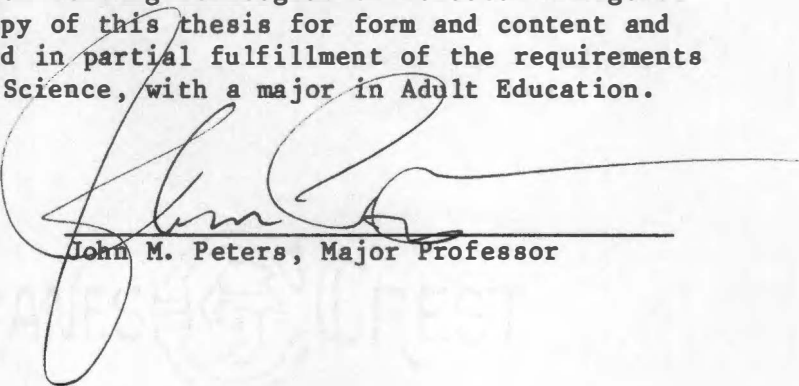


To the Graduate Council:

I am submitting herewith a thesis written by Carl James Ihlenfeld II entitled "Problem Solving Strategies of Selected Managers." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Adult Education.



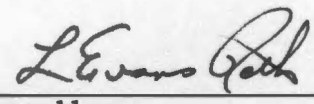
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Vice Chancellor
Graduate Studies and Research

**PROBLEM SOLVING STRATEGIES
OF SELECTED MANAGERS**

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Carl James Ihlenfeld II

December 1982

3065103

DEDICATION

This thesis is lovingly dedicated to my wife Elaine. Without her patience, understanding and encouragement I could not have completed this long and often frustrating project.

CRANES & CREST

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ABSTRACT

The purposes of this study were (1) to describe the problem-solving steps followed by selected managers; (2) to examine the reasons supporting problem solving behavior; and (3) to compare the managers' problem-solving processes with selected models of problem solving. Managers from metropolitan Knoxville and Johnson City, Tennessee, were chosen using non-random methods of selection. Twelve individuals were selected for study. Criteria for selection were based on job title and job description.

Personal interviews by the researcher were the primary means of data collection. The interviews were tape recorded and later transcribed verbatim. Transcripts were then submitted to a method of analysis known as ACTS analysis, which was developed for this purpose by a team of researchers engaged in a research project at the University of Tennessee sponsored by the National Institute of Education. Data from the ACTS analysis were analyzed further by frequency counts, comparisons of data within the sample, and comparisons of data with selected models of problem solving.

One major finding of the research was that past experience and external environmental influences were key determinants of problem-solving strategies and reasonings among the sample group. Other factors found to influence problem-solving processes were the problem situation, organizational policies and regulatory dictates, time and common sense.

A second major finding was that approximately one-half of the subject group appeared to follow a problem solving-process similar to one selected as a model. Additionally, many of the cases studied

contained similarities in approach to that described in a well-known work on managerial problem solving.

The overall objective of this study was not to solve a particular problem, but to explore a particular subject area and generate topics for future inquiry. A second goal was to test a new method of analysis to determine its effectiveness. The ACTS method proved to be extremely effective in eliminating extraneous information from a narrative and reducing the data to the lowest, simplest form. Its effectiveness was limited, however, in uncovering the reasonings behind behavior. Another methodology needs to be developed to accomplish this task.

It is evident from this study that much more research in the area of problem solving is required. This is especially true of the relationship between past experience and problem solving. More research into problem-solving processes is also indicated. The comparisons of the sample groups' processes with those selected as models for this study indicate strong similarities. It remains to be seen if this finding was limited to this group only or if similar results would apply to a more universal sample.

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CHAPTER I

INTRODUCTION

Purpose of Study

This study examined the problem-solving activities of managers in various organizations. The problems discussed were unsolved, on-the-job problems that had developed during the normal course of the managers' daily activities. The study was an exploratory study involving a protocol analysis technique developed specifically to analyze first-person accounts of adult problem-solving activities. The results of this study were intended to generate new questions and hypotheses about problem solving and adult learning in non-formal settings.

Background and Rationale

Research in the field of adult learning and development has provided much information about adults as learners. Knowles (1972) states that most adults enter a learning experience to better deal with life problems. Until recently, however, most research on adult learning was conducted in formal teaching/learning environments or in highly controlled laboratory environments. A few researchers (e.g., Tough, 1971; Peters and Gordon, 1974; Penland, 1978) have begun to investigate adult learning activities in "natural" settings—outside traditional classrooms and laboratories. They have discovered that most adults conduct a number of learning activities each year. Most of these projects are self-directed, number four or five each year, and average approximately one hundred hours in length. These learning projects deal

with all facets of adult life, with many focusing on the problems that arise as a part of normal everyday life.

The relationship between problem solving and learning has also been the subject of considerable research, especially in science and the professions. Reif (1981) has concluded that a close relationship exists between these two activities. Other researchers (Peters, Johnson and Lazzara, 1981; Greeno, 1981) strongly believe that learning is a product of problem solving. This relationship between learning and problem solving, and the need to study it in "natural" environments (Harre and Secord, 1973; Jenkins, 1981) emphasizes the need for further exploratory studies which will expand the data base of learning in non-formal settings.

The discipline of management presents an open field for the study of problem solving. Brightman (1980, p. 4) says, "The problem with problem solving is that no one takes it seriously. By and large, few universities or business organizations offer courses in problem solving, and what training there is, is relegated to second class citizenship." Few introductory management texts give more than cursory mention to problem solving, and then it is usually a discussion of what seems to be generally accepted as the four basic steps to solving a problem: (1) analyze the problem; (2) develop alternative solutions; (3) analyze the alternatives; and (4) select the best alternative (Scanlon, p. 14). More advanced texts and other writings in the field espouse the value of quantitative models which may be used for problem solving or the closely related activity of decision making. These models often are referred to as following the "scientific method," operations research or management science (Moore, 1970; Flippo and Munsinger, 1975).

Decision making is a closely allied activity to problem solving. According to Graham (1975), problem solving differs from decision making only slightly, in that problem solving "allows subordinates a role in defining the problem." Problem solving goes one step further than decision making, however, in that it assumes that these subordinates have important information to contribute to the definition of the problem.

What most management researchers, engaged in both quantitative and non-quantitative research, have in common is that they all focus their research on the stages of the problem-solving/decision-making process. They have neglected to look "behind" the process at the reasoning that goes on during the problem-solving process. Recent research on problem solving by cognitive scientists has emphasized the knowledge aspect of problem solving, and on how that knowledge is translated into action through reasoning (Peters, Johnson and Lazzara, 1981).

Research on Problem Solving

Early research on problem solving concentrated on the problem solver as an information processor. Like their counterparts in management, these researchers studied the problem-solving process, assuming that problem solving involved a means-end analysis for transformations to achieve a goal. Recently, however, researchers have begun to study the problem solver's understanding of problem domains, and his "constructive search" for solutions (Sacerdoti, 1977, deKleer, 1975; McDermott and Larkin, 1978).

Viewing the individual as the focal point is the basis for Harre and Secord's (1973) argument that theory and research on problem solving should concentrate on "self-directed and self-monitored behavior . . . the prototype of behavior in modern living" (p. 9). They believe that human behavior is driven by "generative mechanisms" and that behavior can be explained by identifying these mechanisms. They further believe that the main process involved in these generative mechanisms is "self-direction according to the meaning ascribed to the situation." They also argue that the best method of getting at these meanings is through first-person accounts of the subject's behavior. By analyzing these accounts, researchers should be able to uncover the reasons that guide the individual's behavior.

First-person accounts, according to Harre and Secord, should be reported in ordinary language. By using ordinary language, researchers can better describe the generative mechanisms within the individual--the beliefs, wants, desires, and rule structures that direct his actions and behavior. Additionally, these mechanisms are explained from the subject's point of view.

Focus of Present Study

The primary purpose of this study is to investigate the problem-solving strategies of a specific population of adults, namely, managers and administrators in various organizations. More specifically, the objectives are:

1. To describe the problem-solving steps followed by selected managers.
2. To examine the reasons supporting problem-solving efforts.

3. To compare managers' problem-solving processes with selected models of problem solving.

Definitions

Decision Making. The process of systematically putting together facts and experience to produce a better judgement on the part of the manager (Kepner and Tregoe, 1965).

Heuristic. An aid to discovery, especially the discovery of a solution to a problem. It can also be any aid or device or procedure used to reduce a problem solving effort (Weist, 1966).

Learning. The process by which an individual: (1) extends and masters what is already known on some subject; (2) extends and clarifies the meaning of one's own experiences; (3) tests ideas and generalizations relevant to some delimitable problems, and tests them in some more or less objectified and controlled experiences designed for the purpose (Kidd, 1959).

Manager. One who coordinates and integrates all resources of an organization (both human and technical) to accomplish specific results (Scanlon, 1973).

Problem. A deviation from some accepted standard or norm of desired performance (Kepner and Tregoe, 1965); also a concern; a question; a task to be completed; a decision to be made; a goal.

Problem Solving. A process of searching through a space of world models for a point (a solution state) or path (a plan) that satisfies an externally imposed criterion (the problem), (Sacerdoti, 1977).

Process Tracing. A method of scientific inquiry that is used to reveal a train of thought (cognitive process) that leads to a final decision or solution. This method relies on the use of retrospective reports which include having the subject describe to the researcher the process or steps that he went through when he attempted to solve or identify the solution to a problem (Svenson, 1979).

Protocol. A description of an event or happening.

Limitations of the Study

This study was subject to certain limitations. These limitations are:

1. Non-randomly selected managers of various organizations in East Tennessee were used in this study.
2. The investigation included only on-the-job problem-solving efforts of managers.
3. The study was limited by the interviewees' ability to recall problem-solving activities conducted over a two-to-three month period, and in some cases, events and activities which occurred as much as twelve months earlier.
4. The method of analysis used required subjective interpretation of data by the analyst. Therefore, discussion of data and conclusions are limited to the analyst's interpretations.
5. The subject's definitions of their problems, their problem-solving processes and underlying reasonings were limiting factors in this study.

