact that all members of a social system exposed to an innovation do not adopt or reject the innovation at the same time. Some individuals move through the process more rapidly than others. The time it takes for an individual to move through the model is termed the innovation-decision period. Through investigation, it has been found that some individuals move through the process more rapidly than others, that is, they have a shorter innovation-decision period. The degree to which an individual is relatively earlier in adopting innovations than others is termed innovativeness. Consequently, it has been found that individuals who are more innovative (adopt quicker) possess differing degrees of certain individual characteristics than those who are less innovative (adopt slower).

Additionally, based on the criterion of innovativeness, researchers have classified individuals into adopter categories. The adopter categories are: innovators, early adopters, early majority, late majority and laggards. By demonstrating that adopter distributions approach normalcy, the normal curve is divided into five segments representing standard deviations from the mean, or the average time of the innovation-decision period. Each of these segments represents a standardized percentage of adopters with similar degrees of innovativeness. Accordingly then, the first 2.5% to adopt are called innovators; the next 13.5% are early adopters; the next 34% are the early majority; the next 34% are the late majority; and the final 16% are called laggards. While it is recognized that

innovativeness is a continuous variable, the partitioning of adopters into discrete categories, labelled "ideal types", is only a conceptual device much like the stages of the model itself. As Rogers (1983:248) states, "Ideal types are based on abstractions from empirical cases and are intended as a guide for theoretical formulations and empirical investigations."

Specific individual characteristics that have been investigated and found to be associated with innovativeness are classified into three categories of variables: socioeconomic variables, personality variables and communication behavior variables. In compiling and synthesizing a large number of empirical research findings, Rogers (1983:251-261) has found support for the following relationships:

1. Socioeconomic variables: Earlier adopters are no different in age; have more years of education; are more likely to be literate; have higher social status; have a greater degree of upward social mobility; have larger sized units (farms, companies, and so on); are more likely to have a commercial (rather than a subsistence) economic orientation; have a more favorable attitude toward credit (borrowing money); and have more specialized operations than later adopters.
2. Personality variables: Earlier adopters have greater empathy; may be less dogmatic; have a greater ability to deal with abstractions; have greater intelligence; have a more favorable attitude toward change, education and science; are more able to cope with risk and uncertainty; are less fatalistic; have higher levels of achievement motivation; and have higher aspirations (for education, occupations, and so on) than later adopters.
3. Communication behavior variables: Earlier adopters have more social participation; are more highly interconnected in the social system; are more cosmopolite; have more change agent contact; have greater exposure to mass media; have greater exposure to interpersonal communication channels; seek information about innovations more actively; have greater knowledge of innovations; have a higher degree of opinion leadership; and are more likely to belong to highly interconnected systems than later adopters.

In general then, it appears that for socioeconomic variables, the more innovative individuals possess both the material resources and mental skills that allow them to innovate more freely. The material resources (money, or more collectively, wealth) may allow them to take the perceived risks associated with innovative behavior and perhaps be better able to absorb the loss from occasional failure. The mental skills (education, literacy) may allow them the flexibility necessary to understand and implement innovations. For personality variables, the more innovative individuals tend to exhibit a more open social psychological orientation that allows them to deal with new ideas, practices and objects in a more favorable manner. And finally, for communication behavior variables, the more innovative individuals have more contact with, and tend to actively expose themselves more, to a variety of communication channels. The result is a greater awareness and knowledge of many different innovations, more so than later adopters.

In summary, individuals who are relatively more innovative will score higher on these variables than those who are less innovative (the reverse is true for dogmatism and fatalism). The utility of this classification system, however, goes beyond the conceptual and empirical needs of researchers; if change agents can identify potential adopter categories in their audience, they might implement somewhat different change strategies for each group.

One additional variable, classified here as an individual variable, is called the problem vs. innovation orientation. While not specifically addressed as such in any of Rogers' texts, he has alluded to this concept when discussing the issue of the process

being initiated from either the innovation fulfilling a need or creating a need. We would also suspect that this is his intent by including the item called "felt needs/problems" in his figure of the innovation-decision process. Although Rogers does not categorize it as a variable affecting the process (it is termed a "prior condition"), it will be considered an individual variable in this study.

The term "problem vs. innovation orientation" is taken from an article by Reynolds (1971) in which he reports the results of a study designed to determine if there is any difference in adoption process behavior related to an individual's process oriented beginning. This study, which was acknowledged as exploratory, utilized perceived risk by retail merchants who adopted a new bank charge account program as the dependent variable. Respondents were asked to respond to a structured set of statements and select the one that best described their reason for joining the bank charge account plan. The situational statements were written to reflect the nature of the respondents' process beginning (the independent variable). An innovation-oriented beginning involved an "un-active" search for the innovation; a problem-oriented beginning involved an "active search" for the innovation. A positive relationship was found between perceived risk and search for information among the respondents. Further, Reynolds (1971:217) stated:

Problem-oriented respondents, in discussing the nature of their credit problems, tended to emphasize some problem that added to the cost or expense of offering credit to customers. Innovation-oriented adopters viewed the innovation more as a competitive necessity ("all my competitors were joining the program") than as a means of reducing credit-related expenses.

Consequently, Reynolds concluded that the current conceptualization of the adoption process could be enhanced by allowing for problem-oriented behavior as a starting point (in addition to the assumed or implied innovation-oriented beginning). We would therefore expect to see some difference in process behavior depending upon if individuals actively sought out the innovation to fulfill a need or solve a problem (a problem orientation) or if they simply became aware of the innovation without actively searching (an innovation orientation). Unfortunately, the exact nature of this difference cannot be specified (as Rogers has done in his generalizations) until more research is conducted.

Social System Characteristics

Characteristics of the social system also act to affect the individual's innovation-decision process. Social system variables include the norms of the system, its tolerance of deviancy, communication integration and the like. Collectively these are referred to as the structure of the social system. While the affects of these variables have received relatively little investigation, one prominent typology applied regarding this concept is the traditional vs. the modern social system (Rogers with Shoemaker 1971). Modern social systems are characterized as being more change oriented, technologically developed, scientific, rational, cosmopolite and empathic. Traditional social systems, on the other hand, are characterized as exhibiting "opposite" orientations on these items. Since modern systems are considered to be more change oriented than

traditional ones, we would expect fewer societal barriers to an individual's innovative behavior in a modern social system.

Communication Channels

Communication channels also play an important role in the adoption process. Communication channels are the means by which messages are moved from a source to a receiver and are associated with all stages of the model. They are typically divided into two categories: mass media channels, or those that enable a source of one or a few individuals to reach an audience of many (examples include radio, television, film, newspapers and magazines); and interpersonal channels, or those that involve a face-to-face exchange of information between two individuals. Past research concerning the innovation-decision process and communication channels has indicated that mass media channels are relatively more important at the knowledge stage. That is, these channels serve to create awareness that the innovation exists and provide general information on the function of the innovation. Interpersonal channels, on the other hand, are more important in subsequent stages of the model (persuasion, decision, implementation and confirmation). In these stages, individuals are in the process of forming or changing their attitude toward the innovation and deciding whether or not to adopt or reject it. As Rogers (1983:18) points out, "most people depend mainly on subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation." Interpersonal communication allow

individuals to secure more specific information and clarification upon which to evaluate and behave with regard to the innovation.

Perceived Characteristics of the Innovation

Perceived characteristics of the innovation, or innovation attributes, are the properties associated with the innovation that affect its adoption or rejection. As in the definition of an innovation, the study of the attributes of an innovation is based upon how they are perceived by individuals. Regardless of their objective evaluation, their affect on innovative behavior is determined by the subjective evaluation of them.

The five categories of innovation attributes proposed by Rogers (1983) and their affect on the rate of adoption are presented in Table 3.1. (While a number of other authors have proposed additional and somewhat different characteristics (see for example, Fliegel and Kivlin 1966; Kivlin and Fliegel 1967, 1968; Fliegel et al. 1968; Zaltman and Lin 1971; Lin and Zaltman 1973), much of the difference is a result of interpretation. For the sake of simplicity and consistency, Rogers' (1983) five categories will be used in this study.) Of the five, four (relative advantage, compatibility, trialability and observability) are considered to be positively related to the rate of adoption. This means that an innovation that is perceived to possess a high degree of these attributes will be adopted more rapidly or readily than if it did not. The remaining attribute's (complexity) association with the rate of adoption is expressed in terms of a negative relationship; the higher the degree of perceived complexity, the slower the rate of adoption.

Table 3.1. Five attributes of innovations and their affect on the rate of adoption

Attribute	Definition	Affect on rate of adoption
Relative advantage	The degree to which an innovation is perceived as being better than the idea, practice or object it supercedes. Sub-dimensions include: degree of economic profitability, initial cost, perceived risk, degree of discomfort, savings in time and effort, and immediacy of reward.	Positively related to its rate of adoption
Compatibility	The degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of the individual.	Positively related to its rate of adoption
Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use.	Negatively related to its rate of adoption
Trialability	The degree to which an innovation may be experimented with on a limited basis.	Positively related to its rate of adoption
Observability	The degree to which the results of an innovation are visible to others.	Positively related to its rate of adoption

Source: Rogers (1983:213-239)

In addition to the affect of innovation attributes on the rate of adoption in general, Rogers with Shoemaker (1971:160) have proposed that the various perceived attributes of the innovation may be more critical at certain stages of the model (not depicted as such in Figure 3.2):

1. At the knowledge stage, the innovation's complexity and compatibility should be most important.
2. At the persuasion stage, the innovation's relative advantage and observability should be most important.
3. At the decision stage, the innovation's trialability should be most important.

These proposed relationships, however, are "logical derivations on the basis of the nature of the stages and the innovation characteristics" (Rogers with Shoemaker 1971:159).

The Rationale for Selecting the Model

Having gained an understanding of the innovation-decision process model, it is important to specifically address the issue of why this particular model was selected and how it will be applied in this study. First, while the idea and practice of pest control is understandably not new to homeowners, it was assumed that the focus of the Pest Management Manual (that is, IPM) and many of the ideas and practices contained in it would be perceived as new by many manual owners. Therefore, the manual could be appropriately considered an innovation. Second, the model characterizes the individual's decision-making process with regard to the innovation. Since the focus of this study is the individual's evaluative response to the manual as a means to effectively convey pest management

information (IPM), the unit of analysis in the study and in the model are the same. Third, the model is essentially a generic one, characterizing any (or most) individual's innovation-decision process. By selecting and using a model that has been validated and applied successfully in other fields (for example, education, medicine, marketing and agriculture), much needed groundwork can be laid for others wishing to utilize the same approach to study similar efforts in the field of urban pest management. And to our knowledge, no one has used this particular model in this field. And finally, the model provides a framework for the collection, analysis and interpretation of data.

Application of the model in this study will focus on determining to what extent it constitutes an appropriate framework for better understanding and explaining information transfer efforts in the field of urban pest management. Towards this end, a number of the relationships proposed by Rogers (1983) and others will be tested. More specifically, the results of this study will provide information to answer the following questions concerning the Pest Management Manual:

1. Was the manual used?
2. To what extent was it used?
3. What characteristics of the manual affected its use or non-use?
4. What are the characteristics of manual owners?
5. To what extent did the characteristics of manual owners affect its use or non-use?

The specific variables that will be used and the relationships that will be tested are addressed in Part II of the chapter.

PART II: THE CONCEPTUAL FRAMEWORK

Having presented the theoretical framework and a rationale for its selection and application, Part II of the chapter focuses on the identification and conceptual treatment of the specific variables and relationships that will be addressed in the study. First, how the manual will be characterized as an innovation and what is meant by adoption -- the main dependent variable in the study -- is presented. The remaining sections, which are organized around Rogers' (1983) variable classification categories, identify and define the specific independent variables that will be addressed in this study. (All categories, except social system variables are represented.) Included in each section, and again in a list at the end of the chapter, are the hypotheses that will be tested in the study.

The Manual as an Innovation

As described in Chapter 2, the Pest Management Manual was one component of Project PEST's community education program that was designed to provide pest management information stressing alternatives to pesticides to urban homeowners. Recognizing the opportunity to present alternative pest management information within an integrated pest management (IPM) framework, the manual was produced by project staff with the aid of community volunteers.

While a variety of popular and technical pest management literature was available, no one publication existed that offered the

pest management focus desired for the project; a publication stressing alternatives to pesticides within an IPM framework, specifically adapted to the pest problems of homeowners in the area (Meridian Charter Township, Michigan). For example, a number of publications were rejected because their presentation of IPM was judged to be either too technical or too general. In addition, Cooperative Extension Service publications, some of which offered alternative control techniques, still primarily recommended pesticide controls for the majority of pest problems. And the so-called "organic" literature, which contained a large variety of alternative techniques, did not specifically advocate using alternatives within an IPM framework. So, while publications existed that satisfied a number of the criteria desired for the project manual, no one publication adequately satisfied all of them. The decision to produce a manual sought to alleviate these perceived shortcomings of existing publications by: (1) providing a procedural guide to IPM specifically written for the homeowners; and (2) including a large number of management techniques -- including both pesticides and alternatives -- from various existing sources and advocating their use within the IPM framework.

Objective and Subjective "Newness" of the Manual

From an objective standpoint, practically all of the information in the manual is not new. The presentation of IPM is based on principles and guidelines previously advanced and applied to an extent in agriculture and currently being recommended for use in the urban sector. In addition, all of the management techniques were

taken from existing pest control and plant care publications. Perhaps the only new aspects of the manual, from an objective standpoint, were the manner in which a number of IPM objectives were adapted for actual use by the homeowner (for example, how to determine an "injury acceptance level" for a particular pest problem) and the way in which the material was organized and presented. However, determining if the manual was new or old in objective terms makes little difference in characterizing this publication as an innovation.

The key to defining an innovation requires acknowledging its perceived or subjective newness for the potential adopter. Because the innovation-decision process seeks to explain an individual's psychological and behavioral actions with regard to an innovation, his perception of the idea, object or practice as new -- not its objective newness -- will predispose his actions. Rogers (1983:11) makes this distinction clear by stating:

It matters little, so far as human behavior is concerned, whether or not an idea is "objectively" new as measured by the lapse of time since its first use or discovery. The perceived newness of the idea for the individual determines his or her reaction to it. If the idea seems new to the individual, it is an innovation.

Therefore, to understand the innovation-decision process among individuals who have acquired the manual, it is necessary to determine if the manual represented a perceived or subjectively new idea for them.

Components of the Manual

The two components of an innovation presented in Part I of this chapter were its hardware aspect (the tool that embodies the innovation as a material object) and its software aspect (the

information base for the tool). Viewing the manual from this perspective, we will consider the hardware component to be the means used to present IPM to individuals (the looseleaf binder). The software component refers to the IPM information and practices in the manual.

The Manual as a Technology Cluster

The singular pest management approach called IPM consists of a number of interrelated yet distinguishable components. To label the manual as a single innovation, we would need to consider only those individuals who had read the entire publication and considered all of it new. If we proceeded based on his approach, however, we would probably have no innovation to study. As described in Chapter 2, the manual was written to be used in a variety of ways by individuals with diverse pest management interests and skills. While individuals were encouraged to use it as a "whole", which presumably would result in their practicing IPM, they could also use only parts of it depending on their current orientations and needs. By acknowledging this diversity in the individuals' knowledge of pest management and their potential selective use of the manual, it becomes apparent that the exact nature of the innovation for each individual may vary considerably. In other words, no two individuals may have attended to the same portions of the manual, and even if they did, what was new for one may have been old for the other. And we must also acknowledge that, depending on an individual's background in pest management, all of the information and practices he read about or used in the manual

might be old information to him. In this case then, the manual would not represent an innovation for that particular person.

Given these circumstances, we will consider the manual to represent a technology (innovation) cluster. While we know the ultimate dimensions of the cluster -- from all information and practices being considered new to at least two being considered new -- the exact dimensions for any given individual will be dependent on the extent to which the information in the manual was attended to and perceived as new by that individual. And given the variety of information, most of which is not objectively new, we would expect that some of it would be perceived as new. Consequently, the manual as an innovation will represent different things to different people. Since the conceptualization of the manual as a technology cluster is closely tied to its adoption, the next section will provide a clearer perspective on this matter.

Adoption of the Manual

Describing the manual as a technology cluster has direct implications for conceptualizing its adoption (the main dependent variable in this study). Because the manual as an innovation can mean different things to different people, it follows that its adoption or rejection can be characterized in the same manner. Before proceeding to a conceptual discussion, however, it is necessary to explore adoption in more detail.

Additional Adoption Concepts

In Part I of this chapter, adoption was defined as a decision to make full use of an innovation as the best course of action. The concept of adoption, however, is open to much interpretation and varies considerably in application. Presser (1969) points out that there are differences in the definition of adoption by researchers, and even between innovations for one researcher. To illustrate this variability he offers that:

Adoption may be defined as continued full scale use since the first trial; increasing scale of use since first trial; trial, use and later discontinuance; trial and then discontinuance; or just trial alone. For new ideas, even intention to use is sometimes classified as adoption (Presser 1969:512).

He concludes that the criterion for adoption needs to be clearly specified in any investigation.

Another issue that has received attention when considering adoption of innovations is the concept and practice of symbolic adoption. If an innovation consists of a hardware component and a software component (also called a material and an idea component, respectively), then it is proposed that the individual will face at least two adoption decisions: "to accept or not accept the idea and to use or not use the product or practice" (Klonglan and Coward 1970:78). (In fact, while not explicitly stating this distinction, Presser (1969:512) implicitly acknowledged the idea of symbolic adoption in the passage quoted above by stating, "For new ideas, even intention to use is sometimes classified as adoption.") Acceptance of the idea refers to symbolic adoption and putting the practice into use refers to use adoption or simply adoption. Klonglan and Coward (1970) expressed the opinion that symbolic adoption should be an

explicit outcome of the adoption process. They pointed out that the advantage of conceptualizing adoption as a two-phase process could help researchers deal with the realities of studying the acceptance of innovations. For example, symbolic adoption might help to explain incomplete adoption, or the situation where an individual was favorably oriented toward an innovation, but for one reason or another was not using it. In other words, the individual may have accepted or adopted the idea, yet was unable or unwilling to act upon this favorable orientation.

While not using the same terminology, Rogers (1983) has essentially incorporated this concept in his most recent version of the model. Whereas the decision stage in his earlier conceptualizations included the action of implementation or use, in his 1983 version he makes the distinction between a decision to adopt (the decision stage, which is equivalent to symbolic adoption) and putting the innovation into use (the implementation stage, which is equivalent to use adoption). The addition of the implementation stage confirms the opinions expressed by Klonglan and Coward (1970). Although not using the term symbolic adoption, Rogers (1983:174) realized the importance of this concept when he wrote:

Past conceptualizations of the innovation-decision process have generally not fully recognized the importance, or even the existence, of the implementation stage (for example, Rogers with Shoemaker 1971, pp. 98-133). It is often one thing for the individual to decide to adopt a new idea, and quite a different thing to put the innovation into use. Problems in exactly how to use the innovation may crop up at the implementation stage. Implementation usually follows the decision stage rather directly unless it is held up by some logistical problem, like the temporary unavailability of the innovation.

The act of adopting an innovation will also vary depending on the type of innovation under investigation and what people perceive to be adoption. Many studies of adoption deal with a single, easily defined innovation in which adoption (including implementation) is clearly uniform across adopter units (for example, planting hybrid seed corn or using a new antibiotic). However, where the innovation is not as easily defined, the meaning of adoption may be less clear. Warner (1974:441) provided a good example of this phenomenon when he discussed the difference between adopting hybrid seed corn and PPBS (the Planning, Programming, Budgeting System):

The former [hybrid seed corn] is specific and well-defined; the latter [PPBS] means many different things to different agencies. PPBS is implemented in numerous ways: some agencies may consider themselves "adopters" by merely adopting the label, whereas others will not employ the label until they have seriously attempted to incorporate the principles of systematic analysis into their programming, planning, and budgeting.

Again, Rogers (1983) has incorporated this idea into his most recent conceptualization of the process by including the act of re-invention. As defined in Part I, re-invention is the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation. If the innovation is not a single or simple entity, then re-invention is likely to occur.

The Extent of Adoption and Implementation of the Manual

The approach taken to determine adoption and implementation of the manual must necessarily take into consideration its characterization as a technology cluster and the concept of re-invention. In addition, this approach will also be influenced by the current circumstances and the focus of the study. Given these considerations,

the following approach, which represents an extension of "typical" adoption behavior, will be used in this study to determine adoption and implementation of the manual.

Because the diffusion of an innovation to members of a social system is a process that takes place over a long period of time (Rogers with Shoemaker 1971), researchers typically analyze the process after it is complete, or nearly complete, in the population of adopter units (Klonglan et al. 1971). Using time (usually year) of adoption (and implementation) as the dependent variable, they then go back and reconstruct the stages of the adoption model as they occurred, define adopter categories, determine the rate of adoption and so on. Since only two years have elapsed since the manual was introduced, and only a small number of individuals have purchased the manual to date, it would be reasonable to assume that this study is taking place during, rather than after, the diffusion process. Given these circumstances, the focus on adoption behavior in this study will be shifted from the relative time that adoption (or rejection) occurred to the amount of adoption or rejection that took place in the two years since the manual's introduction among those individuals who currently own it.

The approach taken to determine the amount of adoption behavior is closely linked with its definition as a technology cluster. In characterizing the manual as an innovation, it was described as a dynamic technology cluster. That is, for any individual, the boundaries of the cluster will vary depending on the parts of the manual he attended to and perceived as new or old. Since it would be virtually impossible to determine the exact elements in any one

individual's technology cluster a priori, it will be determined when adoption behavior is measured. Since re-invention of the manual was essentially encouraged and expected, the dimensions of the technology cluster will be defined as the extent to which re-invention occurred. In other words, the combinations of new information and practices that an individual adopted and implemented will constitute the technology cluster for him.

While the discussion to this point has centered on the new aspects of the manual, we have also acknowledged that some parts of it will be perceived as old information and practices. Investigating only its "new" aspects would keep us within the focus of the model, but would also limit the focus of this study (that is, use of the manual in general). Rather than exclude these old items, the approach used to determine adoption behavior will be extended to include them. By including all items used from the manual and weighting new ones more than old ones, a total use score will be determined that will not only reflect the extent to which the manual as an innovation was adopted and implemented but also the extent to which the manual was used in general. Thus, individuals who used more of the information and practices from the manual and considered more of these as new will receive the highest scores. Because this score, labelled the extent of adoption, reflects the amount of adoption and implementation of the manual, we would expect its relationship with the various independent variables proposed by Rogers (1983) and others to remain the same. A more specific discussion will serve to put these concepts and the approach taken to determine the extent of adoption into perspective.

IPM, as described in Chapter 1 and presented in the manual, consists of a number of components that when practiced in combination result in a dynamic approach to managing pest problems. The ultimate implementation of IPM necessarily demands that all of these components be applied in concert. However, it must also be acknowledged that each of these components might be used singly, or in numerous combinations. Given the complex and inherent philosophical nature of IPM, we would suspect that after only two years, most if not all individuals would not have put into use the full range of IPM components from the manual. Rather than ignore the partial use of the components, it seems useful to conceive of the practice of IPM as an incremental activity. In this approach, which has been used in evaluating cotton IPM programs (Boutwell and Smith 1981), the components of IPM are separated into mutually exclusive categories. The extent of practicing IPM is then determined objectively by asking individuals to indicate the components they are currently using. Regardless of their subjective evaluations of the degree to which they practice IPM, those who use more components are described as practicing IPM to a greater extent than those who use less components.

This approach will be used in this study, with modifications for new and old components, to determine the extent of adoption and implementation of the manual. Since the manual contains both information and practice items, it will be necessary to develop a mutually exclusive list of components for each of these. Information components will be those that can be adopted or accepted on an idea level; practice components will be those that can be adopted and

implemented to directly control pest problems. By asking individuals to indicate the new and old information components they had read about and adopted and the new and old practice components that they had adopted and were currently using from the manual, an extent of adoption (and implementation) score can be determined. This score will not only reflect the extent to which IPM from the manual was used but also the extent to which the manual as a technology cluster was re-invented. And because new information and practices will be weighted more than old ones, individuals reading about and adopting more new information components and adopting and implementing more new practice components will receive the highest scores.

Individual Characteristics

In Part I of this chapter, a large number of individual characteristics were presented that have been investigated and found to affect the innovation-decision process. The results of these investigations have shown, in general, that persons adopting innovations earlier than others tend to exhibit or possess greater degrees of certain socioeconomic, personality and communication behavior characteristics. Because this study essentially represents an exploratory application of the model in this field, a number of variables from each of these three categories were selected to include in this investigation. The specific individual variables (considered independent variables) chosen for study and their conceptual treatment are the subject of the next three sub-sections.

Socioeconomic Variables

From among the many socioeconomic variables found to be associated with adoption behavior, three were selected for this study: age, education and socioeconomic status. Based on his review of diffusion studies, Rogers (1983) found that a consistent directional relationship between age and innovativeness was not supported by study results. In other words, earlier adopters are no different in age than later adopters. However, he did conclude that the remaining two variables were positively related to innovativeness; that is, earlier adopters have more years of education and higher socioeconomic status than later adopters.

The explanations proposed for why, in general, innovative individuals exhibit these characteristics are also applicable for this study. Use of the manual, particularly for IPM, requires that individuals comprehend and combine a number of components. Even though attention was given to writing the text in an interesting and readable manner (readability measured by the Flesch formula (Flesch 1951) was equivalent to "some high school"), the manual was intended to be used as a decision-making guide. Rather than telling users exactly what to do in any given situation, the manual offered a framework that essentially required them to design and conduct their own pest management program. Consequently, the ability to read, comprehend and apply the information in the manual would perhaps require the mental skills and flexibility associated with higher educational attainment.

With regard to socioeconomic status, we would expect the same positive relationship, but for reasons somewhat different than those

expressed by Rogers (1983). Persons of higher socioeconomic status are more likely to reside in areas where landscape features are a significant component of the outward appearance of the home and are given considerable attention. The care of plants in the landscape, therefore, becomes an important factor in overall home maintenance. Given this increased importance of plants in the landscape -- whether welcomed or not -- there is perhaps a greater need to protect this investment. In addition, there is typically some degree of social pressure to maintain the landscape in an aesthetically acceptable state (First Survey Research Center, Inc. 1967), which would include pest control. We might also expect that persons of higher socioeconomic status are simply more able to devote the resources (time, money) to their landscape, including the management of pest problems. (This last explanation more closely parallels that presented by Rogers (1983), which was discussed in Part I of this chapter.)

While age and education variables are conceptually straightforward, socioeconomic status needs clarification. Nam and Gustavus (1976:321) define socioeconomic status as "A classification of people or groups on the basis of such social and economic variables as their educational level, occupation, income, and housing status." Essentially it is an attempt to provide, in one indicator, a picture of the overall status structure of individuals or groups of individuals from various social and economic measures. There are currently a large number of indexes that utilize a wide variety of indicators to determine an individual's socioeconomic status. While occupation has been shown to be the best single predictor of social status, a number of other factors such as income and educational

attainment are also known to be associated with occupational ranks (Miller 1977). Selected for use in this study is Hollingshead's two factor index of social position, which utilizes occupation and education to determine socioeconomic status. This particular index was selected over others because it utilizes two indicators rather than one (occupation), it makes a finer distinction between occupational categories than those based on census categories and it is one of the more widely used indexes (Miller 1977). Therefore, socioeconomic status in this study will be determined from the individual's occupation and income.

With regard to these three socioeconomic variables and adoption behavior then, we would expect that age would not be related to the extent of adoption, while education and socioeconomic would be positively related to the dependent variable; that is, individuals with more education and higher socioeconomic status will have adopted the manual to a greater extent than those with less education and lower socioeconomic status.

In addition to the above variables, two other socioeconomic characteristics will be included as descriptors of individuals who purchased the manual. One is the income level of the household. The other is the current employment status of individuals, irrespective of their specific occupation.

Personality Variables

While socioeconomic variables describe the social and economic standing of individuals, personality variables characterize their

social psychological orientations. As discussed in Part I of this chapter, the more innovative individuals exhibit personality orientations that allow them to deal with new ideas in a favorable, more open manner. And even though their utility as independent variables is recognized theoretically, Rogers (1983:257) points out that, "Personality variables associated with innovativeness have not yet received much research attention, in part because of difficulties of measuring personality dimensions in field interviews." While personality variables previously investigated are typically general, those identified for this study focus specifically on the subject matter of interest; a number of attitudes dealing with pest management activities will be measured and associated with adoption behavior. However, before identifying these specific attitudes, an overview of the attitude concept is presented, to better understand its significance in the adoption process.

A Definition of Attitude. While many definitions of attitude have been proposed (Shaw and Wright 1967; Kiesler et al. 1969; Lemon 1973; Fishbein and Ajzen 1975; all contain excellent definitional reviews), most tend to agree that the characteristic that separates attitude from other personality concepts is its evaluative or affective nature (Shaw and Wright 1967; Fishbein and Ajzen 1975; Olson 1980). By affective or evaluative is meant some degree of favorableness or unfavorableness regarding the attitude object. The definition of attitude chosen for this study is one proposed by Shaw and Wright (1967). It was selected because it represents an eclectic one; the authors purposefully extracted the commonalities of various definitions and attempted to relate the concept as closely as

possible to the operations typically used to measure attitudes.

Therefore, the term attitude will be defined as:

A relatively enduring system of evaluative, affective reactions based upon and reflecting the evaluative concepts or beliefs which have been learned about the characteristics of a social object or class of social objects (Shaw and Wright 1967:3).

Attitude Structure. The more traditional view posits that attitude consists of three basic components -- the cognitive (beliefs), affective and behavioral -- that exist in balance (Engel et al. 1968; Katz 1968; Lauer 1971). A more contemporary view, proposed by Fishbein and Ajzen (1975) and reflected in Shaw and Wright's (1967) definition stated above, holds that an attitude toward some object is a function of the individual's beliefs and consists only of the sum of his affective or evaluative reactions associated with those beliefs. In addition, attitudes are considered a primary causal influence on behavioral intentions, which in turn are a major determinant of behavior.

More specifically, a person's beliefs represent the information he has about the object. The object can be any entity or action; the information (or attributes) can be any characteristics or dimensions associated with the object. A belief, then, links an attribute to some object (Fishbein and Ajzen 1975). For example, the belief "using pesticides is dangerous" links the object "using pesticides" to the attribute "dangerous." Beliefs may be formed on the basis of direct observation, from information received through outside sources or by ways of various inference processes (Fishbein and Ajzen 1975).

Moreover, beliefs are motivationally or emotionally neutral (Kassarjian and Robertson 1968). A belief "becomes" an attitude, or an attitude

is formed, when the individual attaches evaluative significance to the attributes associated with the object.

In this view, which is taken in this study, the term attitude is used to describe only the affective or evaluative aspect associated with a belief. It is considered a distinct element in a closely related system, rather than an element in a balanced system labelled attitude. At the foundation of this interrelated system lies a person's beliefs, which serve "as the informational base that ultimately determines his attitudes, intentions and behaviors (Fishbein and Ajzen 1975:14).

Attitude Direction, Intensity and Importance. The directional variation of attitude is represented by its positive or negative valence, which reflects the evaluation of the object (Shaw and Wright 1967). Thus, a person is described as having either a positive or negative attitude toward a particular object. Attitude intensity, or the strength of the affective reaction, refers to "the extremity of the position occupied on the continuum, becoming stronger as one goes outward from a neutral position" (Shaw and Wright 1967:7). This continuum ranges from extremely positive to extremely negative. An individual's location on this continuum is, in part, a function of the importance of the object for him (Newcomb et al. 1965; Andreasen 1968; Fishbein and Ajzen 1975). More important objects stay in the forefront of the individual's consciousness, either because of external circumstances or individual motive states (Newcomb et al. 1965). As the object becomes more important, the individual tends to acquire more specific and certain information (or beliefs) about it, which are typically evaluated more positively or negatively (Shaw and

Wright 1967; Fishbein and Ajzen 1975). Conversely, for objects that are more psychologically remote or peripheral, the individual tends to have less information about them and therefore exhibit a less intense affective reaction.

Importance also affects attitude stability. The more important the object is to the individual, the more stable his attitude will be toward it (Newcomb et al. 1965; Shaw and Wright 1967; Olson 1980). On the other hand, attitudes developed toward less important objects are usually less stable over time. The implications of attitude stability are typically manifested in the degree to which they are resistant to change; stable attitudes are maximally resistant to change, whereas less stable attitudes are more susceptible to change (particularly through new information) (Newcomb et al. 1965; Shaw and Wright 1967).

Attitudes and Behavior. While the above discussion has centered on what attitudes are, the issue of attitudes and behavior focuses on what they are said to do. In addition to overt behavior, which is typically considered the end product of the attitudinal process, attitudes affect the full gamut of psychological processes as well (for example, perception and learning) (Newcomb et al. 1965). Consequently, the ensuing discussion will provide an overview of the attitude concept as it relates to both psychological (in this case, perception) and overt behavior.

Perception is the process by which an individual decodes or interprets incoming information (Newcomb et al. 1965). Attitudes are part of the selective mechanism that governs perception, so that perception of incoming information tends to be congruent with

existing attitudes (Lauer 1971). When this information is perceived as supportive of the person's prior attitude, the experience is more likely to have some reinforcing affect on the attitude and the information is more likely to be learned or retained (Newcomb et al. 1965; Lauer 1971). Depending on the degree to which incoming information is inconsistent with existing attitudes, however, the individual may exhibit selective exposure and/or selective distortion. A person tends to avoid exposure to information that is inconsistent with his attitudes. Therefore, information that is contradictory or otherwise inconsistent with his attitudes is likely to provoke a reaction of selective exposure, whereby the contradictory information is avoided. A person may also selectively distort incoming information that is inconsistent with his attitudes. Once exposed to the information, he may perceive and interpret it in a manner contrary to its original intent, but consistent with his attitudes (Engel et al. 1968).

The relationship between attitudes and overt behavior has received much attention. However, rigorous tests of this relationship are difficult and have produced different and somewhat controversial results (Kiesler et al. 1969; Lemon 1973; Ajzen and Fishbein 1977; Olson 1980). Although the attitude concept was originally introduced as an explanatory device to better understand human behavior (Fishbein and Ajzen 1975), the lack of a simple one-to-one correspondence between the two often results because many studies utilize a general attitude measure to predict or explain a specific behavior (Kiesler et al. 1969; Fishbein and Ajzen 1975; Ajzen and Fishbein 1977; Jaccard et al. 1977; Wells 1980), and

because overt behavior is generally recognized as a function of both attitudes and other variables (Newcomb et al. 1965; Lauer 1971; Wicker 1971; Lemon 1973; Fishbein and Ajzen 1975; Ajzen and Fishbein 1977; Olson 1980).

With regard to the first item, the degree to which attitudes are related to behavior depends in part on the extent to which the attitude and the behavior are in correspondence (Kiesler et al. 1969; Fishbein and Ajzen 1975; Ajzen and Fishbein 1977; Wells 1980). When the attitude object has been general and the behavior specific, low correlations have typically been reported (Ajzen and Fishbein 1977; Jaccard et al. 1977). Therefore, attitude measures are least likely to be useful, from both a predictive and explanatory standpoint, when we try to infer specific behaviors from general attitudes (Wells 1980). Logically then, this relationship should be improved by bringing the attitude and behavior into closer correspondence.

Towards this end, research indicates that a distinction should be made between an attitude toward an object and an attitude toward the act of performing a behavior (Cohen 1981). Where an attitude toward performing a behavior has been used, rather than an attitude toward the object, significant findings have been obtained (Fishbein and Ajzen 1975; Ajzen and Fishbein 1977). For example, if the behavior under investigation is "using pesticides," then the relevant attitude used to predict or explain this behavior should be the individual's "attitude toward using pesticides" and not their "attitude toward pesticides in general."

With regard to the second item, while most authors would agree that attitude is only one factor determining behavior, there is no

agreement as to exactly which "other variables" are most important. Even the manner in which other variables are thought to interact with attitudes is represented by two points of view: one proposes that other variables interact with attitudes to determine behavior; the other suggests that other variables act separately, and when added to attitudes determine behavior (Fishbein and Ajzen 1975). Examples of other variables suggested by various authors include: personal and situational variables including other attitudes held by the individual; his activity level, verbal, intellectual and social abilities; the presence of other people; the range of alternative behaviors available; the occurrence of unforeseen events (Wicker 1971); the extent to which the situation imposes normative prescriptions on the individual about which behavior is appropriate; the extent to which the individual possesses the necessary knowledge to connect his attitude to the relevant behavior; the extent to which the situation actually provides opportunities for attitudinally congruent behavior (if no suitable alternatives are present, the individual may choose to perform some activity he dislikes); and the anticipated future consequences of behavior (Lemon 1973).

Attitudes Selected for Study. Given the above discussion of attitudes and their relationship to psychological and overt behavior, it is apparent that the attitude concept has much to offer in the way of helping to explain an individual's adoption process. However, it is also apparent that the degree to which attitudes can be used as an explanatory device is dependent on the extent to which they are understood and used properly in a given situation. In this study, attitudes will be addressed in two different contexts. First, as

personality variables (described in this section) attitudes are conceived as existing prior to the individual's emergence into the adoption process. To the extent that they influence or are associated with adoption behavior in general, these attitudes might best be described as "other variables." Second, the outcome of the persuasion stage of the model is the individual's formation of a favorable or unfavorable attitude toward the innovation. Since adoption and implementation are generally thought to follow a favorable attitude toward the innovation, in this context the attitude may be considered the focal or primary one most directly associated with overt behavior (this will be taken up in more detail in a later section).

With this in mind, the three personality variables that will be measured in this study are:

1. The individual's attitude toward handling pest problems on the plants in his yard.
2. The individual's attitude toward using pesticides as a way to handle pest problems in his yard.
3. The individual's attitude toward using alternatives to pesticides as a way to handle pest problems in his yard.

Since individuals who purchased the manual had to make a conscious effort to do so, it would be reasonable to expect that these activities were of some interest or importance to them. Therefore, it might also be reasonable to expect them to possess an attitude of some direction and intensity toward each of these items. Moreover, given the focus of the manual and the potential influence of attitudes as other variables on psychological and overt behavior, we would further expect the individuals' attitudes toward each of these

items to be associated with the extent to which they adopted the manual. And finally, to increase the potential power of these variables for explaining these types of behavior, they are expressed as attitudes toward the act of performing specific behaviors most closely related to the innovation.

The first attitude item is the most general of the three. It was included to provide a measure of the person's overall reaction and orientation to the general activity of dealing with pest problems in the yard. Previous research by Pampel and van Es (1977) and Taylor and Miller (1978) found that by including a measure of the respondents' orientations toward the general adoption activity, prediction of adoption behavior was enhanced. Because the practice of IPM is proactive rather than reactive and requires that a number of components be implemented at one time, it is necessarily labor intensive. Realizing this, the degree to which individuals either like or dislike handling pest problems in their yard is likely to influence, in part, their perceptions of the manual and their subsequent behavior. Therefore, we would expect that individuals with a more positive attitude toward handling pest problems on the plants in their yard will have perceived the manual more positively and will have adopted it to a greater extent than those individuals with a less positive or negative attitude toward this activity.

The second and third attitude items are more specific and focus on a somewhat controversial topic and indeed the central issue of why Project PEST was conducted and the manual produced. That urban homeowners possess attitudes toward pesticides has been substantiated (see Chapter 1). And, at least in Meridian Township (Project PEST's

target community), a majority of community survey respondents indicated positive attitudinal orientations toward a number of principles underlying IPM (Lambur et al. 1982). Even though IPM, as presented in the manual, acknowledges that pesticides are part of this approach to handling pest problems, they are explicitly given the status as a control measure of "last resort." In fact one of the beginning sections was devoted to a discussion of the negative consequences attributed to the repeated use of these compounds. Therefore, the manual is unquestionably a persuasive document expressing the point of view that the use of potentially dangerous pesticides should be lessened and replaced, in part, with non-pesticidal alternatives. It should then follow that the extent to which the individual's attitudinal orientations are congruent with this point of view, will affect the extent to which the manual is perceived as positive or negative and, therefore, the extent to which adoption took place. More specifically, we would expect that, relative to attitudes toward using pesticides and alternatives to pesticides as ways of handling pest problems in the yard, individuals with a more negative attitude toward using pesticides and a more positive attitude toward using alternative to pesticides will have perceived the manual more positively and will have adopted it to a greater extent than those individuals who possess lesser or opposite attitudinal tendencies toward these activities.

Communication Behavior Variables

As discussed in Part I of this chapter, the degree to which individuals exhibit more diverse communication behavior is positively

related to their innovativeness. More innovative individuals generally pursue and use a greater number of both mass media and interpersonal channels of communication. Because of this, the likelihood of becoming aware of innovations is increased. The ability to gain initial, as well as additional information about the innovation is also enhanced.

Communication behavior specifically related to pest management will be addressed in this study. While Rogers' (1983) generalizations express the degree to which singular communication channels are related to adoption behavior, it will be treated here as a composite variable. Labelled the *index of communication behavior*, this variable will represent the combination of mass media and interpersonal sources that individuals use to obtain pest management information.

If individuals use a broad array of communication sources for information on handling pest problems in their yard, it might be reasonable to expect them to possess a considerable amount of knowledge about pest management. To the extent that they do possess more knowledge of pest management, they may be more familiar with and receptive to the information in the manual and therefore more apt to use it. Thus, while the number of new items in the manual may be fewer for these individuals, the extent to which they used the manual (the total number of information and practice items used) may be higher. Because the dependent variable in this study is a function of the total number of both new and old items, it should still hold that the relationship between this variable and adoption behavior would be positive (even though adoption behavior scores might be lower).

Therefore, we would expect that individuals exhibiting more diverse communication behavior will have adopted the manual to a greater extent than those exhibiting less diverse behavior.

One additional study specific variable that falls within this category will also be addressed. While a measure of communication behavior is expected to provide a general measure of pest management knowledge, it will also be instructive to determine if and to what extent individuals were familiar specifically with IPM before purchasing the manual. As for communication behavior, individuals familiar with IPM may consider more of the manual old, but at the same time utilize a larger number of information and practice items in it. We would expect then, that individuals more familiar with IPM before purchasing the manual will have adopted it to a greater extent than those less familiar or not at all familiar with IPM before manual purchase.

Problem vs. Innovation Orientation

The last individual variable selected for study concerns the individual's orientation at the beginning of the innovation-decision process. This variable addresses the question, "Does the reason for engaging in the adoption process affect adoption behavior?"

Reasons for initiating the adoption process are labelled an innovation orientation and a problem orientation. An innovation oriented beginning is characterized by an un-active search for the innovation and may also be described as the case whereby the existence of the innovation essentially creates a need for it. A problem oriented beginning involves an active search for the

innovation; that is, the innovation represents a potential solution to a current problem.

While research on this phenomenon is scant (only one study (Reynolds 1971) was found), an intuitive appraisal would suggest that individuals actively seeking information to solve a problem would be more likely to put that information into use, if they perceived it as suitable. From the standpoint of the adoption process then, they might more readily adopt the innovation because they have not had to spend the mental time creating a need for it.

As an explanatory variable in this study, the problem vs. innovation orientation will focus on the reason why the manual was purchased. If individuals indicated a problem oriented purchase decision then we would expect that they will have adopted the manual to a greater extent than if they indicated an innovation oriented purchase decision.

Communication Channels

Communication channels serve not only to create awareness about the existence of innovations, but also provide information upon which individuals gain additional knowledge about the innovation. As variables associated with the model, mass media channels are relatively more important in creating awareness and providing general information about the innovation, whereas interpersonal channels convey more specific, subjective information. For the purpose of this study, the interest in communication channels will focus on

determining how individuals first became aware of the manual being available for sale.

Consistent with past research, we would expect that the majority of individuals would have first become aware of the manual through a mass media rather than an interpersonal channel. In addition, by providing a list of the various ways in which the manual was publicized through the mass media, it will also be possible to determine the relative importance of each of these for creating initial awareness of the manual. However, since the mass media campaign was only conducted the first year of the manual's availability, it will also be necessary to determine the time (year) of purchase.

Perceived Characteristics of the Innovation

Up to this point, variables associated with adoption behavior have focused on characteristics of individuals. The perceived characteristics of the innovation, on the other hand, are the properties or attributes associated with the innovation itself that affect its rate of adoption. The five categories of attributes proposed by Rogers (1983) (see Table 3.1) are relative advantage, compatibility, complexity, trialability and observability. Based on perceptions of the degree to which the innovation exhibits these attributes, relative advantage, compatibility, trialability and observability have been found to be positively related to the innovation's rate of adoption; complexity has been found to be negatively related to its rate of adoption.

All five classes of attributes can be applied to the information and practices contained in the manual. One major aspect of IPM's relative advantage is found in the risk associated with the overuse and potential misuse of pesticides. To the degree that individuals perceive a risk associated with pesticides, IPM may present a relative advantage because it seeks to minimize the use of these compounds, and where possible, to replace them with alternatives. Other sub-dimensions of relative advantage that apply to IPM include the degree to which it requires an additional investment of time and labor (it is typically more labor intensive), its convenience (related somewhat to time and labor) and pest management results obtained (IPM advocates an acceptance of certain levels of pests and damage rather than the complete elimination of these organisms).

Compatibility refers to the extent to which IPM is consistent with the past experiences and needs of individuals. While IPM may be a new term to some people, many of the principles and techniques, viewed individually, could also represent items that individuals are familiar with and perhaps have practiced in the past. In addition, individuals who are concerned with and/or seeking to reduce their use of pesticides, might view IPM as a method for helping fulfill this need. While these examples describe compatibility in a positive sense, IPM could just as easily be perceived as incompatible. Individuals who are satisfied with their current pest control approach may view IPM as something too new and different and not worth the effort. Or they may feel no pressing need to alter their current actions. And even if they did, they may judge that IPM is not the solution for them.

The degree to which IPM is perceived to be relatively difficult to understand and use (its complexity) should also affect the extent to which it was adopted. To practice IPM requires that individuals understand a number of singular components related to pests and plants, but more importantly to integrate and apply these in a unified manner. To add to this, IPM is presented as a dynamic approach that does not necessarily demand the same actions (if any) for the same pest problem each time it occurs. While an extreme effort was made to present the information in an understandable and easily followed format, the "true" practice of IPM requires an ability to put many things together, which is inherently difficult.

IPM can easily be experimented with on a limited basis (its trialability). Although its function of maintaining an ecological balance between beneficial organisms and pest species is dependent in part on a somewhat large scale of operation (for example, within a garden as opposed to only a single plant), many of the practices can be tried on a small scale (for example, experimenting with "organic sprays" on individual plants in the yard).

And finally, to the extent that plants around the home are visible, so too is IPM. In fact, the primary reason for managing pest problems on ornamentals in the landscape is to enhance their visual appearance. However, since IPM maintains that plant appearance may need to be sacrificed somewhat to maintain a degree of ecological balance, an aesthetic compromise may be unacceptable to some homeowners.

In addition to applying the attribute classification scheme to the IPM information and practices contained in the manual (its

software component), it will also be used to separately evaluate the means used to present IPM to homeowners (the looseleaf binder or hardware component of the innovation).

Two attributes, complexity and relative advantage, provide useful criteria for evaluating the hardware component of the innovation. Dimensions of complexity include the degree to which the manual was perceived as easy or difficult to understand, locate information and use, whether the illustrations were meaningful or not, the simplicity or complexity of the language and the degree of detail and organization of the information. Whether the manual contained too little or too much information and the degree to which this means to convey the information was considered as better or worse than other means (publications) are aspects of its relative advantage.

Two additional attributes, introduced by this researcher, will also be used to evaluate the hardware component of the manual. The first, labelled appearance, refers to the outward characteristics or look of the manual. Even though the use of a looseleaf binder was decided upon to accommodate and facilitate the addition of other materials, its size might appear formidable to some individuals. In addition, the quantity of information within it, including the numerous colored tab-dividers, might also appear complicated, even though it was designed for quick and easy reference. The second attribute is durability. Since the manual was designed for active use, its ability to withstand and hold-up over repeated handlings might also affect the degree to which it was actually used.

With respect to the affect of perceived attributes on adoption behavior, virtually all previous research has treated them as separate variables. While the same approach will be taken in this study, they will also be treated in an additional manner. Rogers' (1983) conceptualization of the model posits that the outcome of the persuasion stage is the formation of either a favorable or unfavorable attitude toward the innovation. He further states that the outcome of the decision stage (rejection or adoption) is generally consistent with the direction of this attitude; if the attitude toward the innovation is negative, rejection will occur and if it is positive, adoption will occur. In view of the previous discussion on attitudes, it becomes apparent that since the perceptions of the attributes by the individual are essentially evaluative, taken collectively they provide a measure of the individual's attitude toward the innovation. That is, the attributes constitute a set of beliefs from which an attitude toward the innovation is formed. Given the theory of attitude formation and its relationship to behavior, it is also apparent that the model is essentially a conceptualization of this process. (It is interesting to note that only one citation was found (Valkonen 1970) that explicitly made this observation.) Viewed from this perspective, the various individual, personality and communication channel variables could be considered "other variables" that, in addition to the attitude toward the innovation, determine or lead to a specific overt behavior (adoption and implementation). Consequently, in addition to determining the affect of individual perceived attributes of the

manual's software and hardware components on adoption behavior, they will be treated collectively as attitudes.

In summary, we would expect the following relationships between attributes and adoption behavior. For attributes of the software component, the greater the degree of perceived relative advantage, compatibility, trialability and observability, the greater will be the extent of adoption; the greater the degree of perceived complexity, the lesser will be the extent of adoption. And, individuals with a more positive attitude toward this component of the innovation will have adopted the manual to a greater extent than those with a less positive or negative attitude toward it. For attributes of the hardware component, the greater the degree of perceived relative advantage, appearance and durability, the greater will be the extent of adoption; the greater the degree of perceived complexity, the lesser will be the extent of adoption. And, individuals with a more positive attitude toward the hardware component will have adopted the manual to a greater extent than those with a less positive or negative attitude toward it.

Consequences

Consequences were previously defined as changes occurring to an individual or a social system as a result of adopting or rejecting an innovation. Where the outcome of the adoption process has typically been the focus of most past diffusion research (that is, it is the dependent variable), when studying consequences, adoption becomes an independent variable used to help explain or predict consequences.

For the most part, however, investigation of the consequences of adopting an innovation has been ignored by most diffusion researchers because of a pro-innovation bias, inappropriate research designs, and/or the difficulty of measuring these effects (Rogers 1983).

While the purpose of this study is not to specifically measure the effects of adopting the manual (in fact the research design, presented in Chapter 4, is inappropriate for determining effects), several variables will be included to provide a general (non-causal) indication of the consequences of adopting the manual. With regard to Rogers' (1983) classification scheme for conceptualizing consequences (presented in Part I of this chapter), these would be viewed as direct consequences, or changes that occurred in immediate response to the innovation. The approach used to determine consequences will be to simply ask individuals if they felt that they had changed their way of thinking about and actually handling pest problems in their yard as a result of adopting the manual. While the limitations of this kind of "retrospective pretest" (Campbell and Stanley 1963) are acknowledged (individuals may provide socially desirable responses), it will at least provide a general perspective on consequences of adopting the manual.

If the manual (and more specifically, IPM) represented a useful approach for managing pest problems in the yard, then we might expect the following relationship to exist: individuals who adopted the manual to a greater extent will have changed their way of thinking about and handling pest problems in the yard more than those who adopted the manual to a lesser extent.

Descriptive Variables

A number of additional variables not contained in the theoretical framework, nor easily classified under any of the previous sections, will also be addressed in this study. These variables, which are study specific, are included as descriptive ones and will not be used in a relational context to explain adoption behavior. Descriptive variables include:

1. Pest control on plant groups in the yard. In addition to focusing on items specifically related to the manual, it will also be useful to obtain information on pest management by homeowners. A determination of where pest problems occurred in the yard and how they were handled by homeowners will be made.

2. Satisfaction with results. IPM for urban areas, and especially for urban homeowners, is currently a new, developing field. As stated in Chapter 2, the IPM approach presented in the manual, while theoretically and conceptually sound, has not really been thoroughly tested. In addition, many of the alternatives in the manual have not been scientifically tested and therefore might produce variable results when applied (a caution pointing this out was explicitly stated in the manual). And finally, one of the basic underlying principles of IPM is an acceptance of low levels of pests, which could result in a less than perfect appearance of some ornamental plants. Given these circumstances, it will be useful to determine the individuals' overall satisfaction with the results of applying practices from the manual (both old and new) to specific plant groups in the yard.

3. Recommending the manual to others. One measure of the success of any effort is the degree to which people "pass it along." Perhaps if individuals felt that the manual was a beneficial publication, they would have recommended it to other people. Whether or not individuals who adopted the manual recommended it to others will be determined.

4. Addition of information. As noted in Chapter 2, the manual included information on only a select number of pest problems for three plant groups in the yard (ornamental/shade tree, vegetable gardens, lawns). While project staff had anticipated additional updates, they have not been produced as of yet. In anticipation of the possible production of future updates, individuals who have adopted the manual to some extent would be a meaningful source to tap regarding the content of future updates. Whether or not individuals who adopted the manual would like to see additional information added to it, and if so, what specific types will also be addressed.

5. Best and least liked aspects of the manual. To the extent that all of the previous items do not capture or allow individuals to express a particular point of view and to provide a general evaluative response oriented item to the instrument, the least and best liked aspects of the manual will be determined.

6. Participation in Project PEST activities. As described in Chapter 2, the Pest Management Manual represented only one aspect of Project PEST. A variety of other activities, in which community residents could be involved, were conducted during the duration of this community development effort. This item is included to determine to what extent individuals were involved in other project activities.

Study Hypotheses

In summary, the following hypotheses will be addressed in this study:

For Socioeconomic Variables

- Hypothesis 1: The age of individuals will not be related to the extent to which they adopted the manual.
- Hypothesis 2: Individuals with more education will have adopted the manual to a greater extent than those with less education.
- Hypothesis 3: Individuals of higher socioeconomic status will have adopted the manual to a greater extent than those of lower socioeconomic status.

For Personality Variables

- Hypothesis 4: Individuals with a more positive attitude toward handling pest problems on the plants in their yard will have adopted the manual to a greater extent than those with a less positive or negative attitude toward this activity.
- Hypothesis 5: Individuals with a more negative attitude toward using pesticides in their yard will have adopted the manual to a greater extent than those with a less negative or positive attitude toward this activity.
- Hypothesis 6: Individuals with a more positive attitude toward using alternatives to pesticides in their yard will have adopted the manual to a greater extent than those with a less positive or negative attitude toward this activity.

For Communication Behavior Variables

- Hypothesis 7: Individuals exhibiting more diverse communication behavior will have adopted the manual to a greater extent than those exhibiting less diverse communication behavior.
- Hypothesis 8: Individuals more familiar with IPM before purchasing the manual will have adopted the manual to a greater extent than those less familiar or not at all familiar with IPM before purchasing the manual.

For Problem vs. Innovation Orientation

Hypothesis 9: Individuals indicating a problem oriented purchase decision will have adopted the manual to a greater extent than those indicating an innovation oriented decision.

For Communication Channels

Hypothesis 10: The majority of individuals who purchased the manual in its first year of availability first became aware of it through a mass media channel.

For Perceived Characteristics of the Innovation

Hypothesis 11: For attributes of the software component, the greater the degree of perceived relative advantage, compatibility, trialability and observability, the greater will be the extent of adoption; the greater the extent of perceived complexity, the lesser will be the extent of adoption.

Hypothesis 12: Individuals with a more positive attitude toward the software component will have adopted the manual to a greater extent than those with a less positive or negative attitude toward this component.

Hypothesis 13: For attributes of the hardware component, the greater the degree of perceived relative advantage, appearance and durability, the greater will be the extent of adoption; the greater the degree of complexity, the lesser will be the extent of adoption.

Hypothesis 14: Individuals with a more positive attitude toward the hardware component will have adopted the manual to a greater extent than those with a less positive or negative attitude toward this component.

For Consequences

Hypothesis 15: Individuals who adopted the manual to a greater extent will have changed their way of thinking about and handling pest problems in the yard more than those who adopted the manual to a lesser extent.

CHAPTER 4

METHODS

The methods used in this study are described in this chapter. The first four sections contain the study design, a description of study respondents, the sampling procedure used and a general overview of data collection. The fifth section provides a detailed presentation of how each of the variables was measured. Remaining sections include a description of the instrument used to collect survey data (a self-administered mail questionnaire), the pre-testing procedures and results, how the main survey was conducted (including return results) and the methods used to analyze the data.

Study Design

The study design used in this investigation was a cross-sectional post-only design (Judd and Kenny 1981). This design is characterized by the collection of data after the "treatment" has been administered. In this case the "treatment" refers to the purchase of the manual. The use of this design was dictated primarily from circumstances; the decision to evaluate the manual was made after it had been in the hands of township homeowners.

While the use of a cross-sectional post-only design limits inferences (internal validity) when measuring treatment effects

(Isaac and Michael 1982), it nevertheless offers an approach for describing and determining relationships between variables at the time of the study (Babbie 1973). Given the focus of this study, this design would appear to be a reasonable one because a treatment effect was not specifically being sought.

Study Respondents

Potential study respondents were individuals living in Meridian Charter Township, Michigan who had purchased the manual in 1981 or 1982 ($n = 75$). Although the manual was purchased by an additional 47 people residing in the surrounding area, it was decided to focus on Meridian Township manual owners because the township was the target community for Project PEST activities.

Sampling

A nonprobability sampling approach (total enumeration) was used in this study (Babbie 1973). That is, all individuals living in Meridian Township who had purchased the manual in 1981 or 1982 were considered potential study respondents. This approach was taken because of the relatively small number of individuals who had purchased the manual at the time of the study (February 1983). It was also felt that collecting data from as many of these individuals as possible (all individuals were given an equal opportunity to respond) was appropriate given the exploratory nature of this investigation.

The biggest disadvantage in nonprobability sampling is the inability to generalize study findings to other populations or settings (called external validity) (Babbie 1973). While this limitation is acknowledged, it must also be noted that the approach used to evaluate the manual (the innovation-decision process model) has been "generalized" to many different situations. Therefore, while study findings that pertain to the manual as a means to transfer IPM information to urban homeowners cannot be explicitly generalized to other situations, findings pertaining to the model as a means to evaluate the manual should provide more generalizable evidence regarding its potential usefulness for characterizing other transfer efforts in urban pest management.

Data Collection Method

A self-administered mail questionnaire was used in this study for collecting data. This survey method was preferred rather than personal or telephone interviews for several reasons. First, evidence suggests that the probability of obtaining socially desirable responses is increased in personal and telephone interviews (Dillman 1978). Because a number of proposed survey items dealt with issues that might solicit socially acceptable responses (for example, attitudes toward the use of pesticides and alternatives in the yard), it was felt that a mail survey would avoid this possible bias. Second, the additional time and expense to recruit, train and supervise interviewers -- for personal or telephone interviews -- was considered to be prohibitive. Finally, a self-administered

questionnaire would allow individuals to complete the instrument anonymously and without the time constraints imposed by an interview.

Having decided on the study approach outlined in this and preceding sections, the variables described in Chapter 3 were measured and put into a questionnaire format outlined by Dillman (1978). The questionnaire was then pre-tested among a small group of township homeowners. Based on the results of the pre-test, a number of items were changed and the final questionnaire was subsequently mailed to all manual owners in Meridian Township. In the following sections, each of these procedures is described in detail.