CHAPTER II

REVIEW OF RELATED LITERATURE

In Chapter I several works in the fields of adult education, problem solving, and management were cited to present a general basis for understanding the objectives of this study. To expand on the concepts presented in Chapter I, the literature in the following areas is reviewed in this chapter:

1. Information processing, problem solving, and learning.
2. Management and managerial problem solving.
3. Naturalistic methods of research.

Information Processing, Problem Solving, and Learning

Newell and Simon (1972) conceptualize human beings as processors of information whose learning and behavior reflect the combined effects of the information processed in a given situation and the kinds of retrievable and useable information stored internally in the organism. In a given situation, an individual considers the various means by which he might progress in solving the problem. Errors in selecting the correct solution are inevitable. When this occurs, the individual refers to a finite list of rules, any one of which might bring him closer to a solution. Depending on which rule(s) he elects to follow, he will then decide such issues as what approach to take, how long to continue searching for potential solutions, and whether or not the problem needs to be restated. While this is going on, the individual periodically assesses his progress toward the desired goal (Snellbecker, 1974, p. 337-338).

Gagne (1966) has also done extensive investigation into the field of problem solving. About problem-solving research he wrote:

It is admittedly not an easy kind of behavior to study. On the one hand, it can readily evade the grasp of the experimenter with a "naturalistic" bent who may find himself cherishing a problem that practically none of his subjects can solve. On the other hand, a problem can just as easily slip away in the other direction, by becoming the kind of activity that subjects can do perfectly well, but which no one will agree should properly be called a problem (p. 128).

Gagne relates problem solving and learning by postulating that a fundamental criterion of problem solving is that a kind of performance which could not be exhibited before the "problem" was solved can be exhibited afterwards (Gagne, 1966). This implies that by solving a problem (e.g., exhibiting a new performance skill) one has learned something new. He takes this a step further, however, by theorizing that the performance, or capability acquired in problem solving, seems to be a capability of applying a rule to any number of instances. The problem solver does not have to be able to verbalize the rules but simply to apply them.

Gagne seems to support the Newell and Simon concept of the human as an information processor. He argues that a human does not react directly to physical stimuli presented to him by the problem. Instead, he believes the problem solver reacts to concepts "of which the physical objects present in the situation are simply representatives of a class" (p. 113). Like Newell and Simon, Gagne believes the individual goes through a mediation process, an internal coding of the stimuli (developing symbols). He states that if one assumes that the physical stimuli are first conceptualized (and thus that they carry information), it is then logical to assume that the next step is to process that information (p. 115.)

Hayes (1978) defines a problem as the gap which separates where one is from where one wants to be. He views problem solving as consisting of two major problem solving processes (p. 177):

1. The understand process: the procedures we use to comprehend the gap that separates us from our goals;
2. The solving process: the procedures we use to bridge the gap.

This view is very similar to Newell and Simon's concept of problem space, which is that area where all knowledge, awareness, and elements of the problem are located (Newell and Simon, 1972, p. 59-71). Like Newell and Simon, Hayes says the first step in the process is to construct an adequate internal representation of the problem. Two general principles concerning this construction process are (p. 197):

1. People attend selectively to the data presented to them.
2. People make use of several types of prior knowledge:
 - a. syntactic knowledge, or knowledge of language;
 - b. semantic knowledge, or knowledge of the world;
 - c. knowledge about specific problem types.

Both Sacerdoti and Greeno agree with Hayes as to the importance of knowledge in the problem-solving process. Sacerdoti (1977) has labeled two kinds of knowledge: (1) domain knowledge, which is the basic knowledge about the task to be accomplished; and (2) planning knowledge, which is the knowledge a problem solver develops as he plans the effect of alternative sequences of actions. He also believes that the solution for a problem becomes a simple search for action steps if the problem solver has the requisite knowledge.

Greeno (1981) also is a proponent of the knowledge/problem-solving relationship. He holds that the kind of process required for the solution of a problem depends not only on the characteristics of the problem but also on the knowledge of the problem solver. This knowledge could be any or all of the three types of knowledge described by Hayes.

Mischel (1975) identified a complex set of psychological modes which form a problem solver's cognitive/affective structure. According to Mischel, these modes comprise the base of the individual's problem-solving behavior. They are the person's beliefs, desires, goals, laws and rules which together comprise an "intentional state" for that person. An intentional state is defined as the ability of the individual to direct (have intentions concerning) his own behavior relative to some problem. The problem solver will refer to his own beliefs, desires, etc., when developing a solution to a problem. These beliefs, desires, goals, laws, and rules are a result of the individual's life-long experiences and the knowledge he has acquired. They enable him to put his own personal identity into his solutions.

Peters (1981) has developed a theory of problem solving that breaks down the process into three distinct stages. In stage one the individual searches through his own knowledge and directly related experience to determine if he has ever encountered the same, or a similar problem before, and if so applies the same, or a slightly modified solution to the problem at hand. If this solution satisfies the individual's needs, the process stops there. If not, he proceeds to stage two. This involves searching through indirectly related experiences that may be combined to produce a new solution which will meet his needs. Here again, if an appropriate solution is identified,

the process stops. If not, then, and only then, will the problem solver turn to an external source for assistance. Examples of such external sources may be books or other written material, or an individual. The knowledge and insights gained from these external sources now become part of the individual's experiences to use in the future.

Another element of Peters' theory is the effect of environmental influences on the individual's problem-solving process. At any stage in the process environmental forces may have an impact on the problem solver to the extent that they may dominate his judgement and actions, or at the very least cause him to consider factors and actions he would not deal with in other environments. These environmental influences could relate to his family, his job, friends, the weather, or any factor found in his environment.

Kolb (1976) has developed a theory of learning which in two key elements resembles Peters' three-stage theory. It is a multi-stage theory, and is heavily involved with the individual's past experiences. Kolb's theory is a four-stage learning cycle based on the individual's use of past experiences. To be an effective learner he needs four different kinds of abilities--concrete experience, reflective observation, abstract conceptualization, and active experimentation. Figure 1 is a simple diagram of Kolb's learning cycle.

Ideally, an individual should be able to follow all four stages in the learning experience, from concrete experiences to active experimentation. Such is not the case, however. It appears that these four stages are polar opposites and are found in sets of two in most people. As polar opposites, effective use of concrete experiences would

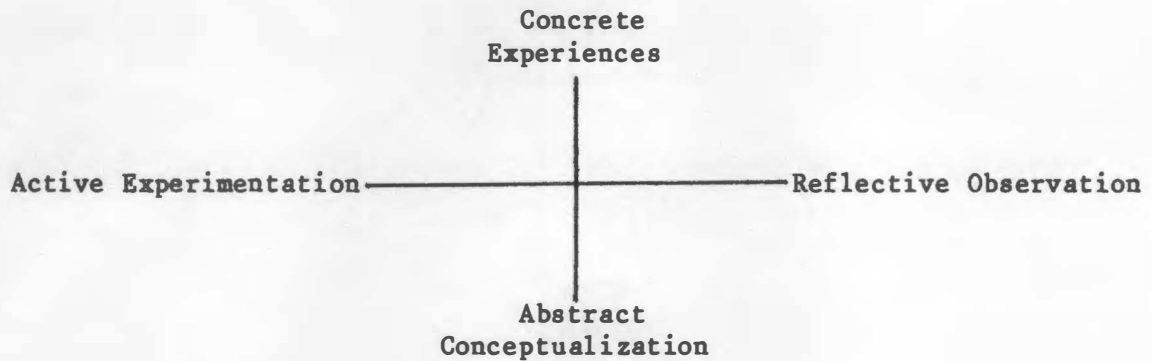


Figure 1
Kolb's Learning Cycle

not be found in an individual proficient in abstract conceptualization or vice-versa. The same is true with active experimentation and reflective observation.

In learning, the individual moves along a scale from actor to observer, from specific involvement to general analytic detachment. By combining these four learning stages, or abilities into sets of two (general to specific) Kolb has identified four dominant types of learning styles. They are the converger, the diverger, the assimilator, and the accommodator. These learning styles, when applied to individuals, can give keys to their strengths and weaknesses as managers or potential managers.

The converger's dominant learning abilities are abstract conceptualization and active experimentation. This type of individual is best at the practical application of ideas. Engineers are usually convergers. They do best in situations where there is one correct answer or solution to a question or problem.

The diverger is the opposite of the converger. His strengths are concrete experimentation and reflective observation. He has great

imaginative ability that allows him to view concrete situations from many perspectives. Divergers perform best as generators of ideas. Managers who have humanities and liberal arts backgrounds are usually divergers and often serve as personnel managers.

Assimilators' greatest strengths are concrete experiences and reflective observation. They excel at creating theoretical models. Assimilators, and convergers as well, are more interested in abstract concepts than people. They really do not care about the practical application of theories, as long as they are logically sound and precise. They can usually be found in the basic sciences.

The fourth learning type is the accommodator, who is the opposite of the assimilator. He is best at concrete experiences and active experimentation. He is a risk taker, better at doing things, carrying out plans and experiments, and involving himself in new experiences. He is called the accommodator because he excels at adapting himself to specific immediate circumstances. He is most often found in marketing or sales (Kolb, 1976).

Kolb has gone so far as to overlay a model of the problem-solving process on his learning model. In doing this he is able to identify the problem-solving strengths of each of his learning types. Accommodators' problem-solving strengths lie in executing solutions based on some goal or model of how things ought to be. The diverger is best at identifying the various possible problems and opportunities that exist in reality. The assimilator excels at building the abstract models that are necessary to choose a priority problem and alternative solutions. The converger's strengths are evaluating solution consequences and solution selection.

Management and Managerial Problem Solving

Much of the recent literature of management devoted to problem solving involves discussions of the value of the "scientific approach" to problem solving. This involves quantifying the various elements of the problem and, through the use of mathematical analysis and other scientific procedures, identifying the best solution.