Measuring the Variables

In Part II of Chapter 3, the variables to be addressed in this study were identified and conceptualized. In this section, a description of the methods that were used to measure each variable are presented.

The Extent of Adoption and Implementation of the Manual

In measuring the extent of adoption and implementation of the manual, the following items needed to be considered: (1) defining the boundaries of the technology cluster in use; (2) distinguishing between "new" and "old" information and practice items; and (3) accommodating a "no-use" and possible rejection response. Given these considerations, the main dependent variable was measured in the following manner.

All items in the manual were divided into two groups: the first group consisted of information items that could be read about; the second group consisted of practice items that could be put into use.

The ten items in each group were:

<u>Information Items</u>	<u>Practice Items</u>
1. The problems with pesticides.	1. Preventing pest problems through proper plant selection and care.
2. The principles and objectives of integrated pest management (IPM).	2. Monitoring plants in the yard.
3. Preventing pest problems through proper plant selection and care.	3. Identifying pests and pest problems.
4. Monitoring activities.	4. Identifying beneficial organisms.
5. Identifying pests and pest problems.	5. Deciding if and when to use management techniques (from Injury Acceptance Levels chart).
6. Beneficial organisms and their identification.	6. Using guidelines to select management techniques.
7. Deciding if and when to use management techniques.	7. Selecting and properly applying alternatives to pesticides.
8. The general categories of management techniques and guidelines for their selection.	8. Selecting and properly applying "appropriate" pesticides.
9. The different types of alternatives to pesticides and how to use them.	9. Handling pesticides safely.
10. The different types of pesticides and methods for their safe use.	10. Evaluating your pest management actions.

First, individuals were asked if they had read any parts of the manual. If they responded "No" to this question, they were also asked to indicate, in an open response format, why they had not read any parts of the manual. Depending on the explanation given, if any, a number of interpretations were possible: (1) they had not progressed any further than the knowledge stage in the model; or (2) they had decided to reject the manual without attending to it.

Second, individuals who responded that they had read parts of the manual were asked to indicate, from the list of information items, those they considered either new or old when first reading

about them. The total number of items represented the extent to which they attended to the ideas and information in the manual; the total number of new items represented the boundaries of the technology cluster that could potentially be adopted.

Third, these individuals were asked if they were currently using any practices from the manual to handle pest problems in the yard. If they indicated "No", they were asked to indicate, in an open response format, why they were not currently using practices from the manual. The nature of this response, if any, was used to determine whether the information items they had read about were adopted or rejected. Unless the response clearly indicated that they had rejected the manual after reading parts of it, it was assumed that they had adopted the new and old information items (on an idea level). The extent of adoption score for these individuals then, was based only on information items from the manual.

Fourth, those individuals who were using practices from the manual were asked to indicate, from the list of practice items, the ones that they considered either new or old for them. The total number of items represented the extent to which practices from the manual were actually used; the total number of new items represented the boundaries of the technology cluster that were actually implemented. Thus, the extent of adoption score for these individuals was based on information items that they accepted or adopted and practice items that they had used or implemented.

As discussed in Chapter 3, the extent of adoption was conceptualized as including both new and old items from the manual. This approach was taken because considering only new items from the

manual might not truly reflect the extent to which it was totally used by any individual. To accommodate both of these needs, an extent of adoption score was calculated that assigned a higher score to those individuals who used more total information and practice items and considered more of these as new rather than old items. The extent of adoption score (EAS) for each respondent was calculated in the following manner:

1. The respective totals of new information items, old information items, new practice items and old practice items were added together.
2. A second value was created by adding one to the value obtained in number 1.
3. The value obtained in number 1 was multiplied by the value obtained in number 2.
4. The respective totals of new information items and new practice items were added together and added to the value obtained in number 3.
5. The respective totals of old information items and old practice items were added together and subtracted from the value obtained in number 4.

Expressed as a formula, the extent of adoption score is:

$$EAS_i = \frac{[(NI + OI + NP + OP) \times (NI + OI + NP + OP + 1)]}{+ (NI + NP) - (OI + OP)}$$

where NI = total number of new information items
 NP = total number of new practice items
 OI = total number of old information items
 OP = total number of old practice items

By using a constant that increases by a factor of one and weighting both new and old items equally (+1 for new, -1 for old), the formula represents a linear transformation with ratio characteristics (equal intervals with an absolute zero). In all cases, the score satisfies the needs expressed for measuring the extent of adoption. In other words, individuals who had used more total items

from the manual (regardless of the mix of new and old information and practice items) would always receive a higher score -- because of the increasing constant multiplier -- than those who had used a smaller number of total items. In addition, by weighting the new and old items, individuals who had used more new items for any given number of total items, would always receive a higher score than those who had used a smaller number of new items (or a larger number of old items). For example, an individual who had used 10 total items would always receive a higher score (by at least one unit) than one who had used only nine, even if all nine items were considered new. On the other hand, if two individuals had both used 10 total items, the one who had used seven new and three old items would receive a higher score (again in this case by one unit) than the one who had used six new and four old items. Using this approach, extent of adoption scores could range from 1 (one old item used) to 440 (20 new items used). Consequently, individuals receiving higher scores would be described as practicing IPM and adopting and implementing items from the manual to a greater extent than those receiving lower scores.

Individual Characteristics

Socioeconomic Variables. Socioeconomic variables included age, education, socioeconomic status, income and employment status. These variables were measured in the following manner:

Age was measured directly in years.

Education was measured by asking individuals to indicate their highest level of formal educational attainment from among the following categories:

1. Some grade school (grades 1 to 8)
2. Completed grade school
3. Some high school (grades 9 to 12)
4. Completed high school
5. Some college
6. Completed college
7. Technical/trade school
8. Some graduate work
9. Completed a graduate degree

Consequently, education scores ranged from 1 to 9.

Socioeconomic status was measured using Hollingshead's two factor index of social position (from Miller 1977). This index combines a weighted occupation and education score for a measure of socioeconomic status. Initial occupation and education scores are taken from pre-determined listings (see Miller 1977). The occupation score is multiplied by a factor weight of seven; the education score is multiplied by a factor weight of four. These two partial scores are then summed to yield the socioeconomic status score. Scores range from 11 to 77 (the lower the score the higher the socioeconomic status) and can be expressed in the following five social classes (Miller 1977:230):

<u>Class</u>	<u>Range of Scores</u>
I	11 - 17
II	18 - 31
III	32 - 47
IV	48 - 63
V	64 - 77

While the procedure for measuring education was described above, occupation was measured by asking individuals to describe their usual occupation by indicating their job title and the kind of work they performed. (If they were retired, they were asked to describe their usual occupation before retirement.)

Income was measured by asking individuals to indicate their gross family income from among the following income brackets:

- | | |
|-----------------------|---------------------|
| 1. Less than \$10,000 | 7. 35,000 - 39,999 |
| 2. 10,000 - 14,999 | 8. 40,000 - 44,999 |
| 3. 15,000 - 19,999 | 9. 45,000 - 49,999 |
| 4. 20,000 - 24,999 | 10. 50,000 - 54,999 |
| 5. 25,000 - 29,999 | 11. 55,000 - 60,000 |
| 6. 30,000 - 34,999 | 12. Over \$60,000 |

Employment status was measured by asking individuals to indicate if they were currently employed, unemployed, retired or a full-time homemaker. In addition to its use as a descriptive variable, this indicator was used as a cross-check when occupation was left blank (especially if individuals indicated they were full-time homemakers).

Personality Variables. The three personality variables measured included individuals' attitudes toward: (1) handling pest problems on the plants in their yard; (2) using pesticides as a way to handle pest problems in their yard; and (3) using alternatives to pesticides as a way to handle pest problems in their yard. The method selected to measure these attitudes was the semantic differential developed by Osgood et al. (1957). While this technique is now widely used for attitude measurement (Lemon 1973; Fishbein and Ajzen 1975), it was originally developed as an instrument for the measurement of meaning. A brief overview of this technique will provide a better understanding of how it was used to measure attitudes in this study.

In their efforts to develop a measure of meaning, Osgood et al. (1957) settled on verbal responses to an object or concept. They concluded that since the basic function of language was to communicate meaning, ordinary language could be used to measure meaning. The resulting technique that was developed utilizes a series of adjective pairs of opposite meaning, each separated by a seven-step scale. The individual is asked to consider the object or concept in terms of each of the adjective pairs in the series and to indicate

the direction of his association and its intensity on the seven-step scale.

Based on analysis of data from a large number of studies involving different sets of adjective pairs and different concepts, Osgood and his associates identified three basic dimensions or components of meaning: evaluative, potency and activity. The evaluative dimension, characterized by adjective pairs such as good-bad, clean-dirty and beautiful-ugly, was the most significant factor. The second dimension that appeared in analysis, labelled potency, was concerned with power and the things associated with it such as size, weight, toughness, and the like. Adjective pairs characterizing this component were large-small, strong-weak and thick-thin. The third dimension was called activity -- concerned with quickness, excitement, warmth, agitation and so forth. Adjective pairs associated with this component included fast-slow, active-passive and hot-cold.

Because the evaluative or attitudinal dimension was identified as a primary component of meaning, Osgood and his associates recognized that the semantic differential technique could be used as a method for measuring attitudes. They concluded that attitudes could be measured by asking the individual to rate a particular object on a set of scale items (adjective pairs) known to be highly associated with the evaluative dimension.

Selection of the semantic differential technique to measure attitudes in this study was based on the following rationale. First, it represented a method that appropriately measured attitude; that is, the direction and intensity of a person's evaluative reaction

(based on beliefs) toward some attitude object. Second, its level of measurement is characterized as interval (Osgood et al. 1957), thereby allowing the use of more powerful statistical procedures in analysis. Third, it constituted a format that could be used to measure attributes of the innovation separately and collectively as an attitude toward its hardware and software components.

The format of the semantic differential as it is presented to the individual consists of the attitude object to be evaluated written at the top of the page. The series of adjective pairs, each separated by a seven-step scale, are listed down the page in the following manner:

Concept/Attitude Object

(1) (2) (3) (4) (5) (6) (7)
polar adjective A ___ : ___ : ___ : ___ : ___ : ___ : ___ polar adjective B

For each adjective pair, individuals are instructed to place an "X" on the line that best represents their reaction to the attitude object according to the following guidelines:

- | | |
|---|--------------------|
| (1) is extremely A | (7) is extremely B |
| (2) is quite A | (6) is quite B |
| (3) is slightly A | (5) is slightly B |
| (4) is neither A nor B, or equally A and B. | |

When using the same set of adjective pairs to measure attitudes toward different objects, the order and the positive and negative poles of the evaluative adjectives are altered randomly to prevent the formation of position preferences. The number of adjective pairs used is variable, but "typical" semantic differentials employ anywhere from 5 to 20 pairs depending on the types of adjectives being used and the attitude being measured. In addition to using evaluative adjective pairs investigated by Osgood et al. (1957),

others can be used as long as they represent dimensions of the attitude being measured. For example, Osgood's potency or activity pairs have been used, as well as situation specific adjectives developed by other researchers. And finally, the semantic differential has been modified with success when applied in other fields such as advertising and marketing. In addition to simple one-word adjectives, descriptive nouns and phrases have also been used as scale items (Mindak 1969). Consequently, the differential offers the investigator the choice of using only "tested" adjective pairs from Osgood et al. (1957) or of constructing a tailor-made instrument to suit his particular needs.

Once the scale items are selected and the differential is administered, a measure of attitude toward the object is obtained in the following manner: responses for each scale item are scored from 1 to 7, with 7 assigned to the positive (favorable) side of the scale. The scores are then summed for all scale items and this value is taken as an index of attitude. The attitude score can range from 1 x the number of scale items (an extremely unfavorable attitude) to 7 x the number of scale items (an extremely favorable attitude).

The single adjective and short descriptive phrase pairs used in the semantic differentials to measure attitudes in this study were selected primarily from those investigated by Osgood et al. (1957). Additional scale items were devised based on this researcher's familiarity and experience in the field of urban pest management. Regardless of the source, the primary criterion for including any adjective or phrase pair was the perceived extent to which it represented an evaluative dimension (based on a belief) of the

particular attitude being measured. One semantic differential was constructed and used to measure the attitude toward handling pest problems in the yard; a second differential was constructed and used to measure both attitudes toward using pesticides and using alternatives to pesticides in the yard. The two original sets of 25 adjective and phrase pairs are presented in Tables 4.1 and 4.2. Since a pre-test was conducted to provide, among other things, a means for eliminating items in each of the differentials, their final forms will be presented later in this chapter.

Communication Behavior Variables. Two measures of communication behavior were included in this study: the index of communication behavior and familiarity with IPM. These variables were measured in the following manner.

An index of communication behavior was constructed by asking individuals to select from a list, the activities or sources that they used to obtain information on handling pest problems and to indicate how frequently they had used them. The activities and sources listed were:

Printed material from:

Books
Magazines
Newspapers
Pamphlets/manuals
Package/container labels

Conversations with:

Cooperative Extension service
personnel
Garden store personnel
Tree/lawn/landscape service
personnel
Friends/neighbors

Watching or listening to:

Radio
Television

Printed material and watching or listening to the radio or television represented mass media communication channels; conversations represented interpersonal communication channels. Frequency of use

Table 4.1. Original semantic differential scale items used to measure the individual's attitude toward handling pest problems on the plants in his yard

Source	Scale items	
	Positive	Negative
Osgood et al. (1957)	Good	Bad
Evaluative dimension	Optimistic	Pessimistic
	Happy	Sad
	Willing	Unwilling
	Voluntary	Compulsory
	Skillful	Bungling
	Pleasurable	Painful
	Soothing	Aggravating
	Successful	Unsuccessful
	Meaningful	Meaningless
	Positive	Negative
	Important	Unimportant
	Useful	Useless
Activity dimension	Attractive	Repulsive
	Motivated	Aimless
	Easy	Difficult
Stability dimension	Leisurely	Hasty
Receptivity dimension	Interesting	Boring
	Curious	Indifferent
Author	Relaxing	Stressful
	Satisfying	Frustrating
	Varied	Monotonous
	Pleasant	Unpleasant
	Like	Dislike
	Rewarding	Unrewarding

Table 4.2. Original semantic differential scale items used to measure the individual's attitudes toward using pesticides and using alternatives to pesticides as a way to handle pest problems in his yard

Source	Scale items	
	Positive	Negative
Osgood et al. (1957)	Safe	Dangerous
Evaluative dimension	Beneficial	Harmful
	Meaningful	Meaningless
	Successful	Unsuccessful
	Important	Unimportant
	Useful	Useless
	Attractive	Repulsive
	Warranted	Unwarranted
	Positive	Negative
	Believable	Skeptical
	Wise	Foolish
	Sufficient	Insufficient
	Valuable	Worthless
	Superior	Inferior
Activity dimension	Skillful	Bungling
	Simple	Complex
	Easy	Difficult
Unassigned dimension	Inexpensive	Expensive
Author	Dangers overplayed	Dangers underplayed
	Necessary	Unnecessary
	Convenient	Inconvenient
	Good results	Bad results
	Certain results	Uncertain results
	Under recommended	Over recommended
	Like	Dislike

ratings were: frequently, sometimes, and seldom. The index of communication behavior was determined by summing the weighted frequency of use ratings (frequently = 3, sometimes = 2, seldom = 1) for all items selected. This yielded an index with scores ranging from 1 to 33; the higher the score the greater the diversity and frequency of communication activities and sources used.

Familiarity with IPM was measured by asking individuals to indicate if they had been familiar in any way with IPM before purchasing the manual (yes/no response format). If they responded "Yes", their extent of familiarity was determined by asking them to indicate if they were: (1) very familiar with IPM; (2) somewhat familiar with IPM; or (3) had heard about IPM but did not really know what it meant. Familiarity scores were interpreted as none, low (3), medium (2) and high (1).

Problems vs. Innovation Orientation. This variable was measured using the same method employed by Reynolds (1971). First, a number of statements were developed, indicative of either a problem (active) or innovation (un-active) oriented beginning. Individuals were then asked to select the one statement that most nearly described their reason for purchasing the manual. The statements used were:

1. I heard about the manual and thought it would be useful (innovation orientation).
2. I was interested in the information and how I could use it in my yard (problem orientation).
3. I am always on the look-out for pest control publications and decided it would be useful to have (problem orientation).

An additional unclassified statement, indicating that the manual was received as a gift, was included to handle cases where the manual was

purchased by a second individual but registered in the receiver's name.

Communication Channels

The communication channel variable focused specifically on how individuals first heard about the manual being available for sale. A list of the various mass media channels that were used to publicize the manual were provided for individuals to select from. An interpersonal channel source and an "other" category (to accommodate an unlisted source) were also provided. The complete list was:

1. Newspaper article/announcement
2. Radio announcement
3. Mail announcement
4. At a Project PEST "Walking Tour"
5. At the Meridian Municipal Building/area libraries
6. From a friend/neighbor
7. Other (specify) _____

Items 1-5 represented mass media channels; item 6 represented an interpersonal channel. Because only a portion of the mass media publicity campaign was conducted in the first year of the manual's availability (items 1-3), individuals were also asked to indicate in what year (1981 or 1982) they had purchased the manual.

Perceived Characteristics of the Innovation

Perceived characteristics of both the software component (information and practices) and the hardware component (the looseleaf binder) were measured using two semantic differentials. Rogers' (1983) five categories of attributes were used for the software component (relative advantage, compatibility, complexity, trial-ability and observability); two of his categories (relative advantage

and complexity) and two original attributes (appearance and durability) were used to assess the hardware component. Where more than one scale item was used to measure a particular characteristic, the score for that characteristic was calculated by adding the differential weights (1 through 7) over the scale items used. And, as discussed in Chapter 3, a total score would be calculated from all scale items in each differential to determine the individual's attitude toward each component of the manual. The two original sets of adjective and phrase pairs are presented in Tables 4.3 and 4.4. The final forms are presented later in this chapter.

Consequences

Changes occurring to individuals were measured in two ways. Individuals were asked to indicate the degree to which the manual had changed their way of thinking about and actually handling pest problems in their yard. Response categories provided for each question were: (1) very much so; (2) somewhat; (3) to a small degree; and (4) not at all. In addition, individuals were invited to comment on their response to each question. Responses were weighted (very much so = 3, somewhat = 2, to a small degree = 1, not at all = 0) and summed for the two items to yield a consequence score with values ranging from 0 to 6. A score of 0 was interpreted as no change taking place for the individual; a score of 6 indicated that the individual had changed a great deal as a result of the manual.

Table 4.3. Original semantic differential scale items used to measure perceived characteristics of and attitude toward the software component of the manual: the pest management ideas and practices contained in the manual

Characteristic	Scale items	
	Positive	Negative
Relative advantage	Small amount of risk involved Benefits apparent Gives good results Easy to apply in the yard Convenient way to handle pest problems Effortless way to handle pest problems Superior	Large amount of risk involved Benefits unapparent Gives bad results Difficult to apply in the yard Inconvenient way to handle pest problems Laborious way to handle pest problems Inferior
Compatibility	Compatible with my feelings about pest control Similar to what I have done in the past	Incompatible with my feelings about pest control Unlike what I have done in the past
Complexity	Easy to understand Easy to apply Simple Clear	Difficult to understand Difficult to apply Complex Confusing
Trialability	Possible to try on a small scale	Impossible to try on a small scale
Observability	Results easy to see	Results difficult to see
General evaluative	Believable Meaningful Approve Useful Positive Beneficial Valuable Complete Helpful	Skeptical Meaningless Disapprove Useless Negative Harmful Worthless Incomplete Hindering

Table 4.4. Original semantic differential scale items used to measure perceived characteristics of and attitude toward the hardware component of the manual: the manual as a means for presenting pest management information

Characteristic	Scale items	
	Positive	Negative
Relative advantage	Contains too much information*	Contains too little information
	Superior to other publications	Inferior to other publications
Complexity	Easy to locate information	Difficult to locate information
	Easy to understand	Difficult to understand
	Illustrations are meaningful	Illustrations are meaningless
	Language in simple	Language is complex
	Easy to use	Difficult to use
	Too much detail*	Too little detail
	Material is organized	Material is unorganized
Appearance	Too large*	Too small
	Too long*	Too short
	Too ornate*	Too plain
Durability	Rugged	Delicate
	Tough	Fragile
General evaluative	Sufficient	Insufficient
	Approve	Disapprove
	Useful	Useless
	Helpful	Hindering

*A positive response to these items was a 4 on the seven step scale. Therefore, coding for these scale items was modified to: 4 = 7, 3 or 5 = 5, 2 or 6 = 3, and 1 or 7 = 1.

Descriptive Variables

Pest Control on Plant Groups in the Yard. Individuals were first asked to indicate the plant groups in their yard that had pest problems and required management over the past two years. Six specific plant groups and an "other" category were listed. The plant groups were: ornamental/shade trees, fruit trees, shrubs, flowers, lawn, and vegetable garden. Secondly, for those plant groups on which pest management activities were performed, individuals were asked to indicate the percentage of time they had used either pesticides or alternatives to pesticides as a means to handle the pest problems. Responses were recorded as direct percentages.

Satisfaction with Results. Individuals who were currently using practices from the manual (both old and new) were asked to indicate, by plant group, how satisfied they were with the results of applying those practices. For each plant group, satisfaction responses were: very satisfied, satisfied, don't know, slightly satisfied and not satisfied at all.

Recommending the Manual to Others. Individuals were asked to indicate if they had recommended the manual to others (yes/no response) and, if they had, to whom (open response).

Addition of Information. Individuals were asked to indicate if they would like to see new information added to the manual (yes/no response) and, if so, what type of information they would like to see added (open response).

Best and Least Liked Aspects of the Manual. Individuals were asked to indicate what they liked best and least about the manual (two questions, both open response).

Participation in Project PEST Activities. Individuals were asked to indicate if and how they had participated in Project PEST.

Activities listed were:

1. Attended the project "kickoff" meeting (Meridian Municipal Building, November 1979)
2. Participated as a project committee member
3. Participated as a project volunteer (distributed and collected project survey questionnaire, March 1980)
4. Received a copy of the project questionnaire (Survey of pest problems in the yard, March 1980)
5. Attended the August 1980 "Walking Tour" (Michigan State University campus)
6. Attended the August 1981 "Walking Tour" (Michigan State University campus)
7. Not applicable

Constructing the Questionnaire

Having developed measures for each of the variables, a self-administered questionnaire was written following the format outlined by Dillman in his 1978 book, Mail and Telephone Surveys: The Total Design Method. This tested approach to survey design and procedures is based on the premise that:

to maximize both the quantity and quality of responses, attention must be given to every detail that might affect response behavior. The TDM [total design method] relies on a theoretically based view of why people do and do not respond to questionnaires and a well-confirmed belief that attention to administrative detail is essential to conducting successful surveys (Dillman 1978:viii).

Following Dillman's (1978) recommendations, the questionnaire was prepared in a booklet format (6-1/2" x 8-1/2"), 16 pages in length (excluding front and back cover). Each page was initially typed on 8-1/2" x 11" paper and then reduced to 75% of its original size. Included on the cover of the instrument, titled "Project PEST's Pest

Management Manual Owner's Survey", was a picture of the manual and a reference to Project PEST (co-sponsored by the Liaison for Inter-neighborhood Cooperation (LINC) and Michigan State University Departments of Resource Development, Entomology and Forestry). The entire questionnaire (in final form) is included in Appendix B.

The questionnaire was organized into four main sections: (1) Handling Pest Problems in the Yard; (2) Reactions to Handling Pest Problems in the Yard; (3) The Pest Management Manual; and (4) Background Information. The Pest Management Manual section was further divided into two sub-sections: Part 1 - Purchase and Use Information and Part 2 - Reactions to the Manual. A total of 29 questions were used to measure all the variables. An overview of the organization of the questionnaire is presented in Table 4.5.

Even though many of the questions in the questionnaire dealt with use of the manual, we could in no way be assured that every manual owner had actually used it. And, given the manner in which use was conceptualized and measured, this too could vary for different individuals. Therefore, organization of the questionnaire was critical. To accommodate these various situations, the questionnaire included specific questions and responses that directed respondents to complete only those items that they could appropriately answer. Consequently, not all respondents completed every item in the questionnaire. Figure 4.1 presents a flow diagram of how respondents were channeled through the questionnaire.

All respondents completed questions one through nine in the first three sections of the questionnaire -- Handling Pest Problems in the Yard, Reactions to Handling Pest Problems in the Yard and The

Table 4.5. Section and question numbers of variables in the Pest Management Manual Owner's Survey

Questionnaire section	Question number	Variable
A. Handling pest problems in the yard	Q-1, Q-2	Pest control on plant groups in the yard (descriptive)
	Q-3	Communication behavior (index)
B. Reactions to handling pest problems in the yard	Q-4	Attitude toward handling pest problems in the yard
	Q-5	Attitude toward using pesticides to handle pest problems in the yard
	Q-6	Attitude toward using alternatives to pesticides to handle pest problems in the yard
C. The pest management manual	Q-7, Q-8	Communication channels
Part 1 - Purchase and use information	Q-9	Problem vs. innovation orientation
	Q-10, Q-11, Q-12, Q-13	Extent of adoption and implementation of the manual
	Q-14	Satisfaction with results (descriptive)
Part 2 - Reactions to the manual	Q-15	Attributes/attitude toward hardware component
	Q-16	Attributes/attitude toward software component

Table 4.5. (Continued)

Questionnaire section	Question number	Variable
C. Part 2 - continued	Q-17	Familiarity with IPM (communication behavior)
	Q-18, Q-19	Consequences
	Q-20	Recommending the manual to others (descriptive)
	Q-21	Addition of information (descriptive)
	Q-22, Q-23	Best and least liked aspects of the manual (descriptive)
D. Background information	Q-24	Age
	Q-25	Employment status (descriptive)
	Q-26, Q-28	Socioeconomic status (occupation and education)
	Q-27	Income (descriptive)
	Q-29	Participation in Project PEST activities (descriptive)

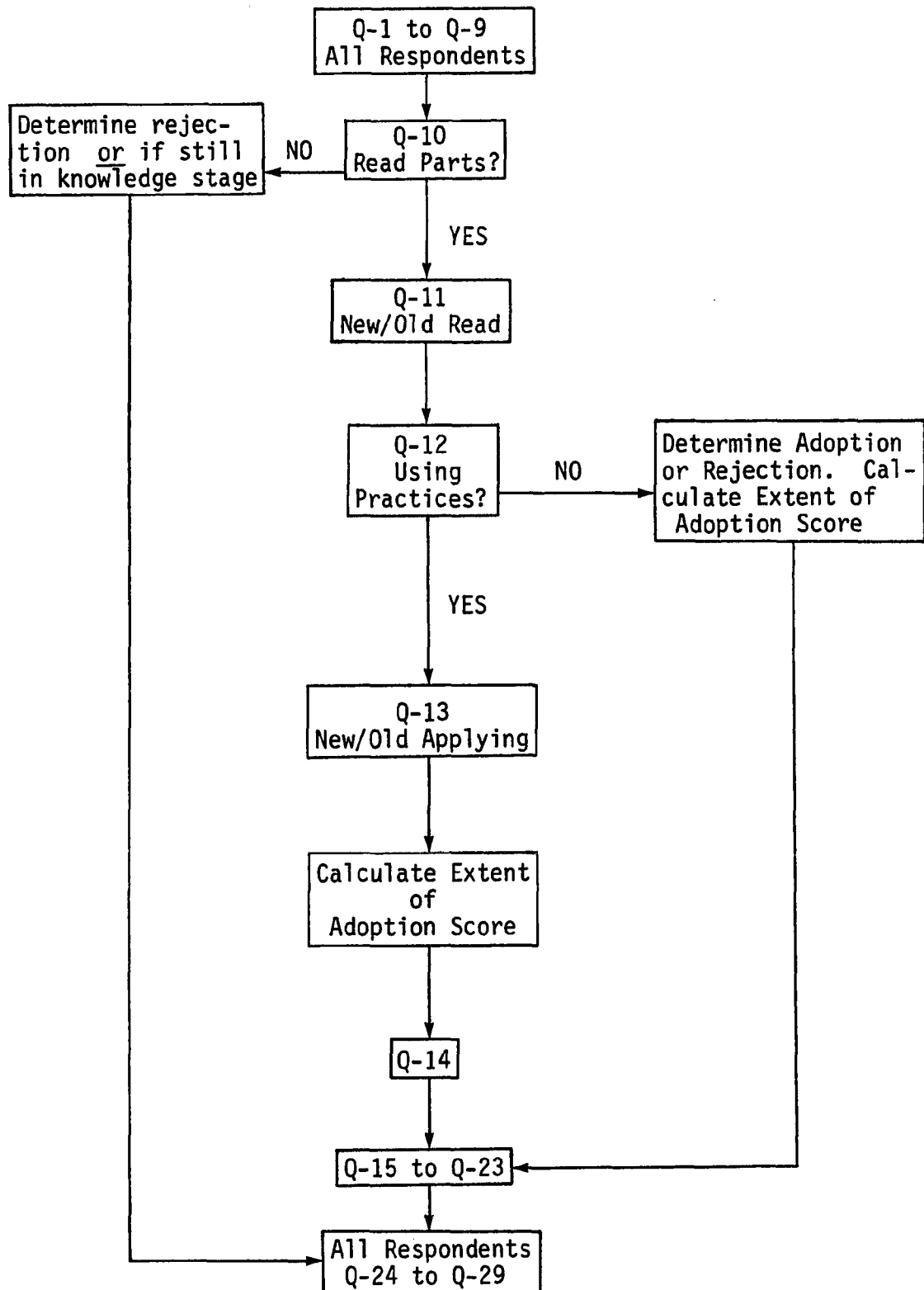


Figure 4.1. How respondents were channeled through the Pest Management Manual Owner's Survey

Pest Management Manual: Part 1 - Purchase and Use Information (see Table 4.5 for specific variables). Question 10 was the first questions that could redirect respondents to other sections of the questionnaire. If respondents had not read any parts of the manual, they were asked to indicate why not (open response) and directed to skip directly to the last section of the questionnaire (Background Information) and complete questions 24 to 29. As previously discussed, the response given in question 10 (if any) would provide evidence to determine if these respondents were still in the knowledge stage of the model or, if they had rejected the manual without attending to it.

Those respondents who indicated that they had read portions of the manual ("Yes" to question 10) then proceeded to question 11 and identified the new and old items they had read about in the manual (and potentially adopted). Moving to question 12, they were asked if they were currently applying any of the practices from the manual in their yard (yes/no response). If they responded "No", they were asked to indicate why not (open response) and then moved directly to Part 2 - Reactions to the Manual. They then completed this sub-section and all remaining questions in the questionnaire (questions 15 to 29). Unless their open response to question 12 (if any) clearly indicated that they had rejected the items they had read about in the manual, it was assumed that they had adopted all new and old information items. Consequently, the extent of adoption score for these respondents was based solely on information items.

Those respondents who indicated that they were currently applying practices from the manual ("Yes" to question 12) proceeded

to question 13 and identified the new and old practices. Their extent of adoption score was based on both information items accepted or adopted and practice items used or implemented. Because these respondents were the only ones to actually apply practices from the manual, only they completed question 14 (satisfaction with results).

Respondents received several additional items with their questionnaire. A cover letter was prepared that: (1) explained the purpose of the survey; (2) indicated who should complete the questionnaire (themselves, or a family member most familiar with the manual); (3) provided an assurance that even if they had not had a chance to read or use the manual, they could still answer a number of questions in the questionnaire; (4) assured them that their responses would be held in confidence and all results would be used collectively; (5) indicated the approximate time it would take to complete the questionnaire (determined in the pre-test); (6) indicated a return mailing date (no later than); and (7) provided a telephone number to call should the respondent have any questions. The final form of the cover letter is included in Appendix C.

In an effort to provide a more tangible reward or incentive for completing the questionnaire (beyond the intangible one of "being important to the study") two items were offered to respondents. One, which was included with the questionnaire itself, was a packet of publications that respondents were encouraged to add to their manuals. These publications were: "Home Vegetable Garden Disease and Insect Control" Michigan State University Extension bulletin E-760(b); "Home Vegetable Garden Variety Recommendations" Michigan State University Extension bulletin E-760(a); "Winter Injuries to

Trees and Shrubs in Michigan" Michigan State University Extension bulletin E-1343; "1982 Suppliers of Beneficial Organisms in North America" California Department of Food and Agriculture publication; and "Available Publications of the Cooperative Extension Service and Agricultural Experiment Station" Michigan State University Extension publication A.P.R. 23.

The second item was a promise to provide a copy of the results of the questionnaire if they were desired. Dillman (1978:171) provides a rationale for including this type of reward:

One reason is an explicit attempt to reward respondents in a manner consistent with something they found interesting to do. We are under no illusion that such an offer will have reward value for every respondent. However, the fact that requests are generally made by from one-half to two-thirds of the respondents suggests that many respondents value the opportunity to see the survey results. Additional evidence of the importance of results stems from the fact that in surveys we have conducted without offering copies of the results, many respondents have asked for them.

Respondents who wanted survey results were instructed to put their name and address on the back of the return envelope, rather than on the questionnaire itself. This was done to reinforce the promise of confidentiality.

Pre-Testing the Questionnaire

The questionnaire was pre-tested in September, 1982. While pre-testing is generally recommended among potential or actual survey respondents (Dillman 1978), due to time constraints and the relatively small number of potential respondents, the questionnaire was pre-tested among members of the original Project PEST Citizen

Steering Committee. Because these people were already aware of the project and the purpose of the manual, and they were homeowners in the township, it was felt that they would provide adequate feedback on the pre-test.

All former members of the Citizen Steering Committee (n = 9) agreed to participate in the pre-test. Pre-test packets were prepared that included all materials that would be used in the main survey (questionnaire, cover letter, publications). Rather than mail the packets, however, they were hand delivered and collected to facilitate rapid turn-around time. A set of pre-test instructions were enclosed in each packet. These instructions directed the individual to consider the following items when completing the questionnaire:

1. Are there any questions or items that are difficult to understand? If so, please indicate these on the questionnaire.
2. Are the directions clear? If not, please indicate difficulties on the questionnaire.
3. Does the cover letter provide:
 - a. A sufficient introduction to the survey?
 - b. Clear directions for who should complete the questionnaire?
 - c. Clear directions for how and when to return the questionnaire?
 - d. Sufficient explanation for the enclosed publications?
 If not, please indicate this on the cover letter.
4. Please indicate the length of time it took you to complete the questionnaire: _____ minutes.

Results of the pre-test indicated that on whole, the questionnaire and accompanying materials were understandable and clear. Minor word changes were made in several questions and on the cover letter. The average completion time was 30 minutes. In

addition, a number of alterations were made in the way that several variables were measured. These included:

1. Pest control on plant groups in the yard (question 2). In addition to asking respondents to indicate the percentage of time they used pesticides and alternatives to handle pest problems on specific plant groups, a "took no action" category was added. This was based on direct suggestions from two pre-test respondents.
2. Index of communication behavior (question 3). While the purpose of this question was to determine only those pest management information sources used on a more regular basis, five of the eight pre-test respondents provided a frequency of use rating for all 11 sources. Since many of these responses were the "seldom" rating, this category was dropped. Using only the "frequently" and "sometimes" ratings, and weighting them 2 and 1, respectively, the range of possible index scores became 1 to 22.

Deleting Scale Items from Semantic Differentials

As mentioned previously, an additional purpose of the pre-test was to obtain actual data to eliminate scale items from the semantic differentials. The intended outcome was a differential of shorter length for each attitude item that would still provide an adequate measure of attitude. The method used to "economize" the scales was a combination of the alpha coefficient of reliability and an examination of the correlations between items in the scale (the entire procedure is presented in Appendix D). The basic approach consisted of the following three steps.

1. Data from each of the five semantic differentials (all nine pre-test respondents were able to complete all differentials) was prepared for analysis on the CDC-6500 computer at Michigan State University. Using the prepared "Statistical Package for the Social Sciences Reliability Program" (Specht and Hohlen 1976), an alpha coefficient of reliability was calculated for each semantic

differential. This statistic provides a measure of the usefulness of the scale in terms of its ability to consistently produce the same scores from individuals. More specifically:

Reliability refers to the degree to which a measure is free of variable error. Thus, if we assume that the "true" score remains constant (e.g., that the person's "true" attitude has not changed), a perfectly reliable instrument will yield the same results on different occasions. Variable factors, such as a person's mood, the temperature or other weather factors, the testing situation, etc., may have different effects on responses, thereby reducing the instrument's reliability. Needless to say, the lower the reliability of some measuring instruments, the less useful it is (Fishbein and Ajzen 1975:107-108).

And, in addition:

The reliability of a test, on the other hand, increases as a function of its length. The basic idea is that random errors on particular items tend to cancel out so that the total score obtained on successive items tends increasingly to be determined by the common factor running through the items. Thus a set of items need not approach a perfect scale, in the Guttman sense, in order to provide reliable measurements along a single, interpretable dimension. Interpretability demands only that some degree of homogeneity or internal consistency be present in the item set. The alpha coefficient is an index of the internal consistency reliability that takes into account both homogeneity and test length (McKennell 1977:195).

Initial alpha coefficients for the original semantic differentials were:

1. Handling pest problems in the yard (25 scale items):
alpha = .90610
2. Using pesticides in the yard (25 scale items):
alpha = .77780
3. Using alternative to pesticides in the yard (25 scale items): alpha = .85892
4. The software component of the manual (24 scale items):
alpha = .90640
5. The hardware component of the manual (18 scale items):
alpha = .63651

2. The next step involved a procedure whereby items were deleted from the scales. Since reliability is dependent on the length of the scale, the intent was to delete a sufficient number of items to shorten the scales, yet still produce an "acceptable" degree of reliability. While "acceptable" is necessarily a tenuous term, McKennell (1970:237) indicates that, "we ought to be seriously concerned when the reliability of our measuring instruments sink below a level of, say, .6 to .7."

The procedure used to delete items consisted of examining the correlation coefficients produced between all items in the reliability program. This common practice posits that, "If respondents who agree with one statement also tend to agree with another statement, one concludes that the two statements are indicators of a common underlying attitude" (Piazza 1980:587). Therefore, where the correlation coefficient between two sets of scale items was positive and significantly high, they were examined to determine if they appeared to be measuring the same dimension of the particular attitude in question. If this was the case, then one of the scale items was deleted.

3. In the final step, selected scale items were deleted from each of the semantic differentials and they were then re-analyzed using the reliability computer program. The final form of each semantic differential and its coefficient of reliability are presented in Tables 4.6 - 4.9. Consistent with McKennell's (1970) guidelines for an acceptable degree of reliability, four of the scales well exceeded .7 reliability (handling pest problems in the yard, using pesticides and using alternatives in the yard, the

Table 4.6. Final semantic differential scale items used to measure the individual's attitude toward handling pest problems on the plants in his yard

Source	Scale items	
	Positive	Negative
Osgood et al. (1957)	Good	Bad
Evaluative dimension	Optimistic	Pessimistic
	Happy	Sad
	Willing	Unwilling
	Voluntary	Compulsory
	Skillful	Bungling
	Pleasurable	Painful
	Soothing*	Aggravating
	Successful	Unsuccessful
	Meaningful	Meaningless
	Positive	Negative
	Important	Unimportant
	Useful*	Useless
Activity dimension	Attractive	Repulsive
	Motivated	Aimless
	Easy	Difficult
Stability dimension	Leisurely	Hasty
Receptivity dimension	Interesting	Boring
	Curious*	Indifferent
Author	Relaxing*	Stressful
	Satisfying	Frustrating
	Varied	Monotonous
	Pleasant*	Unpleasant
	Like	Dislike
	Rewarding	Unrewarding
Final number of items = 20		
Reliability (alpha) = .87108		

*Deleted for the final scale.

Table 4.7. Final semantic differential scale items used to measure the individual's attitudes toward using pesticides and using alternatives to pesticides as a way to handle pest problems in his yard

Source	Scale items	
	Positive	Negative
Osgood et al. (1957)	Safe	Dangerous
Evaluative dimension	Beneficial	Harmful
	Meaningful*	Meaningless
	Successful	Unsuccessful
	Important	Unimportant
	Useful	Useless
	Attractive	Repulsive
	Warranted	Unwarranted
	Positive	Negative
	Believable	Skeptical
	Wise	Foolish
	Sufficient	Insufficient
	Valuable	Worthless
	Superior	Inferior
Activity dimension	Skillful	Bungling
	Simple	Complex
	Easy*	Difficult
Unassigned dimension	Inexpensive*	Expensive
Author	Dangers overplayed	Dangers underplayed
	Necessary*	Unnecessary
	Convenient	Inconvenient
	Good results*	Bad results
	Certain results	Uncertain results
	Under recommended	Over recommended
	Like	Dislike
Final number of items = 20 (each scale)		
Reliability (alpha) = .82531 (pesticides)		
.78443 (alternatives)		

*Deleted for the final scale.

Table 4.8. Final semantic differential scale items used to measure perceived characteristics of and attitude toward the software component of the manual: the pest management ideas and practices contained in the manual

Characteristic	Scale items	
	Positive	Negative
Relative advantage	Small amount of risk involved Benefits apparent Gives good results Easy to apply in the yard Convenient way to handle pest problems* Effortless way to handle pest problems Superior*	Large amount of risk involved Benefits unapparent Gives bad results Difficult to apply in the yard Inconvenient way to handle pest problems Laborious way to handle pest problems Inferior
Compatibility	Compatible with my feelings about pest control Similar to what I've done in the past	Incompatible with my feelings about pest control Unlike what I've done in the past
Complexity	Easy to understand	Difficult to understand
Trialability	Easy to apply* Clear*	Difficult to apply Confusing
Observability	Possible to try on a small scale Results easy to see	Impossible to try on a small scale Results difficult to see
General evaluative	Believable Meaningful Approve Useful Positive Beneficial* Valuable* Complete Helpful	Skeptical Meaningless Disapprove Useless Negative Harmful Worthless Incomplete Hindering

Final number of items = 18
Reliability (alpha) = .87819

*Deleted for the final scale.

Table 4.9. Final semantic differential scale items used to measure perceived characteristics of and attitude toward the hardware component of the manual: the manual as a means for presenting pest management information

Characteristic	Scale items	
	Positive	Negative
Relative advantage	Contains too much information	Contains too little information
	Superior to other publications	Inferior to other publications
Complexity	Easy to locate information	Difficult to locate information
	Easy to understand	Difficult to understand
	Illustrations are meaningful	Illustrations are meaningless
	Language is simple	Language is complex
	Easy to use	Difficult to use
	Too much detail	Too little detail
	Material is organized	Material is unorganized
Appearance	Too large	Too small
	Too long*	Too short
	Too ornate	Too plain
Durability	Rugged	Delicate
	Tough*	Fragile
General evaluative	Sufficient	Insufficient
	Approve	Disapprove
	Useful	Useless
	Helpful	Hindering

Final number of items = 16

Reliability (alpha) = .63402

*Deleted for the final scale.

software component of the manual), and one exceeded .6 reliability (the hardware component of the manual). Based on these final forms of the semantic differentials, the range and interpretation of scores for each attitude scale and the perceived characteristics of the manual are presented in Table 4.10.

Conducting the Main Survey

Names and addresses of all potential respondents ($n = 75$) were obtained from sales receipts. Consistent with Dillman's (1978) recommendations, the individual's complete name and address was typed on each cover letter to personalize the survey. In addition, an identification number was recorded on each questionnaire to monitor returns (this was also noted in the cover letter). To avoid any advance preparation on the part of respondents who had not attended to the manual at all, a pre-survey letter was not used; initial contact was made with the packet of survey materials (cover letter, questionnaire, publications, stamped return envelope). All mailings (to and from) were done by first-class mail.

Survey packets were initially mailed out on October 5, 1982. From this first mailing, three packets were returned undeliverable and were discarded, and 20 questionnaires were returned. A first reminder mailing, which consisted of a letter to all respondents (included in Appendix C), was conducted on October 18, 1982. This procedure yielded an additional return of nine questionnaires. A second reminder mailing, which included an additional copy of the questionnaire only, was carried out on November 1, 1982. (A copy of

Table 4.10. Range and interpretation of scores for the five semantic differentials

Semantic differential	Number of items	Range and interpretation of scores:		
		Extremely negative	Neutral	Extremely positive
Attitudes toward handling pest problems in the yard, using pesticides and using alternatives to pesticides in the yard.	20/each	20	80	140
Attitude toward the software component of the manual.	18	18	72	126
Perceived characteristics of the software component of the manual:				
Relative advantage	5	5	20	35
Compatibility	2	2	8	14
Complexity	2	2	8	14
Trialability	1	1	4	7
Observability	1	1	4	7
Attitude toward the hardware component of the manual.	16	16	68*	112
Perceived characteristics of the hardware component of the manual:				
Relative advantage	2	2	9*	14
Complexity	7	7	29*	49
Appearance	2	2	10*	14
Durability	1	1	4	7

*Because a number of scale items in the hardware semantic differential were coded differently (see Table 4.4) these scores are based on 5 being neutral and are therefore approximate.

this letter is also included in Appendix C.) This reminder was sent only to those individuals who had not yet returned the questionnaire. Fifteen questionnaires were returned as a result of this mailing. No additional mailings were done after the second reminder; no respondent called seeking further information.

A total of 45 questionnaires were returned resulting in a return rate of 62.5% (based on 72 deliverable questionnaires). Of these returned questionnaires, four contained insufficient data to code. Thus, a useable return rate of 57% (41 of 72) was achieved. In addition, four respondents requested a copy of survey results when they were available.

Data Analysis

Data from the 41 questionnaires was prepared for analysis on the CDC-6500 computer at Michigan State University using the SPSS: Statistical Package for the Social Sciences program (Nie et al. 1975). The analysis was organized into three parts: (1) general description; (2) tests of hypotheses; and (3) multivariate relationships.

General Description

The first part of analysis consisted of determining the basic distributional characteristics of the data. Response frequencies and measures of central tendency (mean, median, mode) and dispersion (variance, standard deviation) were generated for each of the variables in the study. In addition to providing a straightforward

description of the data, these results were used to answer several of the evaluative questions posed in Part I of Chapter 3: "Was the manual used?", "To what extent was it used?" and "What are the characteristics of manual owners?"

Tests of Hypotheses

The second part of analysis focused on examining and testing the relationships proposed in the 15 hypotheses stated in Chapter 3. Because each of the hypotheses expressed a relationship between only two variables, correlation analysis was selected for use because it allows "the researcher to assess the extent to which two variables are associated by a single summarizing measure (Nachmias and Nachmias 1976). The hypotheses, expressed in alternative empirical and statistical form, are presented in Table 4.11.

More specifically, zero-order Pearson correlations were used for all hypotheses. This procedure yields a single summary statistic -- the Pearson product-moment correlation coefficient (r) -- that indicates both the strength and direction of the linear relationship between two variables. The interpretation of r is quite straightforward:

If the value of r is close to zero, we can assume there is little or no linear relationship between the two variables. If the value of r approaches +1.0 or -1.0, we can assume there is a strong linear relationship [positive or negative, respectively] (Nie et al. 1975:279).

The Pearson coefficient can also be squared (r^2) to provide a more easily interpreted measure of the strength of the relationship. With values ranging from 0 to +1.0, r^2 (called the coefficient of determination) is a measure of the proportion of variance in one

Table 4.11. Alternative empirical and statistical hypotheses addressed in the study

Alternative empirical hypothesis	Alternative statistical hypothesis
1. Age will not be related to extent of adoption scores.	$r = 0^*$
2. Education scores will be positively related to extent of adoption scores.	$r > 0$
3. Socioeconomic status scores will be negatively related to extent of adoption scores.	$r < 0^+$
4. Attitude scores for handling pest problems on plants in the yard will be positively related to extent of adoption scores.	$r > 0$
5. Attitude scores for using pesticides in the yard will be negatively related to extent of adoption scores.	$r < 0$
6. Attitude scores for using alternatives to pesticides in the yard will be positively related to extent of adoption scores.	$r > 0$
7. Index of communication behavior scores will be positively related to extent of adoption scores.	$r > 0$
8. Familiarity with IPM before purchasing the manual scores will be negatively related to extent of adoption scores.	$r < 0^+$
9. Problem oriented purchase decision scores will be positively related to extent of adoption scores.	$r > 0$
10. Mass media channel scores will be positively related to the first year that the manual was made available for sale (1981).	$r > 0$
11. For software attributes:	
a. Relative advantage scores will be positively related to extent of adoption scores.	$r > 0$
b. Compatibility scores will be positively related to extent of adoption scores.	$r > 0$
c. Trialability scores will be positively related to extent of adoption scores.	$r > 0$
d. Observability scores will be positively related to extent of adoption scores.	$r > 0$

Table 4.11. Continued

Alternative empirical hypothesis	Alternative statistical hypothesis
11. (continued)	
d. Complexity scores will be positively related to extent of adoption scores	$r > 0^{++}$
12. Attitude scores for the software component of the manual will be positively related to extent of adoption scores.	$r > 0$
13. For hardware attributes:	
a. Relative advantage scores will be positively related to extent of adoption scores.	$r > 0$
b. Appearance scores will be positively related to extent of adoption scores.	$r > 0$
c. Durability scores will be positively related to extent of adoption scores.	$r > 0$
d. Complexity scores will be positively related to extent of adoption scores.	$r > 0^{++}$
14. Attitude scores for the hardware component of the manual will be positively related to extent of adoption scores.	$r > 0$
15. Extent of adoption scores will be positively related to consequence scores.	$r > 0$

*Acceptance of the null hypothesis was desired in this instance.

[†]Because of reverse coding, a negative relationship was expected in these hypotheses.

^{††}A high complexity score indicated that the manual was perceived as being easy to understand and use.

variable "explained" by the other. In addition, the level of significance for testing the hypotheses is reported and derived from the use of Student's *t* with $n - 2$ degrees of freedom (Nie et al. 1975).

It should also be noted at this point that, while the use of Pearson correlation is based on the assumption that data are measured on an interval level, where the distance between categories is fixed and in equal units, a number of authors have indicated that this technique may be used if the data satisfy only the assumptions of ordinal level measurement (Labovitz 1970, 1972; Acock and Martin 1974; O'Brien 1981). However, even though *r* is robust with respect to violating this assumption, distortion resulting in smaller correlation coefficients may nevertheless occur (Acock and Martin 1974; Warren et al. 1977; O'Brien 1981). If ordinally measured variables are to be treated as interval, researchers are advised to: (1) use as many order preserving categories as possible (Acock and Martin 1974; O'Brien 1981); and (2) utilize linear transformations or at least additive indexes where possible (Labovitz 1972; O'Brien 1981).

In this study, all variables were treated and analyzed as if they were measured at the interval level. With respect to the suggested criteria for improving ordinal measures for this purpose, both were met as much as possible. It should be noted, however, that the most serious measurement violations -- and potential distortion -- most likely occurred with the familiarity with IPM (three categories), the problem vs. innovation orientation (two categories), and the communication channels and year the manual was purchased (two

categories each) variables and hypotheses (numbers 8, 9 and 10, respectively).

One final issue regarding this second part of analysis deserves mention at this point. This issue concerns the problem of sampling and raises the question: Can significance tests be applied to nonprobability samples? As previously described, a nonprobability sample design was used in this study. The dissenting view holds that:

Only when probability samples are drawn from a specified population can a sample statistic be compared with a sampling distribution to assess its likelihood of occurrence under the conditions specified by the null hypothesis (Nachmias and Nachmias 1976:291).

Consequently, since the assumption of random sampling is often not met in social science research, proponents of this view argue that tests of significance are inappropriate.

The assenting view, which is adopted in this study, is presented by Nachmias and Nachmias (1976:291-292):

Advocates of statistical tests, on the other hand, argue that even when samples cannot be assumed to be random, the tests are a useful device given that any set of data is subject to measurement error and this error can be assumed to be random. Furthermore, it can be assumed that nonrandom samples have been drawn from a hypothetical population that includes all possible samples that could have been drawn under equivalent circumstances. Finally, even when tests of significance are not being used as a device enabling generalizations to a population, they are useful in providing a screen for results that are worth further exploration.

Multivariate Relationships

The third part of analysis consisted of exploring the relationship between the extent of adoption (the dependent variable) and the entire set of independent variables through the use of multiple regression analysis. Essentially, multiple regression "explains" the

variance of the dependent variable by estimating the contributions to this variance of two or more independent variables (Kerlinger and Pedhazur 1973). The specific method used to enter the independent variables into the regression equation was forward (stepwise) inclusion. In this method, "the order of inclusion is determined by the respective contribution of each variable to explained variance" (Nie et al. 1975:345). More specifically, the independent variable that explains the greatest amount of variance in the dependent variable with the influence of the other independent variables statistically controlled is entered first (that is, the variable with the largest coefficient of determination). The next variable that explains the greatest amount of variance in conjunction with the first (again controlling for all others) is entered second, and so forth. The cumulative amount of variance explained by the independent variables can be evaluated by examining the coefficient of determination (R^2). This figure, which ranges in value from 0 to +1.0, expresses the percentage of total variance accounted for by a linear combination of the independent variables entered into the equation (Kerlinger and Pedhazur 1973). In addition, the incremental variance accounted for by each variable added to the equation can be calculated by subtracting each new R^2 value from the previous one (Nie et al. 1975).

While the examination and testing of the relationships proposed in the 15 hypotheses provided a useful means for determining the general applicability of the model in this field, they nevertheless:

Somewhat oversimplify reality, of course, by treating each independent variable separately in its relationship to innovativeness [the extent of adoption in this case]. Many

of the independent variables are interrelated with each other, as well as with innovativeness" (Rogers 1983:265).

Thus, the decision to use multiple regression in the analysis was based on a desire to provide a more realistic interpretation of factors affecting the extent to which the manual was adopted.

CHAPTER 5

STUDY FINDINGS

Survey results are presented in this chapter and are organized according to the data analysis approach discussed in the preceding chapter. Basic distributional characteristics of the data for all variables are presented first. The second part of the chapter describes the results of testing the relationships proposed in the 15 study hypotheses. In the final section, results of exploring the relationship between the extent of adoption of the manual (the dependent variable) and the entire set of independent variables, using multiple regression, are presented.

General Description

Extent of Adoption and Implementation of the Manual

Of the 41 individuals who completed and returned the questionnaire, four indicated that they had not read or used any parts of the manual, 15 indicated reading parts of it only, and 22 reported both reading and regularly using practices from the manual to handle pest problems in their yard. Of the four who had not used the manual at all, two reported that they had simply put the manual away and had not looked at it since, one indicated no use because of a lack of time and serious pest problems, and the final respondent

stated that, while he had briefly skimmed parts of the manual, he found its size to be "inconveniently large and overpowering." For these non-users then, it was concluded that at least the first three were perhaps still in the knowledge stage of the model, while the fourth provided an explanation indicating a rejection decision at this time. Because only four respondents had not used the manual, further survey results for this group are not reported in this chapter. These results are, however, presented in Appendix E.

Before proceeding with analysis of the remaining 37 questionnaires, it was first necessary to determine whether any of the 15 respondents who read portions of the manual only, had adopted or rejected it. As described in Chapter 4, this was accomplished by asking these respondents to indicate why they were not currently using practices from the manual (open response format), after indicating the information items they had read about. Adoption or rejection status was then determined by evaluating these explanations. If no explanation was given, it was assumed that the respondent had adopted or accepted the new and old information items he had read about.

Twelve of the 15 respondents provided explanations for why they were not currently using practices from the manual; the remaining three provided no explanation. Of the 12 explanations given, none were judged sufficient to indicate a rejection decision. The explanations were (number of respondents in parentheses): lack of time (5); specific pest problems not covered in the manual (fruit trees and flowers) (2); already familiar with and use the practices (2); rely on a commercial service to handle pest problems (1);

renter, owner takes care of property (1); and, none appear necessary at this time (1). Consequently, it was assumed that these 15 respondents had adopted or accepted all the new and old information items they had read about in the manual. However, because one of these adopters did not actually indicate the information items he had read about, adoption data was available for only 14 of these respondents. Therefore, extent of adoption scores were calculated for a maximum of 36 cases -- 14 adopters and 22 adopters/implementers.

Information and Practices Items Used. As described in Chapter 4, the method used to measure the extent of adoption of the manual also provided a means to distinguish old from new items, and consequently, the boundaries of the technology cluster in use. While the presentation of manual use data on a respondent by respondent basis would have been ideal for delineating these items, it was considered prohibitive given the large number of respondents. Therefore, data on the extent to which new and old items were used from the manual and the boundaries of the manual as a technology cluster are presented for all respondents who used the manual.

Results for information items that respondents read about in the manual are presented in Table 5.1. Overall, the information items were read about by a large number of respondents; the total percentage of respondents reading about each of the 10 listed items exceeded 70%. The item read about by the largest number of respondents (33 or 91.7%) was "Identifying pests and pest problems." The two items read about by the least number of respondents (26 or 72.2% each) were "Preventing pest problems through proper plant

Table 5.1. Information items respondents read about in the manual

Information items	New information		Old information		Did not read		Total	
	n	%	n	%	n	%	n	%
The problems with pesticides	12	33.3	18	50.0	6	16.7	36	100.0
The principles and objectives of IPM	20	55.6	9	25.0	7	19.4	36	100.0
Preventing pest problems through proper plant selection and care	17	47.2	13	36.1	6	16.7	36	100.0
Monitoring activities	17	47.2	9	25.0	10	27.8	36	100.0
Identifying pests and pest problems	22	61.1	11	30.6	3	8.3	36	100.0
Beneficial organisms and their identification	18	50.0	9	25.0	9	25.0	36	100.0
Deciding if and when to use management techniques	25	69.4	3	8.3	8	22.2	36	100.0
The general categories of management techniques and guidelines for their selection	23	63.9	3	8.3	10	27.8	36	100.0
The different types of alternatives to pesticides and how to use them	24	66.7	8	22.2	4	11.1	36	100.0
The different types of pesticides and methods for their safe use	19	52.8	12	33.3	5	13.9	36	100.0

selection and care" and "The general categories of management techniques and guidelines for their selection."

In terms of the perceived newness of the information, in only one case -- "The problems with pesticides" -- did a greater number of respondents indicate that the item represented old rather than new information. For the remaining nine items, a greater number of respondents who read about each of them considered the information to be new. More specifically, "Deciding if and when to use management techniques" was considered to be new information by the largest number of respondents (25 or 69.4%). This was followed closely by: "The different types of alternatives to pesticides and how to use them" (24 or 66.7%); "The general categories of management techniques and guidelines for their selection" (23 or 63.9%); and "Identifying pests and pest problems" (22 or 61.1%). For the remaining five items, excluding "The problems with pesticides", in only two cases -- "Preventing pest problems through proper plant selection and care" and "Monitoring activities" -- did the number of respondents who considered them to represent new or innovative information fall slightly below 50%.