Some writers in the field believe a close relationship exists between problem solving and decision making. Graham (1975) reports that problem solving differs only slightly from decision making, in that problem solving allows subordinates to participate by allowing them to assist in defining the problem and gives them an opportunity to contribute information to this problem definition. Graham further states that in both decision making and problem solving, management assumes that employees will be more committed to change if they are allowed to participate in that change. Flippo and Munsinger (1975) define decision making as the process by which a person overcomes obstacles placed between where he currently is and where he wants to be. If one assumes that a problem is a type of obstacle, then this definition of decision making could be applied to problem solving, making them one and the same, or at least the former a subset of the latter.

As Brightman (1980) has pointed out, few universities or business organizations have recognized the importance of problem solving in the education/training process of managers. There is little research on problem solving in the management literature, except for that on scientific/quantitative procedures. Therefore, it is helpful to examine

research on decision making, in an attempt to relate the findings to the closely related field of problem solving.

Adam Smith, the classical economist, believed that everything has an economic value. This value can be expressed in terms of utility, the ability to satisfy human wants. Carrying this concept one step further, it could be said that one way to make a decision would be to select the action(s) that has the highest utility (Miller and Starr, 1967, p. 25). This could be considered a decision strategy. Much of the decision-making research focuses on what is called strategy selection.

Beach and Mitchell (1978) view strategy selection as a compromise between the press for more decision accuracy as the demands of the decision task increase and the decision maker's resistance to expend more of his personal resources. They report that there are three types of decision strategies: (1) aided-analytic strategies, which require the use of tools such as paper, calculator, or computer; (2) unaided-analytic strategies, which are all done in the individual's head, and (3) nonanalytic strategies, which are fairly simple, preformulated rules that are applied by rote to decision tasks. This third strategy includes flipping a coin or drawing straws.

Beach and Mitchell's findings have been supported by Christenson-Szalanski (1978). He conducted experiments on decision making using students from both schools of business and liberal arts programs, the latter being included to test the generalizability of Beach and Mitchell's theory among supposedly nonanalytic as well as analytic individuals. Christenson-Szalanski found that there is a point at which the selecting of a more accurate strategy is not worth the cost in time or effort.

Many researchers cited earlier in this study have made reference to rules used in the problem-solving process (e.g., Newell and Simon, 1972; Harre and Secord, 1973; Gagne, 1966). Svenson (1979) found it useful to assign values to the various attributes to a potential decision. These values denote the degree of attractiveness of the particular attribute. To find the best alternative, a decision maker may apply one or more decision rules on the set of choice alternatives. These rules specify which alternative to select, given certain conditions.

According to Svenson, when a decision maker is faced with a complex set of alternatives, the more complex of these decision rules may be particularly relevant. If, however, the same or similar decisions have often been faced before, it is possible to develop simplifying strategies, or heuristics, to help him arrive at a decision more easily. If a problem solver begins to apply decision rules of a less complex type after making a number of successively more complex decisions, he may be using a heuristic strategy which may or may not involve the use of the decision rules he set forth earlier. Instead, he may be developing heuristic strategies from his own experience.

Miller and Starr (1967) studied everyday life problems of individuals and identified several findings concerning attempts to resolve these problems, two of which are especially relevant to this discussion. The first is that most decision problems are so complex that any attempt to discover the set of optimal actions is useless. Instead, people set their goals in terms of outcomes that are good enough for them. Second, in spite of all the difficulties, human beings

make every effort to be rational in resolving their decision problems. To help, they have a large quantity of life experiences codified for them in the form of ethical principles. These principles, maxims and heuristics are such that applying them rigidly is no guarantee of success, although they do afford guidance.

The use of various rule structures in decision making and problem solving has been cited in much of the research discussed above. Kepner and Tregoe (1965) found that most managers, at least consciously, really have no standard methodology (or rules) for arriving at a solution for a problem. They fail to apply even the most widely-held scientific problem solving models. Their thesis is that a universal, nonscientific, systematic procedure for problem solving would enable managers to arrive at the optimal solution for any problem that might arise. Without this universal system, they assert, managers will waste valuable time and other organizational resources following blind paths. Often, the manager really cannot define a problem, or decide which problem is most urgent and should be attempted first. Trying to encourage a manager to ask why a problem had occurred is a fruitless exercise if he does not know exactly what it is he has to explain.

According to Kepner and Tregoe, managers naturally tend to deal with problems, causes and decisions without consciously realizing which is which, or where these problems, causes and decisions fit in the process of thinking a problem through. They do not distinguish between what is wrong that needs correcting (the problem), what brought the problem about (the cause), and what actions to choose to correct it. To make these distinctions, a problem must be analyzed. Problem analysis

involves the logical process of narrowing down a body of information during the search for a solution. The process is described by Kepner and Tregoe (1965, p. 46) as follows:

1. Compare what should be with what is;
2. Recognize that what is (the problem) is a deviation from standard;
3. Precisely identify, locate and describe the deviation from standard;
4. Look for what sets apart that which was affected from that which was not;
5. Consider only those changes connected with distinctive areas of the deviation;
6. Deduce possible causes of the deviation;
7. Apply all the facts to the deduction to confirm the cause.

Then, and only then, should the problem solver set about to plan possible alternative courses of action. This planning is part of the decision making process also described by Kepner and Tregoe (p. 48):

1. Establish the objectives of the decision;
2. Classify the objectives as to importance;
3. Develop alternate courses of action;
4. Evaluate the alternatives against established objectives;
5. Choose the alternative best able to achieve all objectives;
6. Explore the tentative decision for possible adverse consequences;
7. Take action to prevent possible adverse consequences from becoming new problems.

Other procedures, such as creative problem solving, have been hailed as problem-solving techniques. Kepner and Tregoe argue that these are actually methods for generating alternative actions, since they do not lead to (1) an understanding of what is wrong, (2) how things got that way, and (3) what is the most economical way of correcting the trouble (p. 52). The answer to these three areas of inquiry cannot be discovered unless the problem is precisely described and its critical dimensions specified. By specifying a problem the problem solver conducts a careful search for certain kinds of facts that

will draw a boundary line around it. Once this is accomplished the search for alternatives becomes much more efficient.

Argyris (1976) maintains that there are two theories that describe individual behavior. The first theory is the individual's own description of what action he will take in a given situation. This is his (espoused) theory of action. The second one is the theory the subject actually follows in his actions. This is his theory-in-use. In most cases, theories-in-use are not compatible with (espoused) theories of action; the person may not actually do what he says he is going to do. Furthermore, the individual may or may not even be aware of the existence of two theories of action, or their incompatibility.

Argyris also describes two types of organizational learning with a potential relationship to problem solving. Single-loop learning is any detection and correction of error that changes routine but does not alter the underlying values or policies of the organization. Double-loop learning focuses on the changing of the underlying values and policies from which the routines are designed. This is relevant to individual problem solving in that if an individual is affected by these organizational values and policies in a strong enough fashion they may have a major impact on his problem-solving process. Therefore, even though the individual may identify a problem, he may select a less desirable solution, or choose to ignore the problem altogether, if the ideal solution is contrary to organizational values or policies.

Naturalistic Methods of Research

In order to gain a better understanding of the rules, processes and heuristic strategies of problem solvers, many researchers within the

field of cognitive psychology have long espoused the use of more naturalistic methods of research. Process tracing methods fall into this category.

One of the earliest studies to use the process tracing method was de Groot's (1965) investigation of the thought processes of chess players. de Groot presented players of various ability with a chess board set in mid-game and asked them to think aloud as they pondered their moves. He collected verbal protocols of their deliberations as they weighed alternative moves and the likely consequences. This work has been extremely influential among information processing researchers (Elstein et al., 1978).

An increasing number of process tracing proponents agree on the use of verbal reports as legitimate data. The work of de Groot, Kleinmuntz, and Piaget have an important similarity in that they all use verbal reports as data. They also agree that knowledge of the process by which a problem is solved is at least as important to psychologists as observing that it was solved (Elstein, 1978).

Jenkins (1981) is another advocate of naturalistic research. In his paper he takes his fellow cognitive psychologists to task for perhaps over-analyzing and over-researching individual psychological phenomenon, rather than really looking at the organism producing the phenomenon. He believes predictions about a subject's behavior cannot be made without knowing his goals, the structure of the task environment, and most importantly, the invariant structure of his process mechanism (p. 4).

Jenkins also believes there is a serious problem with laboratory-oriented experiments in cognitive psychology. In one

sense, it is a tribute to his fellow researchers; in another, however, it is a serious problem within the field. He writes that it is possible for a psychologist to set up an experiment with a particular theory in mind. Accordingly, he will construct the experiment in terms of the variables that agree with the theory. If the subject adapts to the conditions of the experiment, then it is likely the subject will act in congruence with the theory. The better the researcher understands the constraints of the theory, the better he will be in creating the conditions that will allow the subject to respond to those constraints. In other words, to quote Jenkins, ". . . if the experimenter really believes that the subject is a particular kind of machine and designs experiments for that kind of machine, the subject may well become that kind of machine"

(p. 11). If this is so, then an excellent case has been presented for naturalistic methods of research. Using this method the researcher creates no environment; he does not run the risk of creating a machine which responds to the environment. He simply treats the subject as a human being, encouraging him to discuss in ordinary language his behavior in a given situation.

Perhaps the most persuasive argument for naturalistic research is made by Harre and Secord (1973). They propose an "anthropomorphic model of man" as the basis for studying human action. This theory states that for scientific purposes, we should treat people as if they were human beings, as we know and understand them in everyday life. In order to do this, it must be possible to accept their commentaries upon their own actions as authentic, though revisable, reports of phenomena, subject to empirical criticism (Harre and Secord, 1973, p. 84).

In order to explain social behavior, Harre and Secord believe that the meanings that underlie it must be identified. One way to do this is through the collection of accounts, or verbal reports, from an individual. An important tool in obtaining these meanings is ordinary language, which is well adapted for explaining human interaction in terms of reasons and rules. Harre and Secord maintain that ordinary language is the only method available to describe action-meaningful behavior. By using ordinary language, researchers have an explanation for behavior from the subject's point of view.

Harre and Secord contend that the following of a plan or purpose (to solve a problem, for example) is a case of rule following. The plan is based on the knowledge of the planner, with the knowledge being represented as a rule structure. This concurs with Sacerdoti's (1977) and Greeno's (1981) theses.

Rules are prepositions which guide intended actions in the planning and performance of certain acts. Simply identifying the rule followed is not sufficient; why a particular rule was followed must be ascertained. To do that the researcher must investigate the subject's wants and needs in order to relate the rule to him. By doing this, projections can be made as to how the subject will behave in similar situations (Peters, Johnson and Lazzara, 1981).

Summary

In the recent research on problem solving cited in this chapter, there seems to be a consensus among researchers on several points. First, that human beings are processors of information. As such, they have the ability to solve problems by taking various forms of

information and processing it to develop a solution. This information takes the form of past experiences, knowledge, and senses. Many of the researchers (Newell and Simon, Gagne, Svenson, and Mischel to name a few) agree that processing this information involves the application of rules to human action. These rules may take several forms and can be applied in many different ways. The key, however, is that they are used to solve problems.

One area where there doesn't seem to be consensus is the definition of a problem. Gagne defines problem in performance terms, whereas Hayes defines it in situational terms.

In the field of management most of the research on problem solving has been done in the area of decision making. Research has been conducted on both quantitative and non-quantitative decision making; models have been developed using both strategies. No conclusions have been reached as to the best strategy, although the increased use of computers and financial considerations have focused attentions on the quantitative models. These, however, seem to fail to take into consideration the human element in the process. Calls have been made to bring research attention back to the non-quantitative aspects of decision making.

Naturalistic methods of research are gaining popularity as an effective way to study human problem solving. Very persuasive arguments have been made for the benefits of studying human beings as human beings rather than as objects. Researchers are beginning to recognize the value in listening to a person's description of his behavior and the rationale behind it.

Experience is being identified more and more as a vital factor in problem-solving efforts. By examining the effect of past experiences on human problem solving behavior, researchers hope to discover the underlying forces which direct that behavior.

CHAPTER III

METHODS AND PROCEDURES

Population Sample

The population for this study was individuals in administrative, managerial or executive positions in business and higher education organizations in the metropolitan Knoxville and Johnson City, Tennessee, areas. Twelve individuals were included in the study.

Method of Selection of Sample

A non-random method of sample selection was used in this study. Subjects were chosen on the basis of accessibility and willingness to participate in the study, as well as on the basis of personal acquaintance with and referral by others to the interviewer. Potential participants were initially identified by review of job titles and job descriptions. Individuals with the job title of manager, director, assistant director, or executive titles such as president, vice-president, or treasurer were considered for inclusion in the study. Individuals with these job titles also were required to have substantial responsibility for organizational resources such as people, money, or raw materials.

Instrumentation

The interview approach used in this study was developed by a team of researchers engaged in a National Institute of Education-sponsored research project at The University of Tennessee, Knoxville (Peters and Lazzara, 1982). This interview schedule uses a semi-structured probing

technique to elicit responses from adults regarding their approach to resolving specific problems. It attempts to encourage discussion rather than provide answers to a narrow range of questions. Appendices A and B describe the instructions for the interviewer and list the questions that were asked in each interview.

Procedures

The researcher was trained to conduct two interviews with each of the twelve managers participating in the study. The interview training, conducted during the first phase of the larger NIE study at the University of Tennessee, Knoxville, consisted of group discussion by members of the NIE research team, reading assignments and practice interviews. Individual feedback was provided by the use of video-taped role play and critique of practice interviews by the project director.

Managers identified as potential interviewees were contacted by the researcher in person or by telephone to explain the purpose of the proposed study, and to invite those who met the job title and job description criteria to participate in the project. At this time they were informed that they were simultaneously participating in the larger research project being directed by the interviewer's graduate committee chairman.

Data was obtained in two interviews by verbal responses to a series of questions asked by the interviewer. Two interviews were held to ensure a sufficient amount of data was collected on each subject. Questions asked were designed to elicit a step-by-step description of the subject's activities in solving a problem. Each interview was tape-recorded to facilitate analysis. Interviews were conducted from four to

six weeks apart at locations selected by the interviewee. A different problem was discussed at each session to provide a total of twenty-four problems for study.

The interviews consisted of identification of two to four problems actually encountered by the manager during the normal course of his job activities. In most cases the problem had occurred within the last three months. In one or two cases the problem had existed as long as one year, with the most recent manifestation as recently as one day to three months.

Where there was a choice of appropriate problem situations the researcher selected the problem that was encountered most recently by the manager. This was done to facilitate recall and to provide a more accurate description of the problem-solving process. After a problem was selected for discussion, the interviewer proceeded to question the manager about his activities to date toward solving the problem.

The audio-tape of each interview was transcribed verbatim to produce a written protocol of the interview. The transcript was then subjected to a four-stage process of analysis known as "reduction" developed by Peters and Lazzara (1982). Reduction is a search for thematic structures which are the underlying meanings of what the interviewee has verbally described. These meanings are uncovered through applying what is referred to as the ACTS model of analysis. ACTS is an acronym for the first letter of each of the four stages in the procedure—Atomizing, Categorizing, Thematizing, and Schematizing. The ACTS model is a systematic manipulation of the basic analytical units of text, called "atoms." The process involves dividing a statement or group of statements into its (their) smallest

single thought, or atom. As the atoms are created they are paraphrased and numbered. This phase is called atomization. The following is an example of how a statement is atomized.

Original sentence: "Well, this is something that we have been trying to do for a number of years but I would say that about five or six weeks ago I came in contact with the purchasing agent at Memphis State University who had a commodity listing and we were able to get a copy of his listing and we began to modify that listing to our needs."

Atomizations: 1. I have wanted to develop a vendor commodity listing for a number of years.
 2. Five or six weeks ago I was able to obtain a copy of Memphis State University's commodity listing file.
 3. We began modifying that listing to meet our needs.

The purpose of paraphrasing is to eliminate redundant and tangential information while retaining the intended meaning of the statement.

Paraphrasing allows the analyst to determine what the interviewee meant by a statement when the meaning is not entirely clear, or when there could be more than one possible interpretation. This process identifies and isolates the intended idea of the discussion. Most of the changes made during this process are structural, such as (1) separating phrases joined by conjunctions; (2) completing incomplete ideas on the basis of contextual references; (3) eliminating false starts; and (4) extracting embedded ideas from their context and paraphrasing them as separate atoms. At this level of analysis an atom which is paraphrased is just as valid as a literal transcription (Peters and Lazzara, 1982).

The second stage, categorizing, involves assigning each atom to a category. The categories used are derived from the language of the "intentional idiom" or the language used when a person gives reasons for what has been done or what one plans to do. The major categories as developed by the NIE research team are laws, norms, intentions, wants,

beliefs, and facts, with norms being divided into several sub-categories (Peters and Lazzara, 1982).

The process consists of the successive application of the definitions for each category to each atom. Each application of a definition to an atom is a decision in linear ordering. The application continues on each atom until the analyst matches definition with atom. He then stops the process and begins again with the next atom. The categories are arranged in a hierarchy, with "law" at the top and "fact" at the bottom. The categories, listed in hierarchical order, their definitions, and examples of each are given below.

- I. Law: Any atom which makes mention of a general physical regularity; reference to physical regularities or causal patterns made in the course of explaining or justifying action.

Example: "If I drop a bag of feathers and a bag of coins from the same height, and they both weigh the same, they will both hit the ground at the same time."

- II. Norm: Synonymous with "pattern," "type," "regulation," "rule," and "law."

- A. Laws of State: Norms or regulations which are issued and enforced by the state.

Example: "Tennessee law says that I can't get my driver's license until I turn sixteen."

- B. Norm-As-Regulation:

- 1. Rules of a Game: Rules of behavior which tell which actions are allowed, as well as which actions are not allowed.

Example: "I can't go swimming for an hour after I eat."

2. Prescription: Commands, permissions, or prohibitions issued by someone, which have their source in the will of the norm authority and are directed to some agent or agents.

Example: "Shut the door!"

3. Custom: A species of habits that are culturally determined; a disposition to do similar things on similar occasions under current circumstances.

Example: "I always eat a box of popcorn when I go to the movies."

4. Conditional Intention: A statement informing the listener that the speaker is committed or is committing himself to some course of action, given that a certain condition exists.

Example: "If it stops raining, I am going to the store."

- a. Technical norm: An intention in which the antecedent always mentions something wanted, needed, or desired by the speaker.

Example: "Whenever I want to relax, I work on my car."

- b. Hypothetical Norm: An intention in which the antecedent or enabling condition can be any state of affairs other than a 'want.'

Example: "Whenever my car won't start, I fix it myself."

5. Moral Norm: Those most general characteristics of behavior by which a relatively homogenous social community

holds up various standards of conduct as being exemplary.

Example: "The best boys in town belong to the Boy Scouts."

6. Ideal Rules: Concerned with the properties a thing ought to possess to be good of its kind.

Example: "A perfect diamond will always have a focal point that can easily be seen with a jeweler's piece."

III. Intention: A plan of action; a statement that can express an action towards some goal object.

Example: "I am going to buy a new car."

IV. Want: A statement which names a desire or need without at the same time expressing intent to achieve or obtain the desired need.

Example: "I need a new dress to wear to the party."

V. Belief: An opinion; the mental acceptance of a state of affairs.

Example: "I believe in Santa Claus."

VI. Fact: A state of affairs, a process, or an event that is objective and verifiable.

Example: "We have \$14.00 left in the bank."