With respect to practice items respondents were regularly using from the manual (Table 5.2), a slightly different picture emerged. Whereas a consistently high percentage of respondents reported reading about any one of the information items, these totals for each of the practice items were more variable. For example, of the 10 practice items listed, a fair number of respondents reported that they were not regularly using the following practices: "Evaluating your pest management actions" (11 or 50%); "Monitoring plants in the

Table 5.2. Practice items respondents were regularly using from the manual

Practice items	<u>New practice</u>		<u>Old practice</u>		<u>Did not use</u>		<u>Total</u>	
	n	%	n	%	n	%	n	%
Preventing pest problems through proper plant selection and care	11	50.0	6	27.3	5	22.7	22	100.0
Monitoring plants in the yard	8	36.4	5	22.7	9	40.9	22	100.0
Identifying pests and pest problems	13	59.1	7	31.8	2	9.1	22	100.0
Identifying beneficial organisms	11	50.0	3	13.6	8	36.4	22	100.0
Deciding if and when to use management techniques	16	72.7	2	9.1	4	18.2	22	100.0
Using guidelines to select management techniques	11	50.0	2	9.1	9	40.9	22	100.0
Selecting and properly applying alternatives to pesticides	16	72.7	2	9.1	4	18.2	22	100.0
Selecting and properly applying "appropriate" pesticides	14	63.6	4	18.2	4	18.2	22	100.0
Handling pesticides safely	3	13.6	14	63.6	5	22.7	22	100.0
Evaluating your pest management actions	9	40.9	2	9.1	11	50.0	22	100.0

yard" (9 or 40.9%); "Using guidelines to select management techniques" (9 or 40.9%); and "Identifying beneficial organisms" (8 or 36.4%). Of the remaining six practice items, however, over 75% of the respondents indicated that they were regularly using any one of them. And, it is also interesting that the practice item used by the greatest number of respondents -- "Identifying pests and pest problems" (20 or 90.9%) -- was the same information item read about by the greatest number of respondents.

The perceived newness of applied practices exhibited a pattern quite similar to that for information items; in all cases but one -- "Handling pesticides safely" -- a greater number of respondents reported that the practice was a new rather than an old one. In fact, the two practice items considered as new by the largest number of respondents -- "Deciding if and when to use management techniques" and "Selecting and applying alternatives to pesticides" (16 or 72.7% each) -- were identical to the two "newest" information items.

Data characterizing the boundaries of the technology cluster, or more specifically, the extent to which the manual represented a technology cluster in use (and essentially its re-invention) are presented in Table 5.3. Of the 36 manual "users", only two indicated that the total number of items they had used from the manual (information items they had read about in this case) were not perceived as new. Thus, for these two respondents, the manual did not represent an innovation. For the remaining 34 respondents, the extent of the technology cluster ranged from two to 17 information and practice items. Within this range, frequencies were quite evenly

Table 5.3. The total number of new items respondents read about and were currently using from the manual

Total number of new items	Read only	Read and using	Total	
	n	n	n	%
0	2	--	2	5.6
1	--	--	--	--
2	2	--	2	5.6
3	2	--	2	5.6
4	1	1	2	5.6
5	3	2	5	13.9
6	1	--	1	2.8
7	--	1	1	2.8
8	--	2	2	5.6
9	2	2	4	11.1
10	1	2	3	8.3
11		1	1	2.8
12		--	--	--
13		3	3	8.3
14		4	4	11.1
15		--	--	--
16		2	2	5.6
17		2	2	5.6
18		--	--	--
19		--	--	--
20		--	--	--
Total	14	22	36	100.0

distributed, indicating that re-invention of the manual was quite variable.

With respect to the two categories of adoption behavior, the frequencies of new items adopted and implemented were also quite evenly distributed within their respective ranges. For respondents who read about and adopted information items only, the extent of the technology cluster varied from a minimum of two items for two respondents to a maximum of all 10 items for one respondent. The extent of the technology cluster for those who adopted information items and implemented practice items ranged from four to 17 items. Interestingly, 14 (63.6%) of the 22 adopters/implementers reported adopting and/or implementing 10 or more new information and practice items from the manual.

Overall then, data from these three tables indicates that:

1. A large number of the information and practice items from the manual were "used" by respondents.
2. For 18 of the 20 total information and practice items in the manual, considerably more respondents perceived them as new or innovative, rather than old.
3. The manual represented a technology cluster, ranging in size (extent) from two to 17 information and practice items, for 34 of the 36 manual "users."
4. The extent of re-invention ranged from two to 17 information and practice items.

Extent of Adoption Scores. Extent of adoption scores for the 36 respondents are presented in Table 5.4. As described in Chapter 4, the calculation of each respondent's score was based on the total number of information and practice items used from the manual, with adjustments made for new and old items. Scores ranged from a low of 13 (3 items used) to a high of 434 (20 items used), indicating that

Table 5.4. Extent of adoption scores

Number of items read/used	Range of scores	n	%
1	1 - 3	--	--
2	4 - 8	--	--
3	9 - 15	3	8.3
4	16 - 24	1	2.8
5	25 - 35	3	8.3
6	36 - 48	--	--
7	49 - 63	1	2.8
8	64 - 80	1	2.8
9	81 - 99	1	2.8
10	100 - 120	7	19.4
11	121 - 143	1	2.8
12	144 - 168	2	5.6
13	169 - 195	--	--
14	196 - 224	2	5.6
15	225 - 255	1	2.8
16	256 - 288	--	--
17	289 - 323	1	2.8
18	324 - 360	--	--
19	361 - 399	4	11.1
20	400 - 440	8	22.2
		Total 36	100.0
$\bar{x} = 211.0$ $s = 160.0$ range = 13-434			

the extent to which IPM was practiced from the manual varied considerably. Over one-third of the respondents (13) received scores greater than 288, corresponding to the use of 17 or more information and practice items. And, of these respondents, eight (the modal frequency) reported using all 20 items. Based on the rationale employed for measuring use of the manual then, the five respondents using 17 to 19 items would be described as practicing IPM to a great extent; the eight respondents using all 20 items would be described as fully practicing IPM as presented in the manual.

Furthermore, 17 respondents (47.2%) received scores of 120 or less, corresponding to the use of 10 or fewer items. Of these 17, 14 were necessarily respondents who had read about and adopted or accepted information items only. The remaining three -- and the 19 who received scores greater than 120 -- were those who had "used" both information and practice items from the manual.

Individual Characteristics

Socioeconomic Characteristics. Socioeconomic characteristics included the respondents' age, education, socioeconomic status, income and current employment status. Data on the age of respondents is presented in Table 5.5. Respondents who used the manual ranged in age from 27 to 79 years old; the average age was 47. Slightly more than 50% were younger than 46, and only three were older than 65.

Overall, education levels of respondents were quite high (Table 5.6). All respondents had completed high school; 35 (97.2%) reported pursuing and/or completing some type of college training. In addition, almost 60% indicated that they had completed a graduate degree.

Table 5.5. Respondents' age

Age	n	%
27 - 35	6	16.7
36 - 45	13	36.1
46 - 55	9	25.0
56 - 65	5	13.9
> 65	3	8.3
Total	36	100.0
$\bar{x} = 47.0$ $s = 13.0$ range = 27 - 79		

Table 5.6. Respondents' education level

Education level	n	%
Some grade school (grades 1 to 8)	--	--
Completed grade school	--	--
Some high school (grades 9 to 12)	--	--
Completed high school	1	2.8
Some college	6	16.7
Completed college	7	19.4
Technical/trade school	--	--
Some graduate work	1	2.8
Completed a graduate degree	21	58.3
Total	36	100.0

The respondents' socioeconomic status (SES) scores (Table 5.7) were strongly influenced by their high levels of educational attainment; 75% (27) were classified in the top two SES classes. The remaining 25% were divided among classes III and IV (6 and 3, respectively). No respondent received an SES score greater than 63 (Class V).

Family income data is presented in Table 5.8. For the 33 respondents who completed this question, family incomes ranged from a low in the "\$15,000-19,999" bracket to a high in the "over \$60,000" bracket. Within this range, frequencies were fairly evenly distributed among each of the income brackets. From a comparative perspective, respondent incomes were quite high. Based on 1980 U.S. census data, median gross family income was \$21,503 (U.S. Department of Commerce 1981). Equating the "\$20,000-24,999" bracket with this median income, 75.8% (25) of the respondents reported family incomes exceeding this value.

And finally, with regard to current employment status of the 36 respondents, a majority responded that they were currently employed (24 or 66.7%). Seven (19.4%) indicated that they were retired and three (8.3%) were full-time homemakers. Only two respondents (5.6%) reported that they were unemployed at the time the survey was conducted.

Personality Characteristics. Attitude scores for handling pest problems in the yard, using pesticides and using alternatives to pesticides as a way to handle pest problems in the yard are presented in Table 5.9. For each activity, attitude scores for the largest number of respondents occurred in the 81-110 range, corresponding to

Table 5.7. Respondents' socioeconomic status

Class	Range of scores	n	%
I (high)	11 - 17	14	38.9
II	18 - 31	13	36.1
III	32 - 47	6	16.7
IV	48 - 63	3	8.3
V (low)	64 - 77	--	--
		Total	36
			100.0
		$\bar{x}$ = 23.0	s = 14.0
		range = 11 - 61	

Table 5.8. Respondents' income

Income bracket	n	%
Less than \$10,000	--	--
10,000 - 14,999	--	--
15,000 - 19,999	4	12.1
20,000 - 24,999	4	12.1
25,000 - 29,999	4	12.1
30,000 - 34,999	3	9.1
35,000 - 39,999	2	6.1
40,000 - 44,999	4	12.1
45,000 - 49,999	4	12.1
50,000 - 54,999	4	12.1
55,000 - 60,000	1	3.0
over \$60,000	3	9.1
Total		33
		100.0

Table 5.9. Attitude scores for handling pest problems in the yard, using pesticides and using alternatives to pesticides as a way to handle pest problems in the yard

Attitude scores	Attitudes toward:					
	Handling pest problems		Using pesticides		Using alternatives	
	n	%	n	%	n	%
20 - 49 (negative)	2	5.6	--	--	1	2.8
50 - 79	13	36.1	10	27.8	7	19.4
80 (neutral)	--	--	2	5.6	1	2.8
81 - 110	18	50.0	22	61.1	24	66.7
111 - 140 (positive)	3	8.3	2	5.6	3	8.3
Total	36	100.0	36	100.0	36	100.0
	$\bar{x} = 85.0$ $s = 18.2$ range = 38 - 125		$\bar{x} = 90.0$ $s = 15.6$ range = 61 - 117		$\bar{x} = 92.0$ $s = 16.4$ range = 35 - 123	

a positive attitude of moderate intensity. Mean scores for each attitude also occurred in this range. Handling pest problems in the yard exhibited the lowest mean score (85) -- just slightly above neutral -- due to the large number of respondents (15 or 41.7%) indicating a moderate to extremely negative attitude toward this activity. Mean scores for using pesticides and using alternatives were quite similar (90 and 92, respectively) and slightly higher than for handling pest problems. Although more respondents indicated a negative attitude toward using pesticides than toward using alternatives, the intensity of the 10 respondents' negative attitudes toward using pesticides did not fall below the 50-79 or moderately negative range. In fact, the lowest attitude score recorded for using pesticides was 61, compared to a low of 35 for using alternatives. And finally, three respondents indicated a neutral attitude (80) toward these two activities.

Communication Behavior. The two measures of communication behavior included the index of communication behavior, constructed from the sources of information respondents used for handling pest problems, and the extent to which they had been familiar with IPM before purchasing the manual. Data indicating the sources of information used is presented in Table 5.10. Overall, each of the sources was used by no fewer than 12 respondents (35.3%). The three sources used by most respondents were: pamphlets/manuals (31 or 91.2%); package/container labels (29 or 85.3%); and friends/neighbors (25 or 73.5%). Sources used by the least number of respondents included: radio (12 or 35.3%); tree/lawn/landscape personnel (15 or 44.2%); and television (17 or 50%).

Table 5.10. Sources of information used for handling pest problems in the yard

Information source	Frequency of use							
	Frequently		Sometimes		Not used		Total	
	n	%	n	%	n	%	n	%
Books	10	29.4	13	38.2	11	32.4	34	100.0
Magazines	6	17.6	16	47.1	12	35.3	34	100.0
Newspapers	5	14.7	14	41.2	15	44.1	34	100.0
Pamphlets/manuals	17	50.0	14	41.2	3	8.8	34	100.0
Package/container labels	18	52.9	11	32.4	5	14.7	34	100.0
Radio	1	2.9	11	32.4	22	64.7	34	100.0
Television	5	14.7	12	35.3	17	50.0	34	100.0
Cooperative extension service personnel	4	11.8	16	47.1	14	41.2	34	100.0
Garden store personnel	3	8.8	17	50.0	14	41.2	34	100.0
Tree/lawn/landscape personnel	4	11.8	11	32.4	19	55.9	34	100.0
Friends/neighbors	5	14.7	20	58.8	9	26.5	34	100.0

With respect to frequency of use, the two sources used "frequently" by the largest number of respondents were the top two sources used by most respondents overall (in reverse order, however): package/container labels (18 or 52.9%) and pamphlets/manuals (17 or 50%). The third most used source in the frequently column was books (10 or 29.4%). Thus, the three communication channels used most frequently were printed mass media materials. A larger number of respondents indicated using more of the information sources "sometimes." However, of the four sources used with this frequency by the largest number of respondents, three represented interpersonal communication channels: friends/neighbors (20 or 58.8%); garden store personnel (17 or 50%); and cooperative extension service personnel (16 or 47.1%).

An index of communication behavior score was calculated for each respondent by summing the weighted frequency of use ratings (frequently = 2, sometimes = 1) for all items selected. Possible scores ranged from one to 22 and were divided into three categories: low (1-7); medium (8-15); and high (16-22). Respondents' scores (Table 5.11) ranged from three to 17, with a mean of 9.1. Only two respondents (5.8%) received index scores large enough to be classified in the "high" category. Of the remaining 32 respondents, 18 (53%) were categorized as exhibiting a "medium" and 14 (41.2%) a "low" index of communication behavior.

Extent of familiarity with IPM scores are presented in Table 5.12. Over 50% of the respondents who had used items from the manual indicated that they were not familiar with IPM before purchasing it. For the 16 remaining respondents, three (8.6%) were very familiar

Table 5.11. Index of communication behavior scores

Score	Rating	n	%
1 - 7	Low	14	41.2
8 - 15	Medium	18	53.0
16 - 22	High	2	5.8
	Total	34	100.0
$\bar{x} = 9.1$ $s = 4.0$ range = 3 - 17			

Table 5.12. Familiarity with IPM before purchasing the manual

Response	Rating	n	%
Not familiar	None	19	54.3
Very familiar	High	3	8.6
Somewhat familiar	Medium	9	25.7
Heard about IPM but did not really know what it meant	Low	4	11.4
	Total	35	100.0

with IPM, nine (25.7%) were somewhat familiar with IPM and four (11.4%) indicated that they had heard about IPM but did not really know what it meant.

Problem vs. Innovation Orientation. The last individual characteristic focused on determining whether respondents purchased the manual as a result of an "active" (a problem oriented) or an "un-active" (an innovation oriented) search. Response frequencies for each of the situational statements respondents selected from are shown in Table 5.13. Both the problem and innovation oriented statements were selected quite frequently by the 36 respondents. Fifteen respondents (40.5%) indicated a purchase decision that was considered to be innovation oriented. Of the remaining 21 respondents who selected either of the problem oriented statements, 16 (43.2%) selected the one most directly focusing on the manual.

Communication Channels

The communication channel variable focused specifically on how respondents first heard about the manual being available for sale and the year that it was purchased or received. As revealed in Table 5.14, all sources except one (radio announcement) were responsible for creating awareness of the manual's availability. Although only slightly higher than the rest, the greatest number of respondents first heard about the manual being available for sale through a newspaper announcement (10 or 27.8%). An equal number heard about the manual's availability through either a mail announcement or at a Project PEST "Walking Tour" (7 or 19.4% each); three (8.3%) were alerted to the manual via announcements at the Meridian Municipal

Table 5.13. Why respondents purchased the manual

Reason (orientation)	n	%
Heard about and thought it would be useful (innovation)	15	40.5
Interested in the information and how it could be used in the yard (problem)	16	43.2
Always on the look-out for pest control publications and decided it would be useful to have (problem)	5	13.5
Received as a gift (not applicable)	1	2.7
Total	37	100.0

Table 5.14. How respondents first heard about the manual being available for sale

Communication source	n	%
Newspaper announcement	10	27.8
Radio announcement	--	--
Mail announcement	7	19.4
Project PEST "Walking Tour"	7	19.4
Meridian Municipal Bldg./area libraries	3	8.3
Friend/neighbor	6	16.7
Other*	3	8.3
Total	36	100.0

*Project PEST survey participant (1), husband (1), professional meeting (1).

Building and area libraries. Thus, 27 (74.9%) of the manual users first heard of it through one of the above mentioned mass media communication channels.

Only six respondents (16.7%) indicated that they had become aware of the manual through an interpersonal source (friend/neighbor). Compared to the total for all mass media sources, the interpersonal source is quite small. However, if the interpersonal source is compared to each individual mass media source, it becomes much more significant.

And finally, with respect to the year the manual was purchased or received, 35 respondents (94.6%) indicated 1981 and two (5.4%) indicated 1982.

Perceived Characteristics of the Innovation

Two semantic differentials were used to measure the respondents' perceived characteristics or attributes of the software and hardware components of the manual. In addition, a total score for all items in each differential was calculated to determine the respondents' overall attitudes toward each component of the manual.

Attribute Scores for the Software Component. Attributes of the software component of the manual -- the information and practices -- that were measured included its: relative advantage (5 items); compatibility (2 items); complexity (2 items); trialability (1 item); and observability (1 item). Scores for all five attributes are presented in Table 5.15. An examination of mean scores for the five attributes showed that, overall, the perception of the information

Table 5.15. Attribute scores for the software component of the manual

Scores		Relative advantage	
		n	%
5 - 12	(negative)	--	--
13 - 19		9	24.3
20	(neutral)	5	13.5
21 - 28		22	59.5
29 - 35	(positive)	1	2.7
Total		37	100.0
$\bar{x} = 22.4$		$s = 3.8$	range = 16 - 33

Scores		Compatibility		Complexity*	
		n	%	n	%
2 - 4	(negative)	--	--	3	8.1
5 - 7		2	5.4	5	13.5
8	(neutral)	6	16.2	2	5.4
9 - 11		24	64.9	20	54.1
12 - 14	(positive)	5	13.5	7	18.9
Total		37	100.0	37	100.0
$\bar{x} = 9.8$		$s = 1.7$	range = 7 - 14	$\bar{x} = 9.4$	$s = 2.7$
					range = 3 - 14

Scores		Triability		Observability	
		n	%	n	%
1 - 3	(negative)	1	2.7	11	29.7
4	(neutral)	10	27.0	11	29.7
5 - 7	(positive)	26	70.3	15	40.5
Total		37	100.0	37	100.0
$\bar{x} = 5.4$		$s = 1.1$	range = 3 - 7	$\bar{x} = 4.2$	$s = 1.2$
					range = 1 - 6

*A higher (positive) score corresponds to less complexity.

and practices in the manual was moderately positive. Based on the total number of positive scores, the order of the attributes was: (1) compatibility (29 or 78.4%); (2) complexity (27 or 73%); (3) trialability (26 or 70.3%); (4) relative advantage (23 or 62.2%); and (5) observability (15 or 40.5%).

While the number of respondents perceiving each of the attributes negatively was far less, a trend was nevertheless apparent; observability, relative advantage and complexity were negatively perceived by considerably more respondents (11, 9 and 8, respectively) than compatibility and trialability (2 and 1, respectively). Finally, quite a few respondents indicated neutral reactions to each of the five attributes, especially observability (11 or 29.7%) and trialability (10 or 27%).

Attribute Scores for the Hardware Component. Attributes of the hardware component -- the manual as a means for presenting pest management information -- that were measured included its: relative advantage (2 items); complexity (7 items); appearance (2 items); and durability (1 item). Scores for these four attributes are shown in Table 5.16. Based on mean scores, the manual as a means for presenting pest management information was perceived as moderately to extremely positive. For all attributes except one -- durability -- the majority of the respondents' scores occurred in the positive ranges. In fact, the modal frequency for appearance (21 or 56.8%) and complexity (18 or 48.6%) occurred in the extremely positive range. Based on the total number of positive scores, the order of hardware attributes was: (1) complexity (32 or 86.4%); (2) appearance (27 or

Table 5.16. Attribute scores for the hardware component of the manual

Scores		Relative advantage		Scores		Complexity	
		n	%			n	%
2 - 5	(negative)	3	8.1	7 - 17	(negative)	--	--
6 - 8		5	13.5	18 - 28		5	13.5
9	(neutral)	6	16.2	29	(neutral)	--	--
10 - 12		12	32.4	30 - 39		14	37.8
13 - 14	(positive)	11	29.7	40 - 49	(positive)	18	48.6
Total		37	100.0	Total		37	100.0
		$\bar{x} = 10.4$ $s = 2.9$ range = 2 - 14				$\bar{x} = 37.8$ $s = 7.8$ range = 20 - 49	

Scores		Appearance		Scores		Durability	
		n	%			n	%
2 - 5	(negative)	1	2.7	1 - 3	(negative)	2	5.4
6 - 9		2	5.4	4	(neutral)	20	54.1
10	(neutral)	7	18.9	5 - 7	(positive)	15	40.5
11 - 12		6	16.2	Total		37	100.0
13 - 14	(positive)	21	56.8			$\bar{x} = 4.7$ $s = 1.1$ range = 3 - 7	
Total		37	100.0				
		$\bar{x} = 12.3$ $s = 2.6$ range = 2 - 14					

73%); (3) relative advantage (23 or 62.1%); and (4) durability (15 or 40.5%).

The number of respondents perceiving the hardware attributes negatively varied from a low of two (5.4%) for durability to a high of eight (21.6%) for relative advantage. Seven respondents (18.9%) indicated a neutral reaction for appearance and six (16.2%) indicated the same for relative advantage. Interestingly, the largest number of respondents (20 or 54.1%) indicated a neutral reaction for durability.

On whole then, it appears that from a comparative standpoint, while both components of the manual were perceived positively, the hardware component was perceived slightly more positively than the software component of the manual.

Attitudes Toward the Software and Hardware Components. Based on all items in each of the semantic differentials (18 for the software component and 16 for the hardware component), attitude scores were calculated for each of the components (Table 5.17). The distributional characteristics for each of the attitudes were very similar. Mean scores were both within the moderately positive range, although the mean score for the hardware component was greater than its neutral score by more total units than for the software component (19 vs. 16 units). In each case, the total number of positive scores equaled 34 (91.9%) and the total number of negative scores equaled three (8.1%) -- both in the same moderately negative range. However, the range and variability of scores was slightly greater for the hardware component.

Table 5.17. Attitude scores for the software and hardware components of the manual

Attitude scores	Software component		Attitude scores	Hardware component	
	n	%		n	%
18 - 44 (negative)	--	--	16 - 41 (negative)	--	--
45 - 71	3	8.1	42 - 67	3	8.1
72 (neutral)	--	--	68 (neutral)	--	--
73 - 99	28	75.7	69 - 90	19	51.4
100 - 126 (positive)	6	16.2	91 - 112 (positive)	15	40.5
Total	37	100.0	Total	37	100.0
	$\bar{x} = 88.0$ $s = 12.4$ range = 61 - 116			$\bar{x} = 87.0$ $s = 13.7$ range = 45 - 108	

Table 5.18. The degree to which respondents felt the manual had changed their way of thinking about and handling pest problems in their yard

	Degree of change								Total	
	Very much so		Somewhat		To a small degree		Not at all			
	n	%	n	%	n	%	n	%	n	%
Thinking about	5	14.7	23	67.6	3	8.8	3	8.8	34	100.0
Handling	7	20.0	22	62.9	3	8.6	3	8.6	35	100.0

Consequences

The changes occurring to manual users was the last of the measured variables directly associated with the model. A measure of direct consequences was sought by asking these respondents to indicate the degree to which they felt the manual had changed their way of thinking about and actually handling pest problems in the yard. By summing the weighted responses from these two questions, a consequence score was calculated for each respondent.

Responses for the two consequence questions are shown in Table 5.18 (see previous page). Frequencies for each question were almost identical and, overall, indicated some degree of perceived change for the majority of manual users. The lowest frequencies for each question occurred in the "not at all" and "to a small degree" change categories. By far, the largest number of respondents reported that the manual had changed their way of thinking about and handling pest problems "somewhat" (23 or 67.6% for thinking about and 22 or 62.9% for handling). Five respondents (14.7%) indicated a change of "very much so" for thinking about pest problems; seven (20%) indicated the same for handling pest problems.

The model frequency for consequence scores (Table 5.19) was four (20 or 58.8%), indicative of a moderate or medium degree of overall change. The large number of respondents receiving this score was no doubt a result of many reporting a change of "somewhat" (with a weight of 2) for each of the consequence questions. Three respondents (8.8%) received the maximum score of six, corresponding to a great deal of change; two (5.9%) indicated no change taking place at all (a score of 0). The remaining nine respondents (26.5%)

Table 5.19. Consequence scores

Score	n	%
0 (no change)	2	5.9
1 (low)	2	5.9
2	3	8.8
3	4	11.8
4	20	58.8
5	--	--
6 (high)	3	8.8
Total	34	100.0
	$\bar{x} = 3.5$	$s = 1.4$

Table 5.20. Plant groups on which pest problems occurred and required management

Plant group	Problems occurred		Problems did not occur		Total	
	n	%	n	%	n	%
Ornamental/shade trees	28	75.7	9	24.3	37	100.0
Fruit trees	15	40.5	22	59.5	37	100.0
Shrubs	20	54.1	17	45.9	37	100.0
Flowers	17	45.9	20	54.1	37	100.0
Lawn	21	56.8	16	43.2	37	100.0
Vegetable garden	21	56.8	16	43.2	37	100.0

received scores indicating a low (1) to slightly less than moderate (3) degree of change.

Descriptive Characteristics

Pest Control on Plant Groups in the Yard. Respondents were first asked to indicate the plant groups in their yard that had pest problems and required management over the past two years (1981-82) (Table 5.20, see previous page). Pest problems requiring management occurred most frequently on ornamental/shade trees. Based on an equal number of responses for each, two plant groups ranked second; the lawn and vegetable garden. The order of importance for the remaining three was shrubs, flowers and fruit trees.

Respondents were then asked to indicate the percentage of time they had used pesticides, alternatives to pesticides or took no action when managing pest problems on the plant groups indicated above. Results for those respondents who supplied this information are presented in Tables 5.21-5.23.

As shown in Table 5.21, a majority of respondents for each of the six plant groups indicated using pesticides some percentage of the time. While the use of pesticides 100% of the time was registered for each of the plant groups, most respondents using these compounds did so less than 50% of the time (except on fruit trees). In addition, a number of respondents also indicated no use of pesticides (0% usage) for each of the plant groups. Based on percentages, 0% usage of pesticides ranged from a high of 35.3% for vegetable gardens to a low of 12.5% for ornamental/shade trees.

Table 5.21. The percentage of time pesticides were used to manage pest problems

Usage (%)	Plant groups											
	Ornamental/ shade trees		Fruit trees		Shrubs		Flowers		Lawn		Vegetable garden	
	n	%	n	%	n	%	n	%	n	%	n	%
0	3	12.5	4	33.3	3	17.6	2	15.4	5	29.4	6	35.3
1 - 25	8	33.3	1	8.3	6	35.3	6	46.2	6	35.3	4	23.5
26 - 50	5	20.8	--	--	6	35.3	3	23.1	2	11.8	3	17.6
51 - 75	1	4.2	2	16.7	--	--	--	--	1	5.9	2	11.8
76 - 99	2	8.3	--	--	--	--	--	--	1	5.9	1	5.9
100	5	20.8	5	41.7	2	11.8	2	15.4	2	11.8	1	5.9
Total	24	100.0	12	100.0	17	100.0	13	100.0	17	100.0	17	100.0

Alternatives to pesticides (Table 5.22) were used far less. For all plant groups except vegetable gardens, well over 60% of the respondents indicated no use of alternatives (0% usage); this figure was 100% for fruit trees. When alternatives were used, they were typically used less than 50% of the time. The greatest total percentage of respondents using alternatives occurred for vegetable gardens (58.8%), although the most variability in usage occurred for ornamental/shade trees. One respondent each, reported using alternatives to pesticides 100% of the time on ornamental/shade trees and shrubs.

And finally, the percentage of time respondents indicated that they took no action in response to a pest problem varied considerably (Table 5.23). For all plant groups except ornamental/shade trees, over 40% of the respondents indicated that they had taken no action over 50% of the time when confronted with a pest problem (this figure was 33% for ornamental/shade trees). Except for two of the plant groups -- fruit trees and shrubs -- all percentage ranges were represented by at least one respondent. And, because total usage of the three management options needed to equal 100%, figures in the 0% usage category corresponded to those respondents whose use of pesticides and/or alternatives totaled 100%.