Categories may also be created by combining one or more categories. For example, the statement, "Last night I called everybody on my committee to remind them of the meeting" is a fact-intention. It is a fact, for it could be verified by asking the committee members if they were called; it is also an intentional action—the speaker had a purpose for calling the committee members.

The next stage of analysis is called thematizing. The product of this stage is a short (usually no more than one page) synopsis of the

subject's problem-solving process. This synopsis is a concise report of the themes that have been uncovered. In the interview, the interviewee has done two things; first, he has told what he has done, and secondly, he has given various levels of more or less abstract reasons for why he did what he did. These reasons serve as justifications. These justifications come from the interviewee in the form of reasoning structures that can logically be traced to the moral and ideal norms which that person holds. The thematic summary, then, is a structured account of these justifications, along with an account of the stages of the process to which they are relevant.

The thematic summary is written in three parts. The first part is written in the first person, and answers the question, "How would this person have described what took place if he were asked to give a brief description of what happened"? The analyst writes this "autobiography" in a freely associative manner so there are no constraints on its formulation. In this way, the analyst's intuitions can be developed most fully without attention being diverted by preconceived notions about what should or should not be included.

The second part involves structuring the account by rewriting it, making the following changes:

1. All instances of the word "I" are replaced with either "he" or "she";
2. The stages that are discussed are rewritten, if necessary, to reflect the order of the actual process;
3. Any reason which cannot be justified as being one that the interviewee would actually have given is eliminated from the text.

This second version of the thematic summary is then rewritten by

replacing all instances of the word "he" or "she" with the word "I." This third stage creates an objective account, eliminating all assumptions and inferences of the analyst's creation and stating the themes that have been uncovered. In the interview, the interviewee has done two things. First, he has told what he has done, and secondly, he has given various levels of more or less abstract reasons for why he account from the problem solver's point of view. This third version is the final output of the thematic structure.

The final step in the reduction process is to schematize the problem-solving process as described in the thematic summary. By graphically drawing a step-by-step description of the solution, a flow chart is created. This flow chart is drawn in two parallel sequences. The left side describes, in process terms, the decisions made and the actions taken ("sought outside assistance"). The right-side sequence describes the actual specific actions taken by the subject ("went to the library to check out a book"). By delineating both the process and the actual behavior, the analyst can clearly identify patterns in logic and behavior.

After completing the ACTS analysis, a frequency count was made on the categorized atoms. This was done to further determine trends in the subjects' descriptions which might further clarify the underlying reasonings for the managers' behaviors. For example, a high number of hypothetical norms may indicate a high degree of metaknowledge, or knowledge of oneself. A high number of wants, or technical norms, on the other hand, might indicate an extremely goal-oriented individual (or just a very selfish person).

Following the frequency count, the analysis continued by comparing the schematic diagrams with each other. The purpose here was to determine if any patterns or trends of problem solving were discernable among the members of the sample. This was done by placing the schematics side-by-side and making the comparisons through visual observation.

After this, each schematic was compared with the steps for problem analysis and decision making described by Kepner and Tregoe (1965) in Chapter II. This was done to determine if any of the subjects followed a published systematic model for managerial problem solving. The process was then repeated using the general problem solving model described by Peters (1981) in Chapter II, again for the same reason.

At this point the focus of the analysis reverted back to the frequency count. The three psychological modes that had the highest count were isolated and a general review of the representative atoms in each case was conducted. The number three was selected as a random choice. The modes studied here represent potential reasons for the individual to behave in the manner he did. The content of these modes could contain keys to the selection of a particular problem-solving strategy. For example, suppose a subject's job was in a highly regulated industry or organization. By examining the atomizations of his interview transcripts, it could be ascertained that the regulations he works under might have a major impact on his problem-solving activities at work. Identifying the underlying reasons for problem-solving actions provides the basis for further study of the process to determine if there are any global rules applicable to most individuals.

CHAPTER IV

SUMMARY OF FINDINGS

In this chapter the findings of this study are presented. The data are displayed in the following manner: (1) the findings relating to the frequency counts; (2) the thematic and schematic summaries of the ACTS analysis; (3) comparison of the process side of the schematic diagrams to Kepner's and Tregoe's models of problem analysis and decision making; and (4) comparison of the process schematic with the model of problem solving described by Peters.

Although initially twelve managers were interviewed in the study, one manager was dropped midway through the interview process for a number of reasons. Because of schedule conflicts and the nature of the manager's organization, it was difficult to schedule interviews at convenient times. On several occasions the interviewer arrived only to be asked to come back at another time. During the one interview that was conducted, the manager was interrupted so many times that it was difficult to get a cohesive dialogue going. Objective answers were difficult to obtain from this subject, for when asked to describe a problem, on more than one occasion the reply was "We don't have any problems here." Answers to other questions also gave the impression of a company press release, rather than objective, personal answers. Therefore, these findings represent the results of two interviews with eleven managers.

Frequency Count

A frequency count was made on the categorized atoms to determine the number of atoms in the various psychological modes, or categories.

In the twenty-two interviews there were a total of 3,932 atoms. The number of atoms in each interview ranged from a high of 304 to a low of 75. Given below is the combined total of atoms in each category.

TABLE I
SUMMARY OF FREQUENCY COUNT

CATEGORY	TOTAL
Law of Logic	0
Law of State	11
Norm	
Rule	19
Prescription	1
Custom	0
Conditional Intention	19
Technical Norm	11
Hypothetical Norm	114
Moral Norm	0
Ideal Rule	0
Intention	54
Fact-Intention	304
Want	79
Belief	742
Fact	2,582

A complete frequency count by case is contained in Table II.

As can be seen from examining Table I and Table II, the greatest number of atoms occurred in three of the lowest four categories in the hierarchy. Facts accounted for 65% of all atoms; beliefs accounted for 18%; and fact-intentions made up 8%, for a total of 91%.

It appears then that in this sample when an individual discussed problems, he was actually relaying a series of facts, joined together for explanation and justification with beliefs and descriptions of what he has done or is doing. The higher level modes, mainly norms, are much more encompassing within the human cognitive system. For this reason

TABLE II
FREQUENCY COUNT

MODE	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B	9A	9B	10A	10B	11A	11B
LAW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LAWS OF STATE	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	7	1	-
RULES OF THE GAME	-	-	1	-	-	-	2	-	-	-	1	1	2	-	1	-	-	4	-	1	1	1
PRESCRIPTION	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CUSTOM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CONDITIONAL INTENTION	1	-	1	2	3	1	2	-	-	-	-	1	-	-	1	-	-	-	-	5	-	2
TECHNICAL NORM	1	1	-	-	-	1	3	-	-	-	-	-	1	1	1	-	-	1	-	-	1	-
HYPOTHETICAL NORM	4	5	7	8	11	2	11	7	3	-	3	7	7	6	1	2	7	10	1	6	4	2
MORAL NORM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IDEAL RULE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INTENTION	3	3	2	2	4	9	2	5	2	1	3	1	-	3	-	1	2	-	2	5	3	1
FACT-INTENTION	31	17	21	21	7	14	21	14	4	8	12	6	9	16	7	14	13	10	23	14	14	8
WANT	2	-	-	2	5	4	4	13	1	2	4	-	2	3	4	10	2	1	5	5	2	4
BELIEF	49	14	40	44	23	21	21	28	20	25	28	41	66	64	12	36	43	34	50	38	25	20
FACT	80	83	235	220	70	57	105	147	53	43	62	133	226	170	61	84	149	160	113	137	61	133
TOTAL	176	123	308	299	123	109	171	214	83	79	113	191	313	263	87	147	216	220	196	218	112	117

there are fewer of them. It is presumed that these norms lie at the base of cognition (deeper within the personality) and for this reason are harder to observe. Therefore, in describing one's actions the individual really isn't aware of the effect norms have on his behavior. The few norms that appeared in this analysis happened to be occasional expressions which, for whatever reason(s), did lie in the upper levels of the subject's cognition.

ACTS Analysis

As described in Chapter III, part of the ACTS analysis involved placing each atom in a category, or psychological mode. Contained in these atoms are the interviewee's espoused and implied reasons for following the problem-solving strategy he chose. By listing all the modes from a particular transcript together, the analyst can get a picture of these reasons. Because of the large number of atoms found in the total sample, it was decided to select only those modes containing the highest numbers of atoms. The frequency count identified four modes with the highest percentages of all the atoms. These modes were (1) facts; (2) beliefs; (3) fact-intentions; and (4) hypothetical norms. The counts of the other modes indicated negligible instances of appearance.

While there were far more facts than any other category (more than three times as many as beliefs), the nature of facts implied that they may not contain as much insight to the reasons for behavior as other modes. Facts are objective descriptions of what is, without explanation or discussion. Comments of this nature would fit into other

categories and were excluded from this section of analysis. Therefore, beliefs were examined first.

Beliefs are the basic building blocks for action. Referring to the hierarchical structure of the categories, it can be implied that all the higher level modes in the hierarchy are based on the beliefs held by the individual. Wants and intentions, for example, imply a belief that a need exists, such as a need for a physical object or a need for action. In the twenty-two cases studied there was an average of thirty-three beliefs per case. Many of these beliefs expressed "feelings" or values about a subject. These feelings and values have many sources, from parental teachings as to what is "right" or "wrong" to observation of the correctness or worth of something. For example, in Case 5A the following statement was made:

I believe that in an organization if a person has an area of responsibility that person needs to be involved in that area and consulted when there are factors that affect that area or decisions being made.

This belief, or value, is probably based on the interviewee's concept of the organization. Somewhere in his background he may have been taught this value, either in a formal class, or by a mentor within the organization. In any case, it represents an intangible force which could, if necessary, come into action in the selection of a problem solving strategy.

Past experiences were influential in many of the beliefs quoted by the subjects. As managers and administrators, they all deal with numerous situations each day and week. Each subject in this study seemed to have the ability to apply to current problems beliefs founded in these past experiences. In Case 7A, the subject is trying to

recruit, at company insistence, new employees. His company has told him to place advertisements in local newspapers. He states: " I believe that newspaper ads aren't as effective (as other recruiting techniques) because I have seen people who come into this office without college degrees, some without high school diplomas." The implication here is that he has tried this before, unsuccessfully, and if given a choice would not select it again when recruiting new employees because he believes it to be ineffective.