Satisfaction with Results. Respondents who indicated that they had used or implemented practices from the manual were asked to indicate, by plant group, how satisfied they were with the results of applying the practices. As shown in Table 5.24, the majority of respondents reporting satisfaction ratings for ornamental/shade trees, shrubs, flowers and vegetable gardens indicated that they were

Table 5.22. The percentage of time alternatives to pesticides were used to manage pest problems

Usage (%)	Plant groups											
	Ornamental/ shade trees		Fruit trees		Shrubs		Flowers		Lawn		Vegetable garden	
	n	%	n	%	n	%	n	%	n	%	n	%
0	18	75.0	12	100.0	12	70.6	9	69.2	15	88.2	7	41.2
1 - 25	1	4.2	--	--	3	17.6	4	30.8	2	11.8	7	41.2
26 - 50	2	8.3	--	--	1	5.9	--	--	--	--	3	17.6
51 - 75	1	4.2	--	--	--	--	--	--	--	--	--	--
76 - 99	1	4.2	--	--	--	--	--	--	--	--	--	--
100	1	4.2	--	--	1	5.9	--	--	--	--	--	--
Total	24	100.0	12	100.0	17	100.0	13	100.0	17	100.0	17	100.0

Table 5.23. The percentage of time no action was taken to manage pest problems

Usage (%)	Plant groups											
	Ornamental/ shade trees		Fruit trees		Shrubs		Flowers		Lawn		Vegetable garden	
	n	%	n	%	n	%	n	%	n	%	n	%
0	9	37.5	5	41.7	4	23.5	3	23.1	3	17.6	5	29.4
1 - 25	3	12.5	--	--	--	--	1	7.7	1	5.9	1	5.9
26 - 50	4	16.7	2	16.7	4	23.5	2	15.4	3	17.6	4	23.5
51 - 75	2	8.3	1	8.3	3	17.6	2	15.4	1	5.9	1	5.9
76 - 99	5	20.8	--	--	4	23.5	4	30.8	5	29.4	4	23.5
100	1	4.2	4	33.3	2	11.8	1	7.7	4	23.5	2	11.8
Total	24	100.0	12	100.0	17	100.0	13	100.0	17	100.0	17	100.0

Table 5.24. Satisfaction from using practices from the manual

Satisfaction level	Plant group											
	Ornamental/ shade trees		Fruit trees		Shrubs		Flowers		Lawn		Vegetable garden	
	n	%	n	%	n	%	n	%	n	%	n	%
Very satisfied	1	5.6	2	28.6	1	10.0	1	16.7	--	--	4	40.0
Satisfied	12	66.7	1	14.3	5	50.0	3	50.0	4	44.4	4	40.0
Don't know	2	11.1	1	14.3	--	--	--	--	--	--	1	10.0
Slightly satisfied	2	11.1	1	14.3	2	20.0	1	16.7	3	33.3	1	10.0
Not satisfied at all	1	5.6	2	28.6	2	20.0	1	16.7	2	22.2	--	--
Total	18	100.0	7	100.0	10	100.0	6	100.0	9	100.0	10	100.0

either "satisfied" or "very satisfied" with the results. An equal number of respondents indicated satisfaction ratings above (positive) and below (negative) a neutral reaction ("don't know") for fruit trees. The largest percentage of respondents indicating "negative" ratings occurred for lawns.

Recommending the Manual to Others. Of the 34 respondents who completed this question, 17 (50%) indicated that they had recommended the manual to either a friend, neighbor or relative.

Addition of Information. Twenty-seven (87.1%) of the 31 respondents who answered this question indicated that they would like to see additional information added to the manual. Of the 20 respondents who offered suggestions, 12 indicated that the empty plant group sections should be completed, seven wanted additional, more specific management information for pests and pest problems already covered in the manual, and one respondent desired more explicit information on applying pesticides.

Best and Least Liked Aspects of the Manual. Twenty-eight respondents provided one to several comments each regarding what they liked best about the manual. The majority of the comments concerned aspects of the hardware component of the manual. For example, 17 of the respondents indicated that the manner in which the material was organized and presented greatly enhanced their use of the manual; five stressed the convenience of using the manual as a place to store all of their other pest management materials. However, a number of best liked aspects of the manual also focused on its software component. Six respondents expressed positive remarks about the

quality and timeliness of the information and two indicated a strong preference for the IPM approach taken in the manual.

Many of the least liked aspects of the manual were identical to those best liked by respondents. For the 23 respondents who indicated what they liked least about the manual, hardware aspects again predominated. Seven commented on the empty plant group sections, four expressed the opinion that the manual was too large and, therefore, too cumbersome to easily use, three reported that the pages were easily torn and difficult to turn and two felt that the organization of the manual was extremely difficult to understand. Comments related to the software component of the manual included: information in the manual lacked depth on certain subjects, such as pest identification and management techniques (4 respondents) and the IPM approach was simply too complicated and time-consuming for homeowners to effectively practice (2 respondents).

Participation in Project PEST Activities. As shown in Table 5.25, 20 respondents indicated that they had participated in one or more Project PEST activities. Of the remaining 17 manual users, 16 indicated no involvement and one did not complete the question. Twelve respondents (60%) took part in only one project activity; the remaining eight (40%) reported two or more. The largest number of respondents (12 or 60%) participated in Project PEST by taking part in the original assessment study (received the project questionnaire). Conversely, only two (5%) of the 20 had attended the project "kickoff" meeting in November, 1979.

Table 5.25. Participation in Project PEST activities

Project activities	n	%
a. Attended the project "kickoff" meeting	--	--
b. Participated as a project committee member	--	--
c. Participated as a project volunteer	--	--
d. Received a copy of the project questionnaire	4	20.0
e. Attended the August 1980 "Walking Tour"	3	15.0
f. Attended the August 1981 "Walking Tours"	5	25.0
a and d	2	10.0
d and e	1	5.0
d and f	4	20.0
d, e and f	1	5.0
Total	20	100.0

Tests of Hypotheses

The second part of analysis focused on examining and testing the relationships proposed in the 15 study hypotheses using correlation analysis. Presented in Table 5.26 are the results of the correlation analysis and include: the zero-order Pearson correlation coefficient (r); its level of significance (α); the coefficient of determination (r^2); and the number of cases (n) used to calculate the coefficients. The n varied from hypothesis to hypothesis because pairwise deletion of missing data was performed; that is, a case was deleted from the computation of a given coefficient when the value of either of the two variables was missing (Nie et al. 1975). With respect to the level of significance considered "acceptable" for testing hypotheses, researchers typically use an alpha of .05, .01, or .001 (Babbie 1983). Because of the exploratory nature of this study, the relatively small sample size and the potential attenuation of a number of coefficients due to their undermeasurement, the acceptable significance level for rejecting the null hypothesis was "relaxed" to .1. However, as stated above, the actual significance level for each association is reported, should the reader wish to reach his own conclusions.

Individual Characteristics

Socioeconomic Characteristics. Hypotheses 1 - 3 indicate the expected relationships between socioeconomic characteristics -- age, education, socioeconomic status -- and the extent of adoption of the manual. Although it was expected that age would not be related to

Table 5.26. Summary of zero-order correlations for the 15 study hypotheses

Alternative empirical hypothesis	Alternative statistical hypothesis	r	Level of significance (α)	r^2	n
1. Age will not be related to extent of adoption scores.	$r = 0$	-.2754 [†]	.055	.0758	35
2. Education scores will be positively related to extent of adoption scores.	$r > 0$	.3430*	.022	.1176	35
3. Socioeconomic status scores will be negatively related to extent of adoption scores.	$r < 0$	-.4141*	.007	.1715	35
4. Attitude scores for handling pest problems on plants in the yard will be positively related to extent of adoption scores.	$r > 0$	-.0460	.395	.0021	36
5. Attitude scores for using pesticides in the yard will be negatively related to extent of adoption scores.	$r < 0$	.3217 [†]	.030	.1035	35
6. Attitude scores for using alternatives to pesticides in the yard will be positively related to extent of adoption scores.	$r > 0$	-.0646	.356	.0042	35
7. Index of communication behavior scores will be positively related to extent of adoption scores.	$r > 0$	.4533*	.004	.2055	33
8. Familiarity with IPM before purchasing the manual scores will be negatively related to extent of adoption scores.	$r < 0$	.1451	.206	.0211	34

Table 5.26. (Continued)

Alternative empirical hypothesis	Alternative statistical hypothesis	r	Level of significance (α)	r ²	n
9. Problem oriented purchase decision scores will be positively related to extent of adoption scores.	r > 0	.2630*	.061	.0692	36
10. Mass media channel scores will be positively related to the first year that the manual was made available for sale (1981).	r > 0	.3750*	.016	.1406	33
11. For software attributes:					
a. Relative advantage scores will be positively related to extent of adoption scores.	r > 0	-.0565	.372	.0032	36
b. Compatibility scores will be positively related to extent of adoption scores.	r > 0	-.1025	.276	.0105	36
c. Complexity scores will be positively related to extent of adoption scores.	r > 0	.0277	.436	.0008	36
d. Trialability scores will be positively related to extent of adoption scores.	r > 0	.2448*	.075	.0599	36
e. Observability scores will be positively related to extent of adoption scores.	r > 0	.1665	.166	.0277	36

Table 5.26. (Continued)

Alternative empirical hypothesis	Alternative statistical hypothesis	r	Level of significance (α)	r^2	n
12. Attitude scores for the software component of the manual will be positively related to extent of adoption scores.	$r > 0$	-.0212	.451	.0004	36
13. For hardware attributes:					
a. Relative advantage scores will be positively related to extent of adoption scores.	$r > 0$	-.3393 [†]	.021	.1151	36
b. Complexity scores will be positively related to extent of adoption scores.	$r > 0$	.1355	.215	.0184	36
c. Appearance scores will be positively related to extent of adoption scores.	$r > 0$	-.0769	.328	.0059	36
d. Durability scores will be positively related to extent of adoption scores.	$r > 0$	.0099	.477	.0001	36
14. Attitude scores for the hardware component of the manual will be positively related to extent of adoption scores.	$r > 0$	-.0617	.360	.0038	36
15. Extent of adoption scores will be positively related to consequence scores.	$r > 0$	.2451*	.085	.0601	33

[†] Denotes a significant correlation ($p < .1$) opposite the expected direction.

* Denotes a significant correlation ($p < .1$) in the expected direction.

extent of adoption, correlation results indicated a weak, yet significant, negative linear relationship ($r = -.2754$) with age accounting for, or "explaining", approximately 7.6% ($r^2 \times 100$) of the variance in adoption behavior. Therefore, it appears that for the age of respondents (manual users) in this study, the younger the respondents, the greater was their extent of adoption of the manual.

The relationship between education and extent of adoption was in the expected direction (positive) and significant at the .1 (and .05) level. The strength of the association was slightly stronger than that for age, with an r of .3430 and an r^2 of .1176. Thus, respondents with more education adopted the manual to a greater extent than those with less education.

Of the three socioeconomic characteristics, socioeconomic status exhibited the strongest linear relationship with extent of adoption ($r = -.4141$), accounting for 17% of the variance in the dependent variable. In addition, the negative r value and the magnitude of alpha (.007) confirmed the expected relationship expressed in the alternative hypothesis: respondents exhibiting higher socioeconomic status (lower scores) adopted the manual to a greater extent than those exhibiting lower socioeconomic status (higher scores).

Personality Characteristics. The expected relationships between the three attitudes and extent of adoption are expressed in hypotheses 4 - 6. As can be seen, virtually no linear relationship existed between respondents' attitudes toward handling pest problems in the yard or using alternatives to pesticides in the yard and adoption behavior ($r = -.0460$ and $-.0646$, respectively). Consequently, the null hypotheses were accepted in both these cases.

On the other hand, while a significant correlation was found between respondents' attitudes toward using pesticides in the yard and extent of adoption ($r = .3217$), it was in the opposite direction (positive) of the expected relationship (negative) between these two variables. Therefore, respondents possessing a more positive attitude toward using pesticides in the yard adopted the manual to a greater extent than those possessing a less positive or negative attitude toward this activity.

Communication Behavior. The relationships proposed in hypotheses 7 and 8 focused on communication behavior and the extent of adoption of the manual. The correlation between respondents' index of communication behavior scores and extent of adoption was significant ($\alpha = .004$), in the expected direction (positive) and moderately strong ($r = .4533$; $r^2 = .2055$). Given the rationale used to construct the index, these values support the contention that respondents who "typically" use a larger number of sources for information on handling pest problems in their yard adopted the manual to a greater extent than those using a smaller number of sources.

The coefficient for hypothesis 8 -- familiarity with IPM before purchasing the manual -- was positive (.1451), or in the opposite direction of the proposed relationship. While a positive r value would indicate that those respondents less familiar with IPM before purchasing the manual had adopted it to a greater extent than those more familiar with this pest management approach, the calculated alpha level (.206) prohibited rejecting the null hypothesis and thus reaching this conclusion.

Problem vs. Innovation Orientation. The last hypothesis examining the relationship between individual characteristics and adoption behavior (number 9) proposed that respondents indicating a problem oriented purchase decision would have adopted the manual to a greater extent than those indicating an innovation oriented decision. Results of the correlation analysis supported the rejection of the null hypothesis ($\alpha = .061$) and indicated a weak ($r = .2630$), yet positive, association between a problem oriented purchase decision and adoption behavior.

Communication Channels

The alternative hypothesis for communication channels (number 10) proposed that a positive relationship existed between mass media channels used to publicize the availability of the manual and the first year it was made available for sale (1981). This relationship was supported by the analysis ($r = .3750$; $\alpha = .016$), indicating that, for the most part, respondents who purchased the manual in 1981 first heard of its availability through a mass media channel.

Perceived Characteristics of the Innovation

Attributes of the Software Component. The expected relationships between each of the five software attributes and extent of adoption are presented in hypothesis 11. Virtually no linear relationship existed between relative advantage ($r = -.0565$) or complexity ($r = .0277$) and adoption behavior. While the coefficients for compatability ($r = -.1025$ -- opposite its expected direction) and observability ($r = .1665$) exhibited weak associations with the

dependent variable, their respective significance levels (.276 and .166) prohibited rejecting the null hypothesis in each case. The only software attribute that was significantly related to extent of adoption of the manual was trialability. This association, however, was weak at best, accounting for slightly less than 6% of the variance in adoption behavior.

Attitudes Toward the Software Component. As the results for hypothesis 12 show, the expectation of a positive relationship between respondents' overall attitudes toward the software component of the manual and extent of adoption was not supported. In fact, the magnitude of the coefficient (-.0212) indicated essentially no linear association between the two variables.

Attributes of the Hardware Component. With respect to the proposed relationships between the four hardware attributes and adoption behavior (hypothesis 13), an absence of any linear association was indicated for appearance ($r = -.0769$) and durability ($r = .0099$). A weak, although non-significant, positive correlation was shown for complexity (.1355). Interestingly, while the relationship between relative advantage and extent of adoption was significant ($\alpha = .021$), its direction was contrary (negative) to the expected relationship proposed in the alternative hypothesis (positive). Consequently, respondents who adopted the manual to a greater extent tended to perceive its (hardware) relative advantage more negatively than those adopting it to a lesser extent.

Attitudes Toward the Hardware Component. An absence of linear correlation ($r = -.0617$) was also indicated for the relationship

between the respondents' overall attitudes toward the hardware component of the manual and adoption behavior (hypothesis 14).

Consequences

The final hypothesis (number 15) proposed that extent of adoption of the manual would be positively related to consequence scores, or the extent to which respondents felt that they had changed their way of thinking about and actually handling pest problems in their yard. This alternative hypothesis was accepted ($\alpha = .085$), although the strength of the association was weak ($r = .2451$; $r^2 = .0601$).

Multivariate Relationships

The third part of analysis consisted of exploring the relationship between the extent of adoption of the manual and the entire set of independent variables (excluding both communication channel variables and the consequence variable) through the use of multiple regression analysis. The method selected for regressing the 20 independent variables on extent of adoption was forward (stepwise) inclusion. Based on pre-selected statistical criteria,

The variable that explains the greatest amount of variance unexplained by the variables already in the equation enters the equation at each step. Thus, the independent variable which is chosen for entry is the one which has the largest squared partial correlation with the dependent variable (Nie et al. 1975:345).

Using the SPSS "Subprogram Regression" (Nie et al. 1975), the default (pre-programmed) values for the three statistical criteria used to

"select" the independent variables were: (1) n , the maximum number of independent variables that will be entered into the equation (default = 80); (2) F , the minimum level of significance for the F ratio of regression coefficients that the user is willing to accept for variables that will be included in the equation (default = .01); and (3) T , tolerance, or the proportion of the variance of an independent variable being considered for inclusion not explained by the independent variables already in the regression equation (default = .001).

Based on these criteria, all 20 independent variables were included in the final regression equation. Results of the analysis are presented in Table 5.27 and include: the multiple correlation coefficient (R); the significance level of R (α); the coefficient of determination (R^2); the incremental change in R^2 ; and the significance level for the change in R^2 (α). (Additional multiple regression results are contained in Appendix F.)

The alpha value (based on an F ratio) for each of the successive multiple correlation coefficients (see Table 5.27), and most importantly for the final R (.016), supported rejecting the null hypothesis that the relationship between extent of adoption and the linear combination of the 20 independent variables was equal to zero (that is, $R = 0$). In addition, the magnitude of the overall relationship, as expressed by R , was extremely strong (.95913).

Using the more easily interpreted coefficient of determination (R^2) for discussion purposes, approximately 92% of the total variance of extent of adoption, for the 29 respondents included in the

Table 5.27. Results of regressing 20 independent variables on extent of adoption scores*

Step	Variable entered	R	Signifi- cance (α)	R ²	R ² change	Signifi- cance (α)
1	Problem vs. innovation orientation	.42307	.022	.17899	.17899	.022
2	Socioeconomic status	.56893	.006	.32368	.14469	.026
3	Software trialability	.72415	.000	.52439	.20071	.003
4	Hardware relative advantage	.77502	.000	.60066	.07626	.043
5	Index of communication behavior	.80801	.000	.65288	.05222	.076
6	Software compatibility	.82216	.000	.67594	.02307	.224
7	Age	.83713	.000	.70079	.02484	.201
8	Pesticides attitude	.84517	.000	.71432	.01353	.342
9	Handling pest problems attitude	.85234	.001	.72648	.01216	.370
10	Alternatives to pesticides attitude	.86307	.001	.74489	.01841	.269
11	Familiarity with IPM	.89508	.000	.80117	.05628	.042
12	Hardware complexity	.89919	.001	.80855	.00738	.444
13	Hardware attitude	.91131	.001	.83049	.02194	.184
14	Hardware appearance	.93070	.001	.86620	.03571	.074
15	Hardware durability	.94518	.000	.89337	.02718	.092

Table 5.27. (Continued)

Step	Variable entered	R	Signifi- cance (α)	R ²	R ² change	Signifi- cance (α)
16	Education	.95211	.001	.90651	.01314	.218
17	Software relative advantage	.95637	.001	.91465	.00814	.328
18	Software complexity	.95777	.003	.91732	.00267	.582
19	Software attitude	.95906	.007	.91980	.00247	.611
20	Software observability	.95913	.016	.91993	.00013	.911

*All multiple regression results are based on an n of 29.

analysis, was accounted for by the linear combination of the 20 independent variables.

The first variable entered into the analysis was problem vs. innovation orientation, indicating that it explained the greatest amount of variance (.17899) in adoption behavior. The second variable entered -- the one that produced the greatest increment in R^2 , in conjunction with the first -- was socioeconomic status, which added slightly over 14% to explained variance. Variables entered on subsequent steps, contributing substantially to explained variance, included: the trialability attribute of the software component (20%); the relative advantage attribute of the hardware component (7.6%); and the index of communication behavior (5.2%). These five variables accounted for approximately 65% of the total explained variance (92%).

Although the remaining 15 variables contributed to explained variance in adoption behavior, individually they averaged 3% or less (except for familiarity with IPM before purchasing the manual). To gain a perspective on the relative efficacies of the different variables in the equation and their ability to add to the regression, an F-test can be applied to the incremental changes in R^2 (Kerlinger and Pedhazur 1973). Rejection of the null hypothesis (incremental $R^2 = 0$) would indicate that the incremental increase in R^2 explained by that variable added significantly to the regression (only as far as statistical significance is concerned). If the acceptable alpha level is again set at .1, three variables can be added to the five listed above: familiarity with IPM before purchasing the manual (5.6%); the appearance attribute of the hardware component (3.5%); and the

durability attribute of the hardware component (2.7%). This increased the total amount of variance explained by these eight "significant" variables to exactly 77.2%

Finally, results of the multiple regression analysis essentially "reflected" the results obtained in the correlation analysis. For example, the first five variables entered -- and those that clearly explained the greatest amount of variance -- were each significantly related to adoption behavior (based on zero-order correlations). The same was true for age and attitudes toward using pesticides in the yard (entered on steps 7 and 8, respectively). On the other hand, variables that exhibited little or no linear correlation with extent of adoption were entered on subsequent steps (except for education); most notably variables measuring the hardware and software attributes of the manual.

CHAPTER 6

SUMMARY AND CONCLUSIONS

In the final chapter, a brief overview of the study and a summary of the survey results are presented first. The second section is devoted to a discussion of the conclusions that were reached regarding the manual as a means for transferring IPM information to urban homeowners and the applicability of the innovation-decision process model as a means for characterizing this information transfer process in general. Based on study findings and conclusions, a number of implications that others might use to help plan and improve their transfer efforts are discussed. The final two sections present the limitations encountered in this study and recommendations for future research in this area.

Summary

In recent years, integrated pest management (IPM) has been recognized and promoted as a potential strategy for dealing with pest problems on urban vegetation. While research still needs to be conducted on the technical aspects of applying this ecological approach to managing pest problems in urban situations, an additional area of inquiry that has been virtually uninvestigated is the

transfer of IPM information to a significant urban pest management decision-maker -- the urban homeowner.

This study represents a response to that need. It was undertaken to evaluate a recent effort to transfer IPM information to homeowners in a Michigan suburban community; Project PEST's Pest Management Manual -- a homeowner's self-help guide to IPM. A model developed to explain the process by which individuals adopt new ideas and practices, called the innovation-decision process model, was used as the framework for evaluating the manual. In addition to determining the model's usefulness as a means to better understand and perhaps improve other pest management information transfer efforts, answers to the following questions concerning the Pest Management Manual were sought:

1. Was the manual used?
2. To what extent was it used?
3. What characteristics of the manual affected its use or non-use?
4. What are the characteristics of manual owners?
5. To what extent did the characteristics of manual owners affect its use or non-use?

A number of variables associated with the innovation-decision process model were selected and measures for their use in this study were constructed. Using a self-administered mail questionnaire, data were collected from 41 of the 75 manual owners in Project PEST's target community -- Meridian Charter Township, Michigan. Data analysis consisted of: (1) determining the distributional characteristics of the data; (2) testing a number of hypotheses derived from the model, using correlation analysis; and (3) exploring

the relationship between the extent of adoption of the manual (the dependent variable) and the entire set of independent variables in the study using multiple regression analysis. Results of the analyses are summarized and presented below.

General Description

Extent of adoption and implementation of the manual:

1. Of the 41 manual owners who completed the questionnaire, four had not used the manual at all; 15 had read parts of the manual only; and 22 had read parts and were currently using practices from the manual to handle pest problems on plants in the yard.
2. Only one of the manual non-users rejected the manual. The remaining three were considered to be still in the knowledge stage of the model. None of the 37 manual users indicated that they had rejected the manual. (Subsequent analysis was based on the 37 manual users only.)
3. A large number of the 20 information and practice items from the manual were "used" by respondents.
4. For 18 of the 20 total items, considerably more respondents perceived them as new or innovative, than old.
5. The manual represented a technology cluster, ranging in size (extent) from two to 17 information and practice items, for 34 of 36 manual users.
6. The extent of re-invention of the manual ranged from two to 17 information and practice items.
7. Extent of adoption scores ranged from a low of 13 (three items used) to a high of 434 (20 items used).

Individual characteristics:

8. The age of manual users ranged from 27 to 79 years old; the average age was 47.
9. Education levels were quite high: all manual users had completed high school; 97.2% reported pursuing and/or completing some type of college training.
10. The socioeconomic status of manual users was also high: 75% were classified in the two highest socioeconomic

status classes; the remaining 25% were classified in the middle to lower middle socioeconomic status classes.

11. Slightly over 75% of the manual users reported a gross family income greater than the 1980 U.S. median family income of \$21,503.
12. Based on mean scores, manual users' attitudes toward handling pest problems on plants in the yard, using pesticides and using alternatives to pesticides as a way to handle pest problems in the yard were moderately positive.
13. The three sources of information used "frequently" by the largest number of respondents were printed mass media materials and included: package/container labels (52.9%); pamphlets/manuals (50%); and books (29.4%). For those sources used "sometimes", interpersonal channels predominated: friends/neighbors (58.8%); garden store personnel (50%); and cooperative extension personnel (47.1%).
14. Based on index of communication behavior scores, manual users' communication behavior ratings were: low (41.2%); medium (53%); and high (5.8%).
15. Over half (54.3%) of the manual users were not familiar with IPM before purchasing the manual; 8.6% were very familiar with IPM; 25.7% were somewhat familiar with IPM; and 11.4% indicated that they had heard about IPM but did not really know what it meant.
16. For problem vs. innovation orientation, 40.5% indicated a purchase decision considered to be innovation oriented; 56.7% indicated a problem oriented purchase decision.

Communication channels:

17. The majority of manual users (74.9%) first heard of the manual's availability through a mass media communication channel; 16.7% heard of it through an interpersonal channel.

Perceived characteristics of the innovation:

18. Based on mean scores, perception of each of the five software attributes -- relative advantage, compatibility, complexity, trialability, observability -- was moderately positive.
19. Based on mean scores, perception of each of the four hardware attributes -- relative advantage, complexity, appearance, durability -- was moderately to extremely positive.

20. Based on mean scores, manual users' attitudes toward the software and hardware components of the manual were moderately positive.

Consequences:

21. Over 90% of the manual users felt that the manual had changed their way of thinking about and handling pest problems in the yard to some degree. The degree of change category selected by the majority of manual users (over 60%), in each case, was "somewhat."
22. Based on consequence scores, overall change ratings for manual users were: high (8.8%); moderate (58.8%); moderate to low (26.5%); and no change at all (5.9%).

Descriptive characteristics:

23. The overall ranking of plant groups on which pest problems occurred and required management was: ornamental/shade trees; lawn; vegetable garden; shrubs; flowers; and fruit trees.
24. Most manual users indicated using pesticides less than 50% of the time for all plant groups except fruit trees.
25. For all plant groups except vegetable gardens, well over 60% of the manual users indicated no use of alternatives to pesticides. When alternatives were used, they were typically used less than 50% of the time.
26. For all plant groups except ornamental/shade trees, over 40% of the manual users indicated that they had taken no action over 50% of the time when confronted with pest problems.
27. With respect to satisfaction with results, the majority of manual users who had applied practices from the manual on ornamental/shade trees, shrubs, flowers and vegetable gardens indicated that they were either satisfied or very satisfied with the results. An equal number indicated both positive and negative satisfaction ratings for fruit trees; the largest number of negative ratings occurred for lawns.
28. Fifty percent of the manual users indicated that they had recommended the manual to either a friend, neighbor or relative.
29. Twenty-seven (87.1%) of 31 manual users indicated that they would like to see additional information added to the manual. Suggestions included: completing the

empty plant group sections; more specific management information for pests and pest problems already covered in the manual; and more explicit information on applying pesticides.

30. Best liked aspects of the manual included: the manner in which the material was organized and presented; the convenience of the manual as a place to store other pest management materials; the quality and timeliness of the information; and the IPM approach.
31. Least liked aspects of the manual included: the empty plant group sections; its size (too large and cumbersome); pages were easily torn and difficult to turn; its organization; the lack of depth of information on certain subjects; and the IPM approach.
32. Twenty (54%) of the manual users had participated in one or more Project PEST activities. The largest number of respondents (12 or 60%) had taken part in the original assessment study; the fewest (2 or 5%) had attended the project "kickoff" meeting in November, 1979.

Tests of Hypotheses

1. Based on zero-order Pearson correlation coefficients and a significance level of .1, a significant degree of linear association was confirmed in 10 of the 22 relationships proposed in the 15 study hypotheses.
2. Seven of the 10 significant correlations were in the expected direction. The following relationships were confirmed:
 - a. Education was positively related to extent of adoption of the manual ($r = .3430$).
 - b. Socioeconomic status was positively related to extent of adoption of the manual ($r = -.4141$, a negative status score corresponded to high socioeconomic status).
 - c. Diversity (index) of communication behavior was positively related to extent of adoption of the manual ($r = .4533$).
 - d. A problem oriented purchase decision was positively related to extent of adoption of the manual ($r = .2630$).
 - e. Mass media channels were positively related to the first year that the manual was made available for sale (1981) ($r = .3750$).
 - f. The perceived trialability of the software component was positively related to extent of adoption of the

- manual ($r = .2448$).
 - g. Extent of adoption of the manual was positively related to the degree of perceived change (consequences) ($r = .2451$).
 - 3. Three of the 10 significant correlations were opposite their expected direction. These relationships included:
 - a. Age was negatively related to extent of adoption of the manual ($r = -.2754$, no relationship was expected).
 - b. Attitudes toward using pesticides as a way to handle pest problems in the yard were positively related to extent of adoption of the manual ($r = .3217$).
 - c. The perceived relative advantage of the hardware component was negatively related to extent of adoption of the manual ($r = .3393$).

Multivariate Relationships

1. All 20 independent variables used in the analysis were included in the final regression equation (using forward, stepwise inclusion) and accounted for 92% of the variance in extent of adoption of the manual.
2. Based on a significance level of .1, eight variables accounted for statistically significant amounts of explained variance that totaled 77.2%. These variables were (step entered/% of variance explained): problem vs. innovation orientation (1/18%); socioeconomic status (2/14.5%); the trialability attribute of the software component (3/20%); the relative advantage attribute of the hardware component (4/7.6%); index of communication behavior (5/5.2%); familiarity with IPM before purchasing the manual (11/5.6%); the appearance attribute of the hardware component (14/3.5%); and the durability attribute of the hardware component (15/2.7%).

Conclusions

Study conclusions are organized and presented in two parts. Conclusions regarding the Pest Management Manual as a means for transferring IPM information to urban homeowners are presented in Part I. Specifically addressed is the extent to which the manual was

used and those factors that were found to be associated with its use. Part II focuses on the applicability of the innovation-decision process model as a means for characterizing the transfer of pest management information to urban homeowners.

Part I: The Manual

Use of the Manual

Based on the method employed to measure use of the manual, it was determined that 37 (90.2%) of the 41 manual owners who had returned useable questionnaires had actually used the manual. Although the percentage of manual users in this group was extremely high, perhaps this was to be expected. One explanation for this conclusion would be that completing the questionnaire was related to use of the manual. Even though the survey cover letter pointed out that portions of the questionnaire could be completed if the manual had not been used, perhaps those manual owners who did not return the questionnaire ($n = 27$) had not used it and, therefore, felt that the survey did not concern them. If this indeed were true, then the 37 manual users represented 51.4% of the current 72 manual owners in Meridian Township. Without direct evidence, however, this explanation is only speculative. On the other hand, it does represent a "worst case" situation; no fewer than 37 manual owners had actually used the manual.