Common sense and reason were also found to be the basis for many beliefs. In Case 1B, for example, the subject commented that if he could learn to fix his computer himself, he believed repairs would be cheaper. In the future, if he learned to repair his machine, his problem-solving strategy would more likely involve attempting to fix it himself before calling a repairman.

In a few cases, company policies and other forms of regulation were mentioned in beliefs, but these were fairly isolated and scattered throughout the transcripts. In most instances, they were judgemental statements about the policies and regulations.

Policies and other forms of regulation did have an effect on the fact-intentions in the transcripts. This was not surprising, given the nature of the problems discussed in the interviews. If a person works in a profession or organization or industry whose activities are governed by standard operating procedures, policies, or government regulations, it follows that these controls would have an impact on the steps they take to solve on-the-job problems. In the fact-intentions these controls were not always specifically mentioned by the interviewee. Sometimes they were indirectly alluded to, while in other

instances they were brought out as a result of the analyst's knowledge and understanding of the subject's profession or industry. An example of this would be Case 4A, where the interviewee was attempting to computerize her company's accounting system. Some of the steps in her process were normal things an accountant would do. The analyst understood this as a result of some academic experience in accounting and some past associations with other accountants. Another analyst who had not been exposed to these experiences might not identify this information as easily.

Many of the fact-intentions seemed to be problem-specific or situation-specific. The action was dictated by the problem or the situation, rather than by any broad, systematic design. This was especially true in those cases where time constraints were a major factor. If the problem solver had a good deal of time to develop a solution, he was more likely to develop a plan of some kind, rather than just react to the situation. Time was a primary influence in strategy.

There was an average of five hypothetical norms per interview. As a result of the small number of instances per interview there were few insights into problem-solving strategies. It appears that in this sample group past experience, regulatory controls, and personal and professional values are prime factors influencing hypothetical norms.

In general terms, other factors appeared to play some part in the selection of problem-solving strategy. One of these was interaction with other individuals. In nine cases interaction with superiors was mentioned, often as an actual step in the solution process. References ranged from simply seeking approval for a proposed action or decision to some aspect of the relationship with the superior being the problem.

Interactions with subordinates or peers were referred to in twelve cases, usually seeking information or giving instructions. In all of these cases the interaction was specifically mentioned, but it was not dwelled upon unless the relationship was part of the problem. Using individuals as a source of information or assistance appeared to be a most common aid to these managers, as opposed to seeking out non-human resources.

An interesting finding to come out of this analysis is that in several cases there was frequent use of the pronoun "we" when discussing the solution steps, as opposed to using the pronoun "I." This was especially true of those who were at or near the top of their organization. This could be the result of two factors. One, there may have been a high personal identification with their organization. The individual may have been so involved and committed to the organization that he had difficulty thinking of himself apart from his employer. The other factor could be that at that level within certain organizations decisions are made as a group and there is little opportunity for individual problem solving. This appeared to be especially true of managers in financial institutions. Their problems were often problems relating to organizational policy, which may have been arrived at by group decision.

The thematic and schematic sections of the ACTS analysis are given on the following pages. The narrative description of the problem-solving process, the thematic, appears first, followed by the schematic, for each interview.

CASE STUDY 1A

Thematic

I have been hired by a company to develop a training seminar for new sales employees. Because I have never done sales training before, I had to get most of the course content from the sales manager. I prefer to learn things this way because I am an extremely verbally-oriented person, and my understanding and comprehension of information is greater using this method.

I spent a lot of time asking the sales manager questions about the product, the company's history, selling techniques and perceived problems. This enables me to develop new criteria for hiring new salesmen. At this point I also asked some salesmen I know personally to give me some background information on how to sell intangible products. They also gave me some material to read. From the discussions and reading material I was able to sit down and write an initial outline.

After having this initial outline typed I let it settle in my mind for a while. Then I gave it to the sales manager for him to review. The two of us made some revisions before submitting the outline to the company vice-president for approval.

I am now at the point of identifying and locating supplementary material for the class, finding a suitable meeting location, and generally arranging logistics for the training program. Because of a prior commitment to another client I have to leave town and will not return until just before the program begins. Therefore I will have to turn over to the sales manager the task of finalizing the arrangements and actually setting up the meeting site.

Schematic 1ASTART

(DECISION: Do I know enough
about the problem to proceed
on my own or do I need outside
assistance?)

Y

N

ACTION: Seek outside
assistance.

Talked to sales manager,
other salesmen.

Read insurance company
training manual.

ACTION: Develop formal
plan.

Made written outline
and had typed.

ACTION: Let plan germinate
for a while--don't do
anything.

Did nothing on plan
for one week.

(DECISION: Does plan meet
client's wants & needs?)

Showed outline to sales
manager for his critique.
Made changes if necessary.

N

Y

(DECISION: Is outline
complete enough to
present to top man-
agement for approval?)

Y

N

ACTION: Review and
revise outline.

Reviewed and added
enrichment techniques.

ACTION: Get client's
final approval.

Gave proposal to
company VP for his
final approval.

END

CASE STUDY 1B

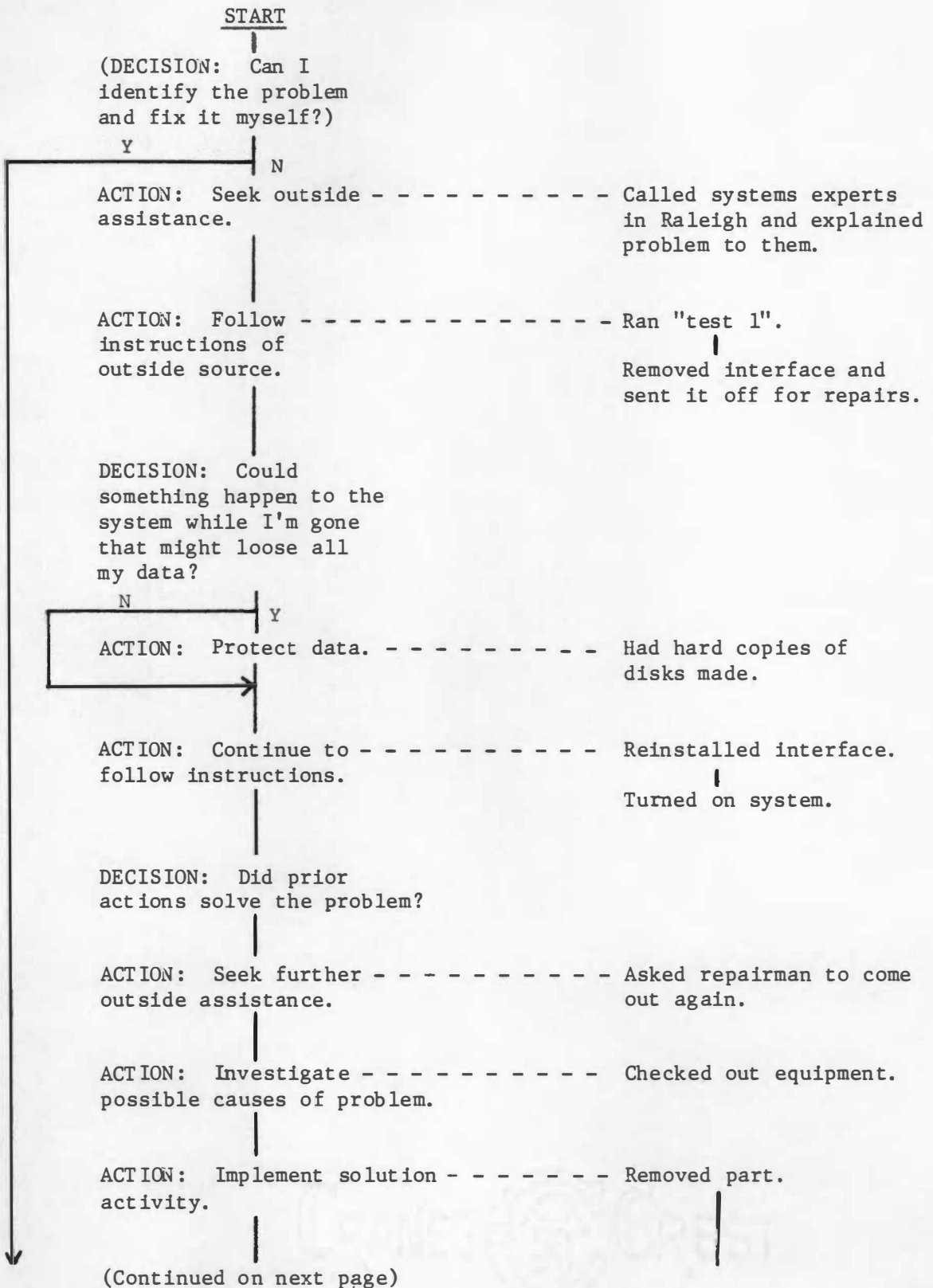
Thematic

I am a person to whom time is important. I like to get things done in the quickest manner possible. I would much rather call someone on the telephone and ask them a question than look up the answer in a manual or a book. I also know my limitations, and will not attempt something myself without some sort of assistance from others if I know little about the subject.