Information and Practice Items Used. Data reported in Tables 5.1 and 5.2 suggest that each of the information and practice items were used by a large number of manual users. Based on the total number of

users reading about each of the 10 information items (see Table 5.1), it appears that specific pest management information was sought most frequently; that is, information on identifying pests and pest problems and the types and uses of alternatives to pesticides and pesticides. These were followed closely by the more general topics of the problems with pesticides, the principles and objectives of IPM and preventing pest problems through proper plant selection and care.

In addition to reading about information items, 22 (61%) of 36 manual users reported applying practices in their yard on a regular basis (see Table 5.2). Overall, practice items were used a bit more selectively. Again, however, based on the total number of users applying each of the 10 practice items, specific pest management techniques predominated (identifying pests and pest problems, deciding if and when to use management techniques, selecting and applying alternatives to pesticides and pesticides). In fact, the order of these top four practices represent important components of the IPM decision-making process: (1) correctly identify the pest and/or problem; (2) decide if action is necessary and, if it is, which management technique(s) is/are appropriate; and (3) select and apply the appropriate management technique(s) (alternatives to pesticides and/or pesticides).

Because manual users were also asked to indicate whether the information or practices they had used represented new or old items, data from these two tables also provided a general perspective on the perceived newness of items used from the manual. As the results showed, for 18 of the 20 information and practice items, considerably more users perceived them as new rather than old. Consequently, from

the standpoint of these users, the manual contained a substantial amount of new or innovative pest management material.

With respect to individual items, it was also noted that a similar pattern existed for both information and practice items. In fact, upon closer inspection, it also appeared that this pattern exhibited a good deal of substantive significance; that is, information and practice items we might have expected to be perceived as either new or old were indeed perceived as such. For example, as stated in Chapter 3, one of the newest aspects of the manual was the method for deciding if and when to use management techniques (using the "Injury Acceptance Levels" chart). While the fact that this item was objectively new really made little difference, it was nevertheless the "newest" information item (based on "new" response frequencies) and one of the "newest" practice items used by respondents. The same reasoning could be applied for alternatives to pesticides. Because the manual focused quite heavily on providing this material, we might have expected users who had read about and applied alternatives to have perceived them, for the most part, as new. And, in fact, this expectation was essentially confirmed; the material on alternatives to pesticides was considered to be the second "newest" information item and one of the "newest" practice items.

Only one information and practice item was considered to be "old" by more manual users than new. The one "old" information item was the problems with pesticides; the "old" practice item was handling pesticides safely. From these two items, it seems that many users were already aware of the potential risks associated with

pesticides and, perhaps, took the appropriate precautionary steps when using them. These results would appear to be reasonable, given the pest control profile presented in Chapter 1. And, if we consider that individuals had to make a deliberate effort to acquire the manual, indicating some degree of awareness and interest in pest management, then it would also be reasonable to expect that they possessed some degree of familiarity with these two items.

Extent of Adoption and Implementation. In addition to the general perspective on use of information and practice items described above, use of the manual was also characterized by the number of items each individual actually used. Considering only new items adopted and implemented, data in Table 5.3 revealed that the manual did indeed represent a technology cluster of some magnitude for the majority of manual users. Only two of the 36 users -- both reading about information items only -- indicated that the manual did not represent an innovation for them. For the remaining 34, the extent of the cluster (or re-invention of the manual) varied considerably from a low of two items to a high of 17 items.

Considering the total number of items used from the manual, extent of adoption scores indicated overall use of the manual and essentially IPM (see Table 5.4). The range of scores was quite variable, from a low of 13 (3 items used) to a high of 434 (20 items used). However, the variability in scores was built-in to some extent because information users could only indicate a maximum of 10 items, whereas information and practice users could indicate a maximum of 20 items. In fact, only three information and practice users indicated using less than 10 total items. Although perhaps inevitable, users

who read about and applied practices did utilize more of the manual and, hence (on whole), practiced IPM to a greater extent than those users only reading about information items.

The most revealing finding drawn from this table was that four respondents indicated that they had used 19 items, whereas eight indicated using all 20 items from the manual. Consistent with the measurement rationale, these manual users would be described as practicing IPM "to a very great" and "full" extent, respectively, as presented in the manual. While there is no way to confirm or dispute these figures, they do seem somewhat unrealistic given the scope of the manual. Beyond this intuitive doubt, there is one circumstance that might have contributed to these results. Although respondents were asked to indicate only those information and practice items they had actually used from the manual, a considerable number of pre-test respondents provided answers to all items. Concerned that the questions might have implied that individuals were to respond to each of the 10 respective items, an explicit statement was added to each question pointing out that they should respond only to those items they had used from the manual. While only speculation, this may have contributed to these high extent of adoption scores.

Individual Characteristics

Socioeconomic Characteristics. Results for the socioeconomic characteristics of manual owners alone would seem to indicate that these individuals were innovators or early adopters; educational attainment, socioeconomic status and income were, on average, quite high. This might also help explain why extent of adoption scores were

high. Additional evidence for this conclusion comes from the fact that, as stated in Chapter 3, this study took place relatively soon (2 years) after the manual was introduced. Based on the publicity campaign conducted to advertise the manual (see Chapter 2), it would not be unreasonable to assume that more than 75 individuals had been aware of the manual. Because adopter categories are based on the relative time of adoption, and innovators and early adopters represent a small percentage of total adopters, then this might be a viable conclusion. It should be noted, however, that overall socioeconomic characteristics of Meridian Township homeowners are generally quite high (see Lambur et al. 1982). Consequently, there might already be a disproportionate number of innovative individuals in the study community.

In addition, both education and socioeconomic status were significantly associated with adoption behavior in the expected direction; both of these variables "increased" as did extent of adoption of the manual. When combined with the other independent variables in regression analysis, socioeconomic status proved to be a strong explanatory variable, accounting for the second largest amount of variance in adoption behavior (14.5%). However, education added little to the regression equation. On the other hand, while no relationship was expected between age and adoption behavior, a significant (although weak) negative correlation was found. Thus, the younger the user, the greater the extent of adoption. One explanation for this relationship may have been that the labor intensiveness of IPM (as presented in the manual) was more appealing to younger manual users. And, as for education, age did not contribute significantly in

the regression analysis, even though it was entered much earlier in the equation.

Personality Characteristics. Based on mean scores, manual users' attitudes toward each of the three pest management activities were moderately positive (see Table 5.9). More specifically, for handling pest problems in the yard, the almost even distribution of positive and negative attitude scores indicated that there was no definite trend for manual users; approximately 50% exhibited a favorable orientation and 50% an unfavorable orientation toward this activity. Results of the correlation and regression analysis also indicated a lack of linear association between this variable and adoption behavior, both singly, and in combination with the other independent variables. Thus, virtually no support was found in this study for the hypothesis that the respondents' orientations toward the general adoption activity enhance the prediction and/or explanation of adoption behavior, as proposed by Pampel and van Es (1977) and Taylor and Miller (1978). Conversely, these results appear to lend support to the contention that a general attitude is a poor predictor/explainer of a specific behavior.

A definite positive trend existed for attitudes toward using alternatives to pesticides and pesticides to handle pest problems in the yard. While this was expected for alternatives, it was not for pesticides. In fact, manual users' attitudes toward using pesticides exhibited a significant positive correlation with adoption behavior, whereas their attitudes toward the use of alternatives did not. (Neither contributed significantly to explained variance in the regression analysis, however.) In light of these results, it appears

that perhaps the practice of IPM is not necessarily dependent on an "either/or" stance regarding pesticides and alternatives, as suggested in the study hypotheses. In other words, a positive attitude toward using pesticides does not mean that an individual will not consider and, ultimately use an IPM approach for handling pest problems in the yard. On the contrary, manual users with more positive attitudes toward the use of these compounds tended to use the manual to a greater extent than those with less positive or negative attitudes toward this activity.

Communication Behavior. Results regarding the sources of information that manual users consulted for pest management information essentially corroborated those reported in other studies. Printed mass media materials, such as product labels and pamphlets and manuals, were used most frequently. Interpersonal channels (face-to-face communication) predominated the sources that were used "sometimes" and included conversations with friends and neighbors, garden store personnel and Cooperative Extension Service personnel.

When the sources of information used were combined into an index, the majority of users (94.2%) were rated as exhibiting a medium to low index of communication behavior. However, this variable showed one of the strongest correlations with adoption behavior ($r = .4533$) and explained a fair amount of variance (7.6%) in the dependent variable. Thus, individuals using a larger number of information sources, which would seem to indicate a more active interest in pest management in general, did indeed use the manual to a greater extent.

Over 50% of the manual users indicated that they were not familiar with IPM before purchasing the manual; the remaining users reported some degree of familiarity (see Table 5.12). Interestingly, while not significant, the correlation coefficient indicated a slightly positive relationship between this variable and adoption behavior. And, the users' familiarity with IPM was one of the eight variables found to significantly contribute to explained variance in extent of adoption. Although tentative, these results suggested that manual users who were less familiar or not at all familiar with IPM before purchasing the manual tended to use more items from it. Even though the opposite relationship was expected, these results are perhaps more logical if we consider that users less familiar with IPM might have necessarily relied more on the manual as a source of information and practices on this approach to pest management than those who were already familiar with IPM.

Problem vs. Innovation Orientation. Results of the correlation and multiple regression analysis confirmed the hypothesis that manual users who specifically sought out the manual for pest management information (a problem orientation) would have used it to a greater extent than those indicating an innovation oriented purchase decision (the manual would simply be useful to have). In fact, this variable accounted for the largest amount of variance in adoption behavior (approximately 18%), although the fact that it was dichotomous may have contributed to its ability to explain variance in the dependent variables.

Communication Channels

Survey results indicated that the majority of users who purchased the manual in 1981 first became aware of it through a mass media communication channel. In addition, the relative importance of these sources was also revealed: the three most effective sources were newspaper announcements, radio announcements and the Project PEST "Walking Tour."

Characteristics of the Manual

The Software Component. Even though the majority of manual users positively perceived each of the five attributes of the software component -- the information and practices in the manual -- trialability was the only characteristic that showed a significant and positive linear correlation with adoption behavior. In fact, from an explanatory perspective, this variable accounted for the greatest amount of variance in use of the manual (20%). One explanation for why trialability was the only software attribute significantly related to adoption behavior might be that it represents one of the attributes most closely related to actual use of the information and practices in the manual. Although any manual user could speculate on the degree to which IPM was possible to try on a small scale, perhaps those who actually used more items from the manual, particularly practice items, were less speculative in their responses to this attribute. This reasoning could also be applied to the observability attribute, from at least the correlation results. Although not significant, the coefficient for observability was stronger than that

of the remaining three attributes and indicated a positive relationship with use of the manual.

This line of reasoning may also help to explain why relative advantage, compatibility and complexity, while positively perceived by a majority of users, were not directly associated with use of the manual. Perhaps on a conceptual level, the overall idea of IPM appears to offer advantages as a way to manage pest problems, is compatible with peoples' feelings about managing pests and is relatively easy to understand for most individuals. If this were true, as it appeared to be in this study, then these attributes would not necessarily exhibit a positive correlation with adoption behavior.

On the other hand, while the coefficients for these three attributes were not significant, the direction for relative advantage and compatibility is nevertheless noteworthy. In light of the fact that attitudes toward using pesticides in the yard were positively related to adoption behavior, it might have been reasonable to expect that users would not have considered pesticides to represent a risk, and, therefore, would have perceived IPM as offering no great deal of relative advantage over these compounds. And, because attitudes are influenced, in part, by past experiences and behaviors, we might have also expected a low degree of compatibility. While these conclusions are extremely tentative, the negative direction of the coefficients for these two variables offer some evidence to at least consider them plausible.

Based on the overall positive perceptions of the five attributes, it was not surprising that users' attitudes toward the

software component of the manual were also positive. While it was presumed that their attitudes toward the manual would perhaps be one of the strongest variables explaining adoption behavior, data from this study do not support this contention. In addition, the same explanations and conclusions presented above would apply to this variable. Considering the significance of the coefficient, it could be concluded that the idea of IPM was appealing to most users, regardless of the extent to which they practiced it. Conversely, if we consider their attitudes toward using pesticides, the direction of the coefficient (negative) would appear consistent.

The Hardware Component. Results for the four attributes of the hardware component -- the manual itself as a means for presenting the pest management information -- exhibited a trend similar to that for the software component. While we could conclude that overall, users were favorably oriented to the manual as a means for presenting or transferring IPM information and practices, when related to use, a somewhat different picture emerged.

For example, the manual's relative advantage was significantly related to adoption behavior, but in a negative direction. Consequently, those individuals who used more items from the manual perceived it to be relatively inferior to other pest management publications and to contain either too little or too much information. Unfortunately, coding of the information item prohibited specifically determining the direction of a negative response. However, based on data from two of the descriptive questions (addition of information and the best and least liked aspects of the manual), it might not be unreasonable to assume that too little

information, particularly with respect to the empty plant group sections, was a typical response. Even though these users considered the manual to be less advantageous than other publications, they still tended to perceive it to be relatively well organized, written in simple language, and easy to understand and use -- or a publication low in complexity. (This relationship was positive but not significant). In fact, the manual's complexity was the attribute most positively rated by all manual users.

Conclusions regarding users' attitudes toward the hardware component were essentially identical to those offered for the software component; the majority of manual owners possessed a favorable attitude toward the manual as a means to present pest management (IPM) information and practices regardless of the extent to which they had used it.

Consequences

Conclusions regarding the direct consequences of using the manual are fairly straightforward: overall, manual users had changed their way of thinking about and handling pest problems on the plants in their yard; and the degree of change was relatively greater for those individuals using more items from the manual. However, these conclusions should also be viewed as extremely tentative because: (1) they were based on the individual user's perceptions, which could have resulted in socially desirable responses; (2) most users indicated a relatively "safe" degree of change (somewhat); and (3) the direction of the change was not specified in the question --

while assumed to be positively oriented to the manual, it could just as easily have been negative.

Descriptive Characteristics

Although not correlated with adoption behavior, a number of conclusions regarding the manual were drawn from responses to these questions and included:

1. Individuals who used practices from the manual appeared, in general, to be satisfied with the results. Surprisingly, satisfaction ratings were reported for all six plant groups, even though the manual only contained specific pest management techniques for ornamental/shade trees, lawns and vegetable gardens.

2. Approximately 50% of the users viewed the manual favorably enough to recommend it to another person.

3. A considerable number of users (20) were interested in seeing additional information added to the manual. Suggestions included completing the empty plant group sections and adding to the ones already covered in the manual.

4. A considerable number of users took the time to express what they liked best and least about the manual. For both items, the majority of comments concerned aspects of the hardware component of the manual; fewer alluded to the software component. Interestingly, many of the best liked aspects were identical to the least liked aspects (see Chapter 4 for specific comments).

Part II: The Model

In addition to using the innovation-decision process model to evaluate the manual by determining the extent to which it was used and identifying specific factors associated with its use, a secondary purpose of this investigation was to determine if the model was applicable for characterizing the transfer of pest management information to urban homeowners. This was accomplished by "testing" 15 hypotheses derived from the model. While it is difficult to pass judgment based on one relatively small case study, it was concluded that the innovation-decision process model is applicable, to a degree, for characterizing the transfer of pest management information to urban homeowners. This conclusion was based on the relationships between "generic" variables and the extent of adoption. Generic variables are those that were neither significantly modified or specifically developed for this study and included: age, education, socioeconomic status, communication behavior, problem vs. innovation orientation, communication channels and attributes of the innovation (all five for the software component and only relative advantage and complexity for the hardware component). Correlation results for these 13 variables revealed that:

1. Education, socioeconomic status, communication behavior, problem orientation, and software trialability were significantly related to adoption behavior, and communication channels were significantly related to awareness of the manual, in the expected direction.
2. Age and hardware relative advantage were significantly related to adoption behavior opposite the expected direction.

3. Software relative advantage, compatibility, complexity, and observability, and hardware complexity were not significantly related to adoption.

From these results, individual variables provided the "strongest" evidence for this conclusion.

Three cautions should also be pointed out regarding this conclusion. First, the model characterizes the acceptance and use of new ideas and practices, or the adoption of innovations. Although the idea or practice need only be perceived as new to be considered an innovation, a serious violation of this criterion might render the model useless. Second, the dependent variable used in all other applications of the model has been the time of adoption. In this study, the dependent variable was the extent to which the manual was adopted over a two-year period. In addition, measurement of the extent of adoption included use of both new and old items (although all but two individuals perceived the manual to contain some new material) and considered adoption and implementation to represent equal components of use. Third, while socioeconomic status and education were quite high for manual users (indicating that perhaps we were dealing with more innovative individuals), it should be noted that overall socioeconomic characteristics of community homeowners are quite high anyway (see Lambur et al. 1982). Consequently, there might already be a disproportionate number of innovative individuals (based on these characteristics anyway) in the community.

A second conclusion regarding the model was that it offered a useful framework for specifically evaluating the manual and, more generally, for understanding the transfer effort. Although use of the manual needed to be modified to reflect adoption and implementation,

it nevertheless provided a dimension to use that would not have been pursued. The two components of an innovation and the characteristics of an innovation also provided meaningful criteria to actually evaluate the manual. In addition to the generic variables taken from the model, it also presented a rationale for selecting and modifying a number of other variables that would have been otherwise ignored. And, finally, even though a number of the hypotheses were not confirmed, descriptive characteristics provided a wealth of information to better understand the particular transfer effort.

Implications

Although based on only one relatively small case study, a number of implications concerning the transfer of pest management information to urban homeowners can be drawn from this investigation. It should also be noted, however, that because the study design severely restricted the degree to which the results and conclusions can be generalized to broader situations -- except perhaps for those most directly related to the model -- these implications should be treated cautiously.

1. Because IPM is a framework that some homeowners are willing to use, in whole or in part, and a good portion of it is new for them, perhaps more comprehensive IPM materials -- similar to the manual -- should be developed for urban homeowners.

2. Even though homeowners may have positive attitudes toward the use of pesticides in the yard, they still seem willing to try IPM. Thus, the notion that IPM appeals to only those that hold

unfavorable orientations toward the use of these compounds may not be true.

3. Efforts to promote IPM to urban homeowners should concentrate more on its use and outcomes, rather than on its overall relative advantage. While the idea of IPM is appealing and understandable to many homeowners, its use is dependent upon the degree to which they can actually implement techniques and view their outcomes.

4. The Pest Management Manual offers one example that others might use to develop IPM materials for urban homeowners. While not recommending its indiscriminate duplication, a number of its positive qualities were: its organization and presentation of material; its clear and understandable language; its convenience as a place to store other pest management materials; and the quality and timeliness of the information. On the other hand, its negative qualities were: its lack of pest management information (techniques) on a wide variety of pests and problems for all plant groups in the yard; and its size (too large and cumbersome).

5. The innovation-decision process model offers a framework that can be used to help plan and improve the transfer of pest management (including IPM) information to urban homeowners. If the information is "new" from the homeowners' perspective, those involved in transfer efforts could benefit from what the model has to offer. Examples could include: focusing initial transfer efforts at early adopters to "legitimize" the innovation and promote its adoption, rather than at innovators who might more conveniently adopt it but help little in promoting it; using mass media to create initial awareness of an innovation and interpersonal channels to induce its

adoption and implementation; realizing what the characteristics of an innovation are and how they might affect its adoption; and understanding that innovations may be adopted but not immediately implemented, and altered or "re-invented" when they are implemented.

Study Limitations

As in any exploratory investigation, foreseen and unforeseen limitations are often confronted. Listed below are those that were encountered in this study.

1. Because of the relatively small number of potential study respondents ($n = 75$), a nonprobability sampling approach was used, which severely limited the ability to generalize study findings to other populations or settings.
2. Characteristics of the community may also limit generalizability of results and the results themselves. As noted previously, the socioeconomic characteristics of community homeowners were quite high, which might have affected the relationships between these and perhaps other variables and adoption behavior.
3. The small number of useable questionnaires and the large number of variables limited the ability to detect relationships among the data. Most of the significant correlation coefficients were quite weak and, for most others, almost no linear correlation was found. To check this, nonparametric coefficients were calculated but no significant differences were noted. And, while smaller coefficients were expected for those variables that were not truly interval (problem vs. innovation orientation, familiarity with IPM and communication

channels), two of the three were large enough to be significant (problem vs. innovation orientation and communication channels). The small number of respondents also affected the results of the multiple regression analysis; for the most part, those variables with significant correlation coefficients also explained the largest amount of variance in adoption behavior. Consequently, many "tentative conclusions" were expressed.

4. Because the decision to undertake this study was made after the manual had been in the hands of homeowners, the ability to detect change over time by pre- and post-measurement was sacrificed. This condition most notably affected the attitude and consequence variables.

5. The length of the questionnaire and some of the questions within it may have affected return rates. Two of the three unuseable questionnaires were not completed because it was "too long and complicated." In retrospect, one way that the questionnaire could have been shortened would have been to focus on fewer items from the model. The reason it looked complicated was probably because of the semantic differentials (although they can be completed rather quickly once the directions are read). Aside from eliminating these, and using a different attitude measure, perhaps more items could have been deleted from them. While this might have sacrificed reliability to some extent, it might have been offset by a higher return rate.

6. While the procedure used to measure use of the manual produced good quantitative results, much qualitative information was lost. This was particularly true when describing each individual's extent of adoption of the manual. Although the procedure allowed us

to determine the mix of information and practice items used, much interpretative impact was given up by not knowing specifically what those items were and how they were actually used.

Recommendations for Future Research

1. Additional research needs to be conducted on the innovation-decision process model within the context of pest management information transfer. Although the model appears to characterize the transfer of pest management (IPM) information as an innovation, this was based mostly on tentative evidence in this study. Aside from a small sample size which affected the magnitude of the relationships, altering the dependent variable and the pre-existing socioeconomic characteristics of the community may have distorted the results. Consequently, additional research efforts need to be conducted in less atypical settings using the time of adoption as the dependent variable to really validate the model.

2. More research is needed on what IPM means to, and how it is being practiced by urban homeowners. Given the philosophical and inherently dynamic approach that IPM represents, perhaps a more qualitative research orientation would be more appropriate for measuring its use by urban homeowners. The best way to do this would be through observation and personal interviews. This approach would not only allow us to better understand what IPM means to urban homeowners, but would also yield valuable information for attempting to quantify its use.

APPENDICES

APPENDIX A

Front Cover and Table of Contents of the
Pest Management Manual

PEST MANAGEMENT MANUAL

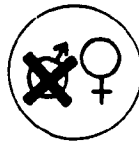
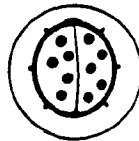
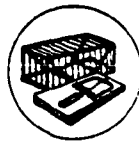
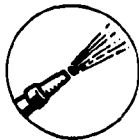
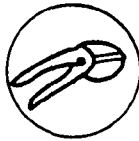
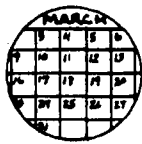


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Question #1 Have I correctly identified the cause of the problem?	3
Question #2 Have I correctly identified the plant which has the pest problem?	3
Question #3 Do I know the pest's life cycle?	4
Question #4 Have I considered and decided whether the damage is now serious enough to apply control techniques, or can I expect it to become serious enough later on?	4
Control Techniques	5
(3) Manual Pest Control	5
(4) Mechanical Pest Control	5
(5) Biological Pest Control	5
(6) Chemical Pest Control	5
Guidelines for Selecting Management Techniques	6

SAFETY

PESTICIDES

Pesticides and Safe Use
 Pesticide Classifications and Formulations
 Dormant Oils: What They Are And How They Are Used
 What Is On The Pesticide Label?
 Factors Affecting Pesticide Activity
 Protecting the Environment
 Protecting Man - Using Pesticides Safely
 First Aid For Pesticide Poisoning

EQUIPMENT

Equipment For Pest Control
What You Should Know About Safe Chain Saw Operation

PEST INFORMATION AND STRATEGY SELECTION

Pests: An Introduction To Their Identification

LAWNS

Quick Pest Reference Guide

INSECTS

DISEASES

WEEDS

VERTEBRATES

PLANT SELECTION

PLANT MANAGEMENT

FLOWERS

VEGETABLE GARDENS

Quick Pest Reference Guide

INSECTS

DISEASES

ENVIRONMENTAL

VERTEBRATES

CHEMICAL PEST CONTROL

SMALL FRUITS

SHRUBS

FRUIT TREES

NUT TREES

ORNAMENTAL/SHADE TREES

Quick Pest Reference Guide

INSECTS

DISEASES

ENVIRONMENTAL

VERTEBRATES

PLANT SELECTION

PLANT MANAGEMENT

CHEMICAL PEST CONTROL

APPENDIX

PLANT SELECTION

PLANT MANAGEMENT

BIOLOGICAL PEST CONTROL

TC-4

IDENTIFICATION
REFERENCE MATERIAL

GLOSSARY

MISCELLANEOUS

APPENDIX B

**The Pest Management Manual
Owner's Survey Questionnaire**

project PEST's

PEST MANAGEMENT MANUAL OWNER'S SURVEY



Project PEST is co-sponsored by The Liaison for Inter-Neighborhood Cooperation (LINC) and Michigan State University, Departments of Resource Development, Entomology and Forestry.

**Project PEST'S
Pest Management Manual Owner's Survey**

This questionnaire deals with the current status of the Pest Management Manual. It is organized into four sections:

- A HANDLING PEST PROBLEMS IN THE YARD**
- B REACTIONS TO HANDLING PEST PROBLEMS IN THE YARD**
- C THE PEST MANAGEMENT MANUAL**
- D BACKGROUND INFORMATION**

The following definitions are given to help in answering the questions:

Pest: Any insect, disease, animal, weed, or other living thing that you believe has caused problems on the plants in your yard.

Pesticides: Chemical substances used to control, destroy, or prevent damage from pests.

Alternatives to pesticides: Non-chemical/pesticidal substances or means to control, destroy, or prevent damage from pests.

SECTION A HANDLING PEST PROBLEMS IN THE YARD

First, we would like to ask you several questions about pest problems you have had and methods you used to handle them.

Q-1 Thinking back over this year and last, did you have pest problems that required management on any of the plant groups listed below? (Circle numbers that apply)

- 1 ORNAMENTAL/SHADE TREES
- 2 FRUIT TREES
- 3 SHRUBS
- 4 FLOWERS
- 5 LAWN
- 6 VEGETABLE GARDEN
- 7 OTHER (specify) _____

Q-2 For the plant groups circled in Q-1, please estimate the percentage of time you used pesticides, alternatives to pesticides, or took no action when handling pest problems on those plants.

Percentage of time you used:				
	Pesticides	+	Alternatives	+
				Took No Action = 100%
1 ORNAMENTAL/SHADE TREES . . .	_____	+	_____	+
2 FRUIT TREES	_____	+	_____	+
3 SHRUBS	_____	+	_____	+
4 FLOWERS	_____	+	_____	+
5 LAWN	_____	+	_____	+
6 VEGETABLE GARDEN	_____	+	_____	+
7 OTHER (specify) _____	_____	+	_____	+
				= 100%

2

Q-3 From the list below please select those activities or sources you normally use to obtain information on handling pest problems and indicate how frequently you use them.

		Frequency of Use (Circle numbers that apply)	
		FREQUENTLY	SOMETIMES
Printed material from:			
1	BOOKS	1	2
2	MAGAZINES	1	2
3	NEWSPAPERS	1	2
4	PAMPHLETS/MANUALS	1	2
5	PACKAGE/CONTAINER LABELS	1	2
Watching or listening to:			
6	RADIO	1	2
7	TELEVISION	1	2
Conversations with:			
8	COOPERATIVE EXTENSION SERVICE PERSONNEL	1	2
9	GARDEN STORE PERSONNEL	1	2
10	TREE/LAWN/LANDSCAPE SERVICE PERSONNEL	1	2
11	FRIENDS/NEIGHBORS	1	2

(PLEASE CONTINUE)

SECTION B REACTIONS TO HANDLING PEST PROBLEMS IN THE YARD

In this section we would like to get your reactions to several topics regarding handling pest problems in your yard. The instructions below apply for completing questions 4, 5, and 6.

Instructions

We would like you to indicate your reactions or feelings toward the topic at the top of the page as they relate to a list of word pairs found beneath it. Each pair is separated by 7 lines. To indicate your reaction, place an "X" on one of the lines for each word pair according to the following guidelines:

1 2 3 4 5 6 7

Example word pair: GOOD ____: ____: ____: ____: ____: ____: ____ BAD

- If you feel the topic is:
- a. very closely related to either word, place an "X" on line 1 or 7;
 - b. quite closely related to either word, place an "X" on line 2 or 6;
 - c. only slightly related to either word, place an "X" on line 3 or 5;
 - d. neutral, completely irrelevant, or equally associated with either word, place an "X" on line 4.

Even though some word pairs may be the same for different topics, do not try to remember how you checked others. You need not worry or puzzle over individual word pairs - it is your first reaction or feeling to each pair as it relates to the topic that is important.

Also: Please be sure to register your reaction for all word pairs under each topic - do not omit any.
Place an "X" on one line only for each word pair.

4

Q-4 Please indicate your reactions or feelings toward the following topic. (Directions on page 3)

HANDLING PEST PROBLEMS ON THE PLANTS IN MY YARD

[illegible]

Q-5 Please indicate your reactions or feelings toward the following topic. (Directions on page 3)

USING PESTICIDES AS A WAY TO HANDLE PEST PROBLEMS IN MY YARD

	1	2	3	4	5	6	7	
USEFUL	___	:	___	:	___	:	___	USELESS
WORTHLESS	___	:	___	:	___	:	___	VALUABLE
REPULSIVE	___	:	___	:	___	:	___	ATTRACTIVE
SUPERIOR	___	:	___	:	___	:	___	INFERIOR
NEGATIVE	___	:	___	:	___	:	___	POSITIVE
BENEFICIAL	___	:	___	:	___	:	___	HARMFUL
SUCCESSFUL	___	:	___	:	___	:	___	UNSUCCESSFUL
UNIMPORTANT	___	:	___	:	___	:	___	IMPORTANT
CERTAIN RESULTS	___	:	___	:	___	:	___	UNCERTAIN RESULTS
UNDER RECOMMENDED	___	:	___	:	___	:	___	OVER RECOMMENDED
BUNGLING	___	:	___	:	___	:	___	SKILLFUL
DANGERS UNDERPLAYED	___	:	___	:	___	:	___	DANGERS OVERPLAYED
UNWARRANTED	___	:	___	:	___	:	___	WARRANTED
WISE	___	:	___	:	___	:	___	FOOLISH
INCONVENIENT	___	:	___	:	___	:	___	CONVENIENT
SUFFICIENT	___	:	___	:	___	:	___	INSUFFICIENT
DANGEROUS	___	:	___	:	___	:	___	SAFE
SKEPTICAL	___	:	___	:	___	:	___	BELIEVABLE
SIMPLE	___	:	___	:	___	:	___	COMPLEX
DISLIKE	___	:	___	:	___	:	___	LIKE

6

Q-6 Please indicate your reactions or feelings toward the following topic. (Directions on page 3)

**USING ALTERNATIVES TO PESTICIDES
AS A WAY TO HANDLE PEST PROBLEMS IN MY YARD**

	1	2	3	4	5	6	7	
WARRANTED	___	___	___	___	___	___	___	UNWARRANTED
DANGERS OVERPLAYED	___	___	___	___	___	___	___	DANGERS UNDERPLAYED
SUCCESSFUL	___	___	___	___	___	___	___	UNSUCCESSFUL
INFERIOR	___	___	___	___	___	___	___	SUPERIOR
NEGATIVE	___	___	___	___	___	___	___	POSITIVE
CONVENIENT	___	___	___	___	___	___	___	INCONVENIENT
DISLIKE	___	___	___	___	___	___	___	LIKE
DANGEROUS	___	___	___	___	___	___	___	SAFE
SIMPLE	___	___	___	___	___	___	___	COMPLEX
ATTRACTIVE	___	___	___	___	___	___	___	REPULSIVE
BUNGLING	___	___	___	___	___	___	___	SKILLFUL
SUFFICIENT	___	___	___	___	___	___	___	INSUFFICIENT
BELIEVABLE	___	___	___	___	___	___	___	SKEPTICAL
WORTHLESS	___	___	___	___	___	___	___	VALUABLE
BENEFICIAL	___	___	___	___	___	___	___	HARMFUL
FOOLISH	___	___	___	___	___	___	___	WISE
USEFUL	___	___	___	___	___	___	___	USELESS
CERTAIN RESULTS	___	___	___	___	___	___	___	UNCERTAIN RESULTS
UNIMPORTANT	___	___	___	___	___	___	___	IMPORTANT
UNDER RECOMMENDED	___	___	___	___	___	___	___	OVER RECOMMENDED

SECTION C THE PEST MANAGEMENT MANUAL

Now we would like to ask you some questions about the Pest Management Manual. Even if you have not had a chance to read or use the manual you will still be able to answer a number of the questions in this section, providing much useful information. Questions in this section are organized into two parts:

PART 1 - PURCHASE AND USE INFORMATION PART 2 - REACTIONS TO THE MANUAL

PART 1 - PURCHASE AND USE INFORMATION

Q-7 How did you first hear about the manual being available for sale? (Circle one number)

- 1 NEWSPAPER ARTICLE/ANNOUNCEMENT
- 2 RADIO ANNOUNCEMENT
- 3 MAIL ANNOUNCEMENT
- 4 AT A PROJECT PEST "WALKING TOUR"
- 5 AT THE MERIDIAN MUNICIPAL BUILDING/AREA LIBRARIES
- 6 FROM A FRIEND/NEIGHBOR
- 7 OTHER (specify) _____

Q-8 When did you purchase or receive the manual? (Circle number)

- 1 1981
- 2 1982

Q-9 Please select the one statement that most nearly describes your reason for purchasing the manual. (Circle number)

- 1 I HEARD ABOUT THE MANUAL AND THOUGHT IT WOULD BE USEFUL.
- 2 I WAS INTERESTED IN THE INFORMATION AND HOW I COULD USE IT IN MY YARD.
- 3 I AM ALWAYS ON THE LOOK-OUT FOR PEST CONTROL PUBLICATIONS AND DECIDED IT WOULD BE USEFUL TO HAVE.
- 4 I DIDN'T PURCHASE THE MANUAL. IT WAS GIVEN TO ME AS A GIFT.

Q-10 Have you read any parts of the manual? (Circle number)

- 1 YES
- 2 NO

↳ Could you briefly explain why?

PLEASE SKIP TO
SECTION D ON
PAGE 16

8

Q-11 The manual contains a large amount of information on a variety of topics. When first reading the manual you may have come upon both new and old information. For those items below, which you have read about, please indicate whether they represented mostly new or old information for you. (Please respond only to those items you have read about in the manual)

Information in the Manual	Type of Information (Circle numbers that apply)	
	NEW INFORMATION	OLD INFORMATION
1 THE PROBLEMS WITH PESTICIDES (In "Manual Focus" section)	1	2
2 THE PRINCIPLES AND OBJECTIVES OF INTEGRATED PEST MANAGEMENT (IPM) (In "Manual Focus" section)	1	2
3 PREVENTING PEST PROBLEMS THROUGH PROPER PLANT SELECTION AND CARE (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
4 MONITORING ACTIVITIES (In "Monitoring/Records" section)	1	2
5 IDENTIFYING PESTS AND PEST PROBLEMS (In "Pest Information and Strategy Selection", "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
6 BENEFICIAL ORGANISMS AND THEIR IDENTIFICATION (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
7 DECIDING IF AND WHEN TO USE MANAGEMENT TECHNIQUES (In "Monitoring/Records" section)	1	2
8 THE GENERAL CATEGORIES OF MANAGEMENT TECHNIQUES AND GUIDELINES FOR THEIR SELECTION (In "Management Techniques" section)	1	2
9 THE DIFFERENT TYPES OF ALTERNATIVES TO PESTICIDES AND HOW TO USE THEM (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
10 THE DIFFERENT TYPES OF PESTICIDES AND METHODS FOR THEIR SAFE USE (In "Safety", "Lawns", "Vegetable Gardens" and "Ornamental/Shade Trees" sections)	1	2
11 OTHER (specify) _____	1	2
12 OTHER (specify) _____	1	2
13 OTHER (specify) _____	1	2

Q-12 Are you currently applying any practices from the manual to help handle pest problems in your yard? (Circle number)

1 YES

2 NO

PLEASE CONTINUE WITH
Q-13 ON THE NEXT PAGE

Could you briefly explain why?

PLEASE SKIP TO
PART 2 ON
PAGE 12

10

Q-13 The manual also contains many practices to help handle pest problems in the yard. You may have considered some, or all, of these practices to be new or old. For those practices below, which you now regularly use, please indicate whether they represent mostly a new or old practice for you. (Please respond only to those practices that you use from the manual)

Practices in the Manual	Type of Practice (Circle numbers that apply)	
	NEW PRACTICE	OLD PRACTICE
1 PREVENTING PEST PROBLEMS THROUGH PROPER PLANT SELECTION AND CARE (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
2 MONITORING PLANTS IN THE YARD (In "Monitoring/Records" section)	1	2
3 IDENTIFYING PESTS AND PEST PROBLEMS (In "Pest Information and Strategy Selection", "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
4 IDENTIFYING BENEFICIAL ORGANISMS (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
5 DECIDING IF AND WHEN TO USE MANAGEMENT TECHNIQUES (From INJURY ACCEPTANCE LEVELS chart in "Monitoring/Records" section)	1	2
6 USING GUIDELINES TO SELECT MANAGEMENT TECHNIQUES (In "Management Techniques" section)	1	2
7 SELECTING AND PROPERLY APPLYING ALTERNATIVES TO PESTICIDES (In "Lawns", "Vegetable Gardens", "Ornamental/ Shade Trees" and "Appendix" sections)	1	2
8 SELECTING AND PROPERLY APPLYING "APPROPRIATE" PESTICIDES (In "Safety", "Lawns", "Vegetable Gardens" and "Ornamental/Shade Trees" sections)	1	2
9 HANDLING PESTICIDES SAFELY (In "Safety" section)	1	2
10 EVALUATING YOUR PEST MANAGEMENT ACTIONS (In "Monitoring/Records" section)	1	2
11 OTHER (specify) _____	1	2
12 OTHER (specify) _____	1	2
13 OTHER (specify) _____	1	2

Q-14 Considering all practices indicated in Q-13 and the plant groups on which you are currently applying them, how satisfied are you with the results?

Satisfaction with results (Circle numbers that apply)					
VERY SATISFIED	SATISFIED	DON'T KNOW	SLIGHTLY SATISFIED	NOT SATISFIED AT ALL	
1 ORNAMENTAL/SHADE TREES . . .	1	2	3	4	5
2 FRUIT TREES	1	2	3	4	5
3 SHRUBS	1	2	3	4	5
4 FLOWERS	1	2	3	4	5
5 LAWN	1	2	3	4	5
6 VEGETABLE GARDEN	1	2	3	4	5
7 OTHER (specify) _____ . .	1	2	3	4	5

(PLEASE CONTINUE)

12

PART 2 - REACTIONS TO THE MANUAL

Now we would like to get your reactions to several topics regarding the Pest Management Manual. Question 15 and 16 are presented in the same format as questions 4, 5, and 6. Please indicate your reactions or feelings toward each topic as they relate to the list of word pairs found beneath it. You may want to refer back to the Instructions on page 3 before doing so.

Also: Please be sure to register your reaction for all word pairs under each topic - do not omit any.
Place an "X" on one line only for each word pair.

Q-15 Please indicate your reactions or feelings toward the following topic. (Directions on page 3)

THE MANUAL AS A MEANS FOR PRESENTING PEST MANAGEMENT INFORMATION

	1	2	3	4	5	6	7	
USEFUL	___	___	___	___	___	___	___	USELESS
TOO SMALL	___	___	___	___	___	___	___	TOO LARGE
ILLUSTRATIONS ARE MEANINGFUL	___	___	___	___	___	___	___	ILLUSTRATIONS ARE MEANINGLESS
EASY TO USE	___	___	___	___	___	___	___	DIFFICULT TO USE
DISAPPROVE	___	___	___	___	___	___	___	APPROVE
LANGUAGE IS SIMPLE	___	___	___	___	___	___	___	LANGUAGE IS COMPLEX
HELPFUL	___	___	___	___	___	___	___	HINDERING
DIFFICULT TO LOCATE INFORMATION	___	___	___	___	___	___	___	EASY TO LOCATE INFORMATION
SUFFICIENT	___	___	___	___	___	___	___	INSUFFICIENT
MATERIAL IS ORGANIZED	___	___	___	___	___	___	___	MATERIAL IS UNORGANIZED
CONTAINS TOO MUCH INFORMATION	___	___	___	___	___	___	___	CONTAINS TOO LITTLE INFORMATION
TOO PLAIN	___	___	___	___	___	___	___	TOO ORNATE
SUPERIOR TO OTHER PUBLICATIONS	___	___	___	___	___	___	___	INFERIOR TO OTHER PUBLICATIONS
DIFFICULT TO UNDERSTAND	___	___	___	___	___	___	___	EASY TO UNDERSTAND
RUGGED	___	___	___	___	___	___	___	DELICATE
TOO MUCH DETAIL	___	___	___	___	___	___	___	TOO LITTLE DETAIL

Q-16 Please indicate your reactions or feelings toward the following topic. (Directions on page 3)

**THE PEST MANAGEMENT INFORMATION AND PRACTICES
CONTAINED IN THE MANUAL**

	1	2	3	4	5	6	7	
LABORIOUS WAY TO HANDLE PEST PROBLEMS	___	___	___	___	___	___	___	EFFORTLESS WAY TO HANDLE PEST PROBLEMS
POSITIVE	___	___	___	___	___	___	___	NEGATIVE
SIMILAR TO WHAT I'VE DONE IN THE PAST	___	___	___	___	___	___	___	UNLIKE WHAT I'VE DONE IN THE PAST
LARGE AMOUNT OF RISK INVOLVED	___	___	___	___	___	___	___	SMALL AMOUNT OF RISK INVOLVED
EASY TO APPLY IN THE YARD	___	___	___	___	___	___	___	DIFFICULT TO APPLY IN THE YARD
SKEPTICAL	___	___	___	___	___	___	___	BELIEVABLE
POSSIBLE TO TRY ON A SMALL SCALE	___	___	___	___	___	___	___	IMPOSSIBLE TO TRY ON A SMALL SCALE
HINDERING	___	___	___	___	___	___	___	HELPFUL
BENEFITS APPARENT	___	___	___	___	___	___	___	BENEFITS UNAPPARENT
COMPATIBLE WITH MY FEELINGS ABOUT PEST CONTROL	___	___	___	___	___	___	___	INCOMPATIBLE WITH MY FEELINGS ABOUT PEST CONTROL
COMPLEX	___	___	___	___	___	___	___	SIMPLE
GIVES GOOD RESULTS	___	___	___	___	___	___	___	GIVES BAD RESULTS
DISAPPROVE	___	___	___	___	___	___	___	APPROVE
EASY TO UNDERSTAND	___	___	___	___	___	___	___	DIFFICULT TO UNDERSTAND
USELESS	___	___	___	___	___	___	___	USEFUL
MEANINGFUL	___	___	___	___	___	___	___	MEANINGLESS
INCOMPLETE	___	___	___	___	___	___	___	COMPLETE
RESULTS EASY TO SEE	___	___	___	___	___	___	___	RESULTS DIFFICULT TO SEE

14

Q-17 The approach presented in the manual for handling pest problems in the yard is called Integrated Pest Management (IPM). Were you familiar in any way with IPM before purchasing or receiving the manual? (Circle number)

- 1 NO
- 2 YES

→ Please select the one statement that best describes your familiarity with IPM before purchasing or receiving the manual. (Circle number)

- 1 I WAS VERY FAMILIAR WITH IPM
- 2 I WAS SOMEWHAT FAMILIAR WITH IPM
- 3 I HAD HEARD ABOUT IPM BUT DIDN'T REALLY KNOW WHAT IT MEANT

Q-18 Would you say that the manual has changed your thinking about handling pest problems in your yard. (Circle number)

- 1 VERY MUCH SO
- 2 SOMEWHAT
- 3 TO A SMALL DEGREE
- 4 NOT AT ALL

If you care to, please comment on your answer.

Q-19 Would you say that the manual has changed the way you handle pest problems in your yard? (Circle number)

- 1 VERY MUCH SO
- 2 SOMEWHAT
- 3 TO A SMALL DEGREE
- 4 NOT AT ALL

If you care to, please comment on your answer

Q-20 Have you recommended the manual to other people? (Circle number)

- 1 NO
2 YES

→ To whom?

Q-21 Would you like to see additional information added to the manual? (Circle number)

- 1 NO
2 YES

→ What type of information would you like to see added?

Q-22 What did you like best about the manual?

Q-23 What did you like least about the manual?

16

SECTION D BACKGROUND INFORMATION

Finally, we would like to ask you several background questions about yourself to help interpret the results. All information is strictly confidential and will never be identified with your name.

Q-24 Your present age: _____ YEARS

Q-25 Are you presently: (Circle number)

- 1 EMPLOYED
- 2 UNEMPLOYED
- 3 RETIRED
- 4 FULL-TIME HOMEMAKER

Q-26 Please describe your usual occupation. (If retired, describe the usual occupation before retirement.)

TITLE: _____

KIND OF WORK YOU DO: _____

Q-27 What is your family income bracket (before taxes)? (Circle number)

- | | |
|----------------------|--------------------|
| 1 LESS THAN \$10,000 | 7 35,000 - 39,999 |
| 2 10,000 - 14,999 | 8 40,000 - 44,999 |
| 3 15,000 - 19,999 | 9 45,000 - 49,999 |
| 4 20,000 - 24,999 | 10 50,000 - 54,999 |
| 5 25,000 - 29,999 | 11 55,000 - 60,000 |
| 6 30,000 - 34,999 | 12 OVER \$60,000 |

Q-28 Which is your highest level of education? (Circle number)

- 1 SOME GRADE SCHOOL (Grades 1 to 8)
- 2 COMPLETED GRADE SCHOOL
- 3 SOME HIGH SCHOOL (Grades 9 to 12)
- 4 COMPLETED HIGH SCHOOL
- 5 SOME COLLEGE
- 6 COMPLETED COLLEGE
- 7 TECHNICAL/TRADE SCHOOL
- 8 SOME GRADUATE WORK
- 9 COMPLETED A GRADUATE DEGREE

Q-29 Please indicate any of the following Project PEST activities that you have participated in. (Circle numbers that apply)

- 1 ATTENDED THE PROJECT "KICKOFF" MEETING (Meridian Municipal Building, November, 1979)
- 2 PARTICIPATED AS A PROJECT COMMITTEE MEMBER
- 3 PARTICIPATED AS A PROJECT VOLUNTEER (Distributed and Collected Project Survey Questionnaire, March, 1980)
- 4 RECEIVED A COPY OF THE PROJECT QUESTIONNAIRE (Survey of Pest Problems in the Yard, March, 1980)
- 5 ATTENDED THE AUGUST 1980 "WALKING TOUR" (Michigan State University Campus)
- 6 ATTENDED THE AUGUST 1981 "WALKING TOURS" (Michigan State University Campus)
- 7 NOT APPLICABLE

APPENDIX C

Cover Letter and First and Second Reminder
Letters Used in the Pest Management
Manual Owner's Survey

Cover Letter

"project pest:"

alternative approaches to urban pest management

DEPARTMENT OF RESOURCE DEVELOPMENT, 885 NATURAL RESOURCES BUILDING,
MICHIGAN STATE UNIVERSITY, E. LANSING, MI 48824 (313) 353-6787

Liz Leistikow
6247 Endenhall
East Lansing, MI 48823

October 6, 1982

Pest Management Manual Owner's Survey

Purpose of the Survey

As you may know, the idea for your Pest Management Manual came from Project PEST's original township-wide pest control survey conducted in March, 1980. In that survey, a large number of homeowners indicated that a manual would be a preferred way to obtain information that would assist them with their pest control problems. The Pest Management Manual was written to meet this need, but since its completion we have not had the opportunity to learn whether it has been useful for homeowners like yourself. Because you are a manual owner, we would like you to share your opinions by completing the enclosed Pest Management Manual Owner's Survey.

How to Help

We would like you to either complete the questionnaire yourself, or have a family member most familiar with the manual fill it out. In case you have not had a chance to read or use the manual, we want to assure you that there are a number of questions you can answer that will provide us with much useful information. In appreciation for your help we have enclosed several publications that you may wish to add to your manual.

Please be assured that your responses will be held in the strictest confidence. All results will be used collectively (not individually) to insure your personal privacy. You may have noticed that the questionnaire has an identification number; this is for mailing purposes only. Your name will never be placed on the questionnaire or its results.

How to Return the Questionnaire

Our questionnaire will probably take about 30 minutes to complete. Please fill the questionnaire in, place it in the return envelope, and drop it in the mail no later than October 13, 1982. If you would like a copy of the results, simply write "copy of results" on the back of the return envelope and print your name and address below it. Please do not put this information on the questionnaire itself.

We would like to thank you in advance and to encourage you to call us if you have any questions at 353-6787 (8:00 a.m. to 5:00 p.m. Monday through Friday).

Sincerely,

Michael Lambur

Michael Lambur
Project Coordinator



A MERIDIAN TOWNSHIP FEDERATED HOMEOWNERS ASSOCIATION

DEPARTMENT OF ENTOMOLOGY, RESOURCE DEVELOPMENT & FORESTRY

First Reminder Letter

"project pest:"**alternative approaches to urban pest management**

DEPARTMENT OF RESOURCE DEVELOPMENT, 303 NATURAL RESOURCES BUILDING,
MICHIGAN STATE UNIVERSITY, E LANSING, MI 48824 (517) 353-6787

October 18, 1982

Dear Manual Owner,

Just recently a questionnaire seeking your opinion about Project PEST's Pest Management Manual was mailed to you. If you have already completed and returned it please accept our sincere thanks. If not, please do so today.

Since completion of the manual we have not had the opportunity to learn whether it has been useful for homeowners like yourself. Therefore your response is extremely important so that the results will accurately reflect the opinions of manual owners. Even if you have not had a chance to read or use the manual, we want to assure you that there are a number of questions you can answer that will provide us with much useful information.

If by some chance you did not receive the questionnaire, or it was misplaced, please call me at 353-6787 (8:00 a.m. to 5:00 p.m. Monday through Friday) and I will put one in the mail for you.

Sincerely,

Michael Lambur

Michael Lambur
Project Coordinator

ML/sw

DEPARTMENTS OF ENTOMOLOGY, RESOURCE DEVELOPMENT & FORESTRY



A MERIDIAN TOWNSHIP FEDERATED HOMEOWNERS ASSOCIATION

Second Reminder Letter

"project pest:"**alternative approaches to urban pest management**

DEPARTMENT OF RESOURCE DEVELOPMENT, 225 NATURAL RESOURCES BUILDING,
MICHIGAN STATE UNIVERSITY, E. LANSING, MI 48824 (313) 487-0707

November 1, 1982

Dear Manual Owner,

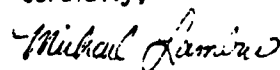
Last month I wrote to you seeking your opinion on Project PEST's Pest Management Manual. As of today we have not yet received your completed questionnaire.

I am writing to you again because of the significance each questionnaire has to this study. Because the manual was written to assist homeowners with their pest control problems, it is important that the opinions of each manual owner be registered for the study results to be truly representative. Even if you have not had a chance to read or use the manual, there are still a number of items in the questionnaire you can answer that will provide us with much useful information. As mentioned in our previous letter, we need you to either complete the questionnaire yourself, or have a family member most familiar with the manual fill it out.

In the event that your questionnaire has been misplaced, a replacement is enclosed.

Your cooperation is greatly appreciated.

Cordially,



Michael Lambur
Project Coordinator



A MERIDIAN TOWNSHIP FEDERATED HOMEOWNERS ASSOCIATION



DEPARTMENT OF ENTOMOLOGY, RESOURCE DEVELOPMENT & FORESTRY

APPENDIX D

The Procedure Used for Deleting Scale Items From Semantic Differentials

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The Procedure Used for Deleting Scale Items From Semantic Differentials

The procedure used for deleting scale items from each of the five semantic differentials involved the analysis of the interitem covariation. This widely used procedure is based on the rationale that "If respondents who agree with one statement also tend to agree with another statement, one concludes that the two statements are indicators of a common underlying attitude" (Piazza 1980:587). The specific measure of covariation used was the Pearson product-moment correlation coefficient. Where the coefficient between two scale items was high and positive, and they appeared to go together on logical grounds, one of them was considered for deletion. The procedure is outlined in the following steps.

Step 1: Since the pre-test was based on a sample size of only nine, it was acknowledged that the degree to which these sample correlation coefficients represented dependable estimates of their population parameters was suspect. To alleviate this problem, only those coefficients that were significant at the .05 level (for $n = 9$) were considered. In essence then, each coefficient was tested against the null hypothesis that the population r was in fact zero. If the computed r was large enough to reject the null hypothesis, then that particular r was accepted as indicating the presence of at least some

degree of correlation. Since significant r values are readily available in statistic texts, this step was carried out by simply comparing the computed coefficients with a table value. Thus, the significant value for r at .05 with a sample size of nine was .666 (Garrett and Woodworth 1960:201); only those coefficients that exceeded this value were considered in the subsequent analysis.

Step 2: The correlation matrix produced in the reliability analysis was used to obtain a list of significant coefficients and corresponding scale items for each semantic differential. The total number of significant coefficients for each differential were:

1. Handling pest problems on plants in the yard = 28
2. Using pesticides in the yard = 25
3. Using alternatives to pesticides in the yard = 41
4. Software component of the manual = 48
5. Hardware component of the manual = 17

All items were examined and where two items were judged to be measuring the same dimension, one was deleted. In some cases, however, an item was deleted solely on intuitive grounds. The scale items from each differential are presented in Table D.1.

Table D.1. Scale items deleted from semantic differentials

Semantic differential	Scale items acted upon*	r	Scale item deleted
Handling pest problems on plants in the yard	Soothing/Pleasurable	.892	Soothing
	Relaxing/Pleasurable	.798	Relaxing
	Pleasant/Attractive	.813	Pleasant
	Curious/Interesting	.889	Curious
	Useful/Important	--	Useful [†]
Using pesticides/alternatives to pesticides in the yard	Necessary/Warranted	.902/.737 ^{††}	Necessary
	Easy/Convenient	.890/.741	Easy
	Good results/Successful	.949/.762	Good results
	Meaningful/Useful	- /.725	Meaningful
	Inexpensive/ --	--	Inexpensive [†]
Software component of the manual	Valuable/Helpful	.906	Valuable
	Clear/Easy to understand	.781	Clear
	Convenient way to handle pest problems/Easy to apply in the yard	.728	Convenient
	Superior/Gives good results	.844	Superior
	Easy to apply/Easy to apply in the yard	--	Easy to apply [†]
	Beneficial/Benefits apparent	--	Beneficial [†]
Hardware component of the manual	Too long/Contains too much information	.858	Too long
	Tough/Rugged	--	Tough [†]

*Listed by their positive adjective or phrase only.

[†]Deleted solely on intuitive grounds.^{††}r for pesticide differential/r for alternatives differential.

APPENDIX E

Survey Results for Manual Non-Users

APPENDIX E

Survey Results for Manual Non-Users

Individual Characteristics

Socioeconomic Characteristics

1. Age:	<u>Age</u>	<u>n</u>
	25	1
	35	1
	38	1
	72	1

2. Education:	<u>Education level</u>	<u>n</u>
	Completed college	2
	Some graduate work	1
	Completed a graduate degree	1

3. Socioeconomic status:	<u>SES Score</u>	<u>SES Class</u>	<u>n</u>
	11	I (high)	1
	15	I	1
	50	IV (low)	1
	57	IV	1

4. Income:	<u>Income level</u>	<u>n</u>
	Less than \$10,000	1
	30,000 - 34,999	1
	50,000 - 54,999	1

5. Employment status:	<u>Employment status</u>	<u>n</u>
	Employed	3
	Full-time homemaker	1

Personality Characteristics

6. Attitude toward handling pest problems in the yard:	<u>Attitude score</u>	<u>n</u>
	72	1
	77 } slightly negative	1
	90 } positive	1
	107 } positive	1

7. Attitude toward using pesticides to handle pest problems in the yard:

Attitude score	n
49 } negative	1
68 } negative	1
83 ~ neutral	1
99 - positive	1

8. Attitude toward using alternatives to pesticides to handle pest problems in the yard:

Attitude score	n
90 } positive	1
107 } positive	1
116 } positive	1

Communication Behavior

9. Sources of information used for managing pest problems:

Information source	Frequency of use		
	Frequently	Sometimes	Not used
Books	2	...	2
Magazines	1	...	3
Newspapers	...	1	3
Pamphlets/manuals	1	...	3
Package/container labels	1	1	2
Radio	...	1	3
Television	...	2	2
Cooperative extension service personnel	...	4	...
Garden store personnel	...	1	3
Tree/lawn/landscape personnel	1	...	3
Friends/neighbors	1	1	2

10. Index of communication behavior scores:

Score	n
2 } low	1
3 } low	1
9 } medium	1
11 } medium	1

Problem vs. Innovation Orientation

11. Why respondents purchased the manual:

Reason (orientation)	n
Heard about the manual and thought it would be useful (innovation)	1
Interested in the information and how it could be used in the yard (problem)	2
Received as a gift (not applicable)	1

Communication Channels

12. How respondents first heard about the manual being available for sale:

Communication source	n
Newspaper article/announcement	2
Mail announcement	1
At a Project PEST "Walking Tour"	1

13. When respondents purchased the manual:

Year	n
1981	3
1982	1

Descriptive Characteristics

14. Plant groups on which pest problems occurred and how they were managed:

Plant group	Pest problems		Management method (%)		
	Yes	No	Pesticides	Alternatives	No action
Ornamental/ shade trees	1	3	100.0	0.0	0.0
Fruit trees	1	3	30.0	0.0	70.0
Shrubs	2	2	0.0	100.0	0.0
Flowers	1	3	0.0	0.0	0.0
Lawn	1	3	0.0	100.0	0.0
Vegetable garden	1	3	0.0	100.0	0.0

15. Participation in Project PEST activities:

Activity	n
Attended the 1981 "Walking Tour"	1
No involvement	3

APPENDIX F

Additional Multiple Regression Analysis Results

Table F.1. Final unstandardized regression coefficients for the 20 independent variables

Step	Variable entered	Coefficient (B)	Significance* (α)
1	Problem vs. innovation orientation	96.4697	.098
2	Socioeconomic status	-4.8216	.189
3	Software trialability	78.6069	.028
4	Hardware relative advantage	19.0485	.249
5	Index of communication behavior	11.5103	.105
6	Software compatibility	-45.9563	.087
7	Age	0.8362	.708
8	Pesticides attitude	3.1697	.072
9	Handling pest problems attitude	-1.3873	.380
10	Alternatives to pesticides attitude	9.5287	.008
11	Familiarity with IPM	135.7975	.037
12	Hardware complexity	42.1851	.013
13	Hardware attitude	-32.3716	.021
14	Hardware appearance	51.9598	.028
15	Hardware durability	65.4248	.082
16	Education	27.7927	.263
17	Software relative advantage	-3.4373	.822
18	Software complexity	14.9282	.490
19	Software attitude	-4.4782	.627
20	Software observability	2.9857	.911
	Constant	-1033.7991	.116

*Based on an F ratio.

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