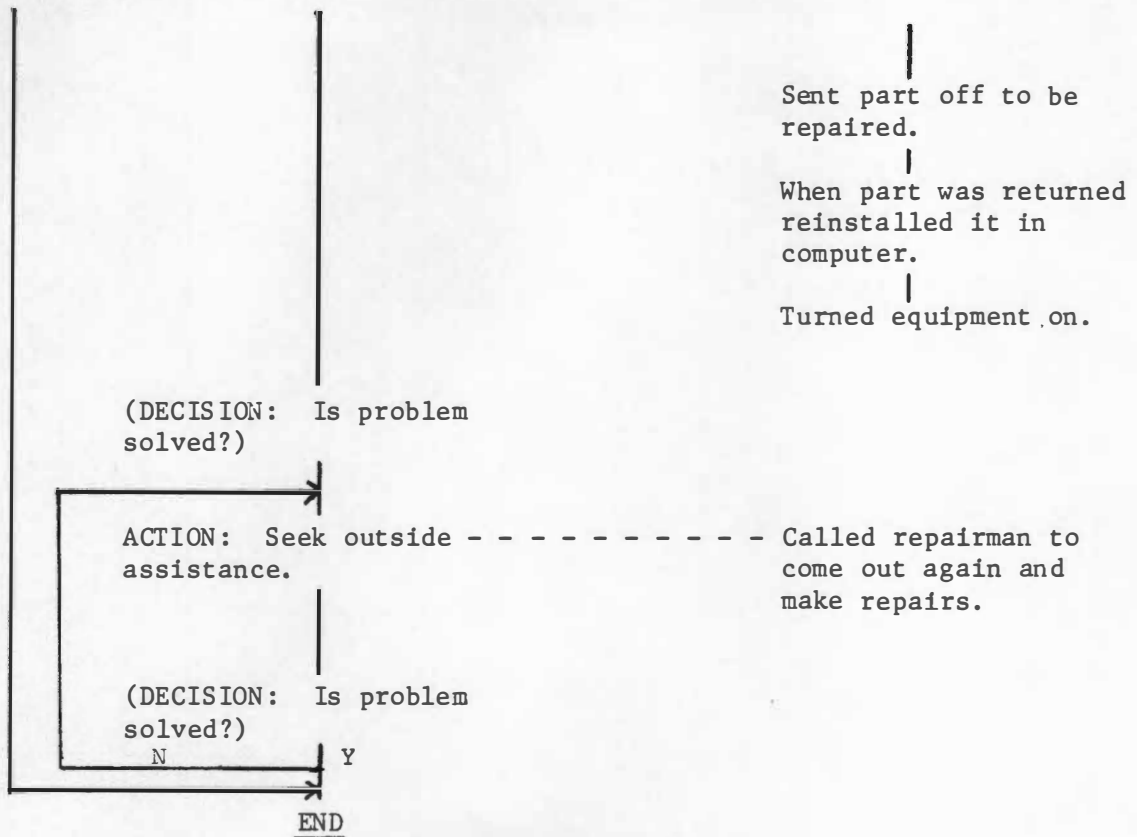
I enjoy learning new information if that information can be put to good use. I also enjoy being in control of the things around me; not necessary controlling, but in control. I have a tendency not to trust the competence of others as much as I trust my own.

When my computer system went down, the first thing I did was call the systems expert in Raleigh. He suggested I do what is called a "test 1," which I did. It indicated the problem was in the expansion drive interface. I removed the interface and took it to Radio Shack to be repaired. I knew I had to be out of town for a week, and that I was the only one in my organization who understood the system. As a backup measure to insure against an accident while I was gone, I took my disks to Radio Shack and had hard copies made. Then the interface was returned. After I returned from my trip I installed it and turned the computer on. The system still did not work right. I called the repairman and asked him to bring out another disk drive to check my equipment. He did, and we isolated the problem as a defective power transformer. We removed the part and I sent it to Raleigh to be repaired. When it was returned, I reinstalled it and powered up the

system. It still did not work. I called the repairman to come out and he discovered a loose wire. I soldered it back on. The system works now but not like it is supposed to. I'll have to try something else.

Schematic 1B

Schematic 1B (cont'd)



CASE STUDY 2A

Thematic

I am a vice-president of a bank. One of my responsibilities is being director of personnel. I was assigned the task of writing an affirmative action plan for the bank.

The first thing I had to do was convince myself I could do it. After that I attended a seminar on developing affirmative action plans. After I got home I reviewed the material they gave us at the seminar to see what kind of data I needed to collect before I could start writing.

As a result of the seminar I followed several steps the instructor told us to do—secure data from the local branch of the state employment security office, contact several other local organizations to get more data, and review and analyze the bank's personnel records.

At about the same time I started talking with personnel officers from other banks. One former bank personnel officer was very helpful and gave me a book on writing affirmative action policy to read, which I did. I also enrolled in a personnel management class at a local college. I knew the instructor and we talked quite a bit about affirmative action.

After all this I decided on a layout for the plan and began writing a rough draft. When I was through I showed it to the bank president who suggested some changes. After making the changes I wrote what I hoped was the final draft and resubmitted it to the president for his approval. After that it will have to be approved by the board of directors.

Schematic 2A (cont'd)

ACTION: Make changes. - - - - - Rewrote and made
suggested changes.

(DECISION: Is plan
complete enough to
meet government
approval?)

ACTION: Submit for - - - - - Submitted plan to Pres.
approval from top for approval from
management. Board of Directors.

(DECISION: Did plan
meet Board of Director's
approval?)

END

CASE STUDY 2B

Thematic

I am a vice-president and branch manager of a local bank, As a result of a bankruptcy on a loan I had made I had the task of repairing and selling a house the bank had taken as collateral.

The first thing I did was inspect the house and determine what repairs would be needed. I took another loan officer to the house with me. We discussed the situation and made a list of repairs we could observe were needed.

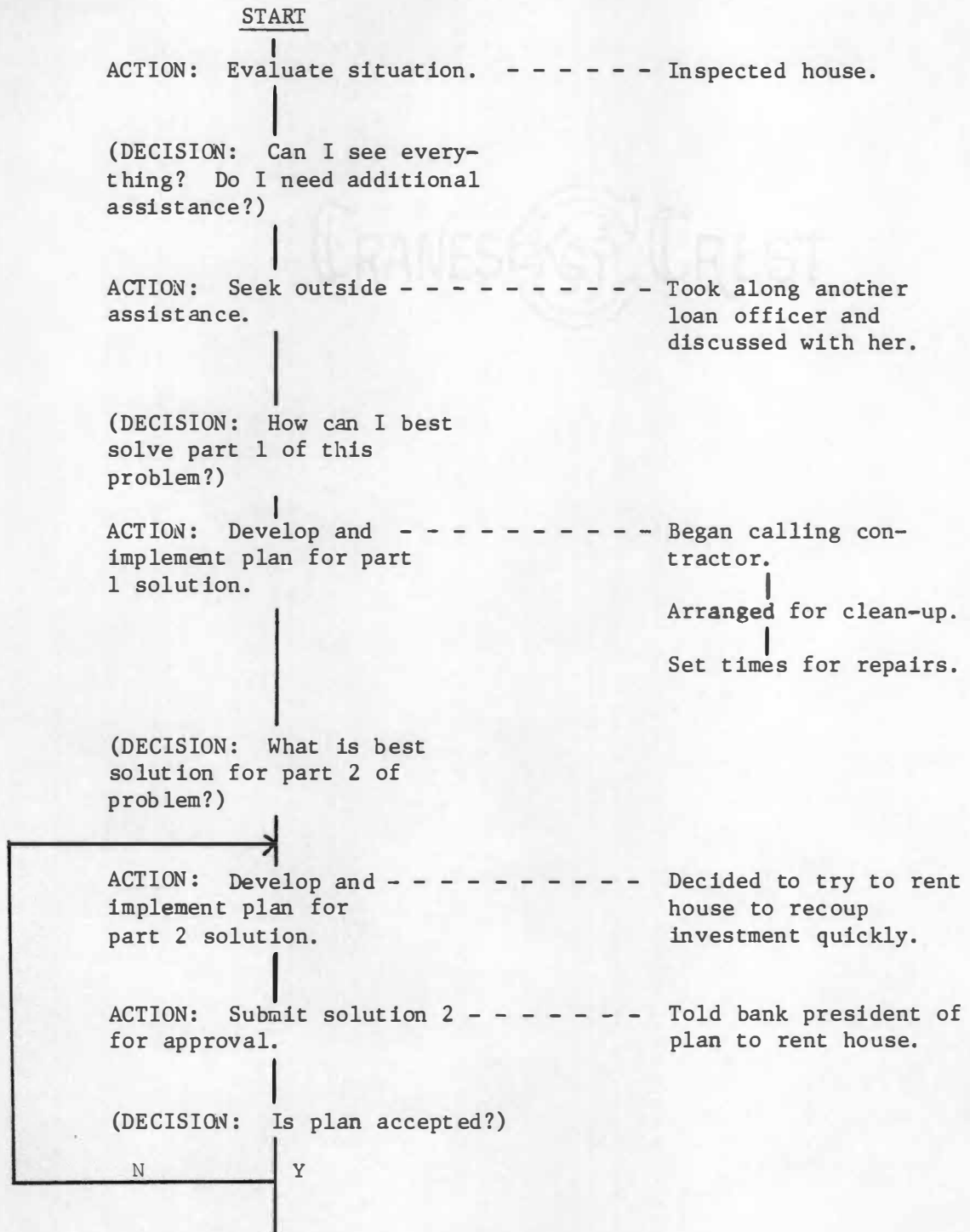
I then began contacting contractors, including several who were customers of the bank, to arrange for the repairs to be made. After some initial refusals I found a contractor who talked some of his sub-contractors into doing the work. I also arranged for some college students on spring break to clean the house, as it had been left in a considerable mess.

After arranging for the repairmen, I had to find someone who could go out to the house when necessary to unlock the door so the repairmen could get in. I didn't feel like I could just give them a key, and I wanted to know when they were working. I assigned this duty to my assistant, who is in training to be a loan officer and might as well get used to doing this sort of thing.

I then had to develop a plan to recover the bank's investment in the house. I believed it would be best to rent the house until the economy improved and real estate was selling better. I was overruled by the bank president, who felt it should be sold. Being in no position to

argue, and trusting his vastly greater experience in the banking profession, I agreed to begin the selling process.

I began by contacting friends, acquaintances, and customers to see if they might be interested in the house as investment property. When this produced no results I ran an ad in the classified section of the local newspaper. A broker called me after seeing the ad and asked if he could sell it for me. I told him I would not sign a contract, but if he could sell it for the bank's asking price plus his commission I had no objections. This is where I am right now.

Schematic 2B

(Continued on next page)

Schematic 2B (cont'd)

ACTION: Develop and implement - - - - - Contacted potential
new plan of action. buyers.

Ran ad in paper.

Talked to broker.

END

CRANES & CREST

CASE STUDY 3A

Thematic

I have been in higher education for a long time. Because I have, and because I am experienced in making administrative decisions I know that solving a problem is not a quick, simple task.

As director of continuing education I was approached by the training officer of a local hospital and asked to develop a series of training programs for LPN's at the hospital. It presents a problem for me because the hospital has already been turned down by the School of Nursing, and I am required to work with them when providing a service like this. The School of Nursing has also declared a one-year moratorium on in-service education programs for hospitals and nurses.

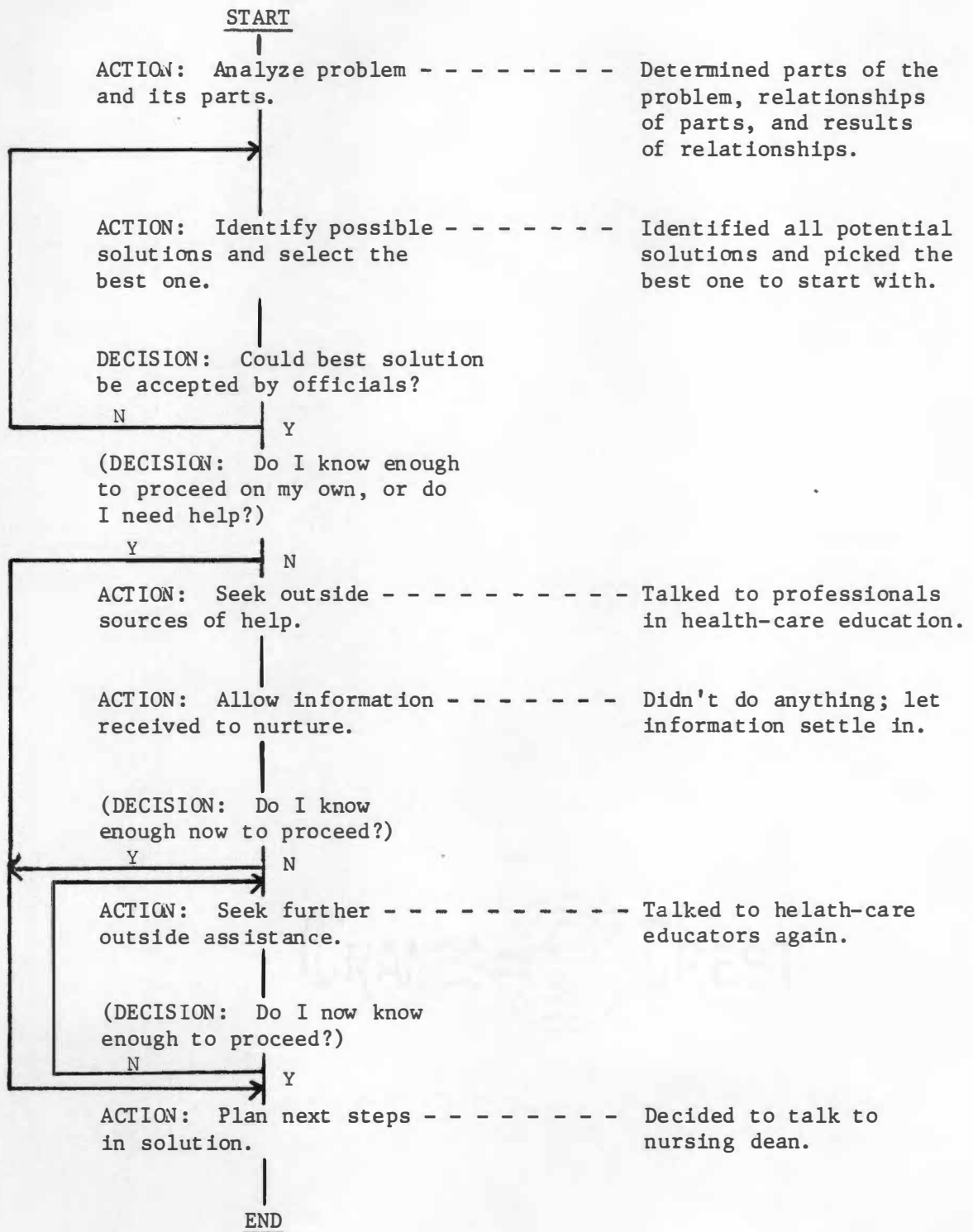
The first thing I did was analyze the problem, looking at its various components, how they are related, and the results of these relationships. I also asked myself how the School of Nursing would react if I made a request to conduct the training. Such an analysis is my usual first step when I attempt to solve a problem. This prevents me from reacting to the problem, rather than acting on it, and lessens the chances of taking a precipitous action(s).

The next thing I did was discuss the problem of in-service training with some professionals in the health-care field. I did this because I wanted to get a complete picture of the problem. It was also quicker than trying to research it myself in the literature of the field.

After letting the problem lie dormant for a week-and-a-half I went to one of the professionals I had consulted earlier and asked some

more in-depth questions. I did this because I was not able to develop a complete analysis in my own mind from my initial series of questions.

The next thing I did was decide to meet with the dean of the School of Nursing and discuss this situation with her. I have attempted to make an appointment with her, but so far I have not been able to get in touch with her. This is where I am right now.

Schematic 3A

CASE STUDY 3B

Thematic

As director of continuing education I am faced with the problem of filling a vacancy on my staff. The last time I made a poor choice, partly because I had too small a pool of candidates to make a selection from. I don't want that to happen again.

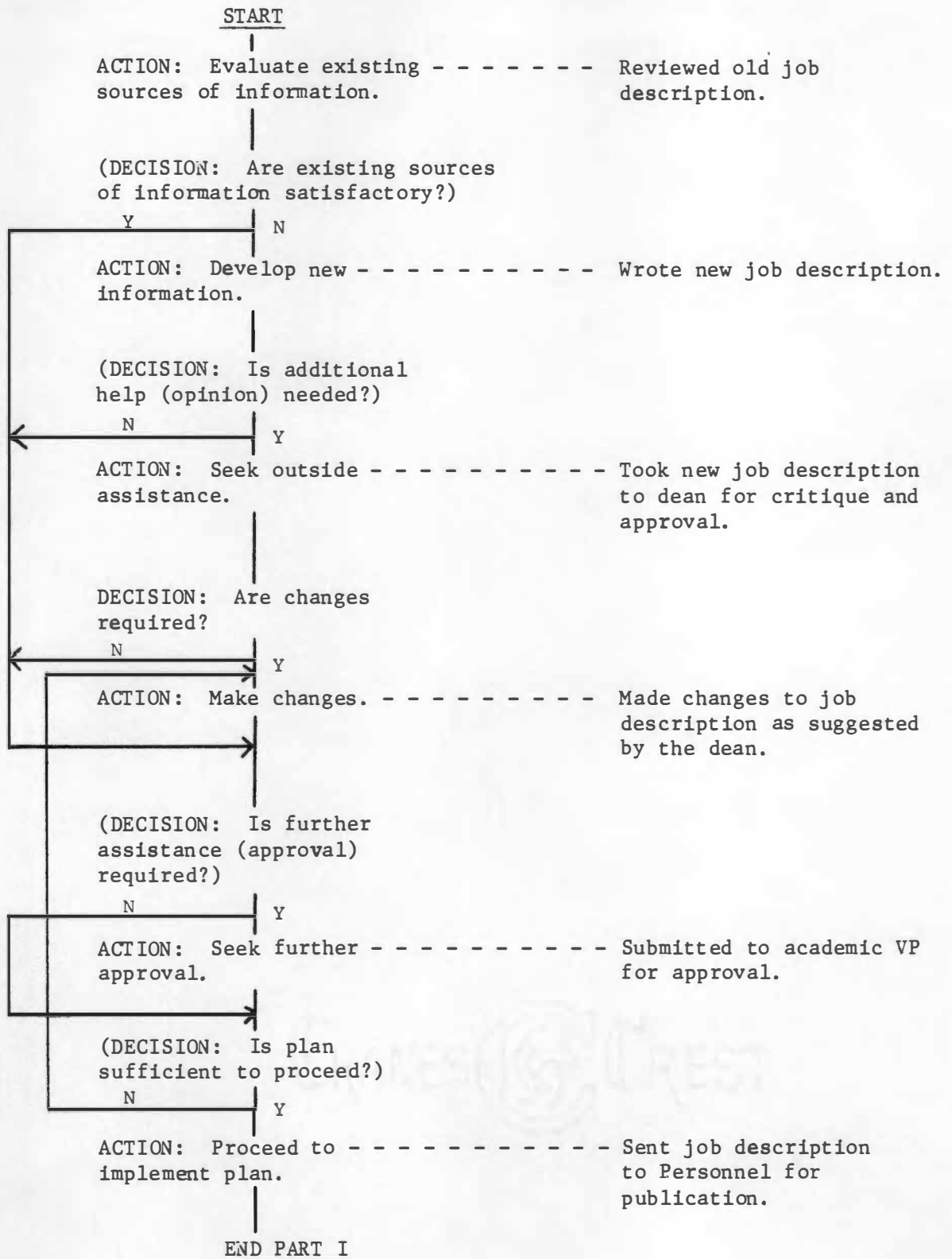
The first thing I did was get out the old job description and review it with my dean. After reviewing it we felt that I should write a new one, which I proceeded to do. I then took it to the dean and we reviewed it together. We made a few changes, after which we sent it through the appropriate channels for institutional approval. When it was approved, I took it to the personnel office for official publication. This is standard procedure at this institution.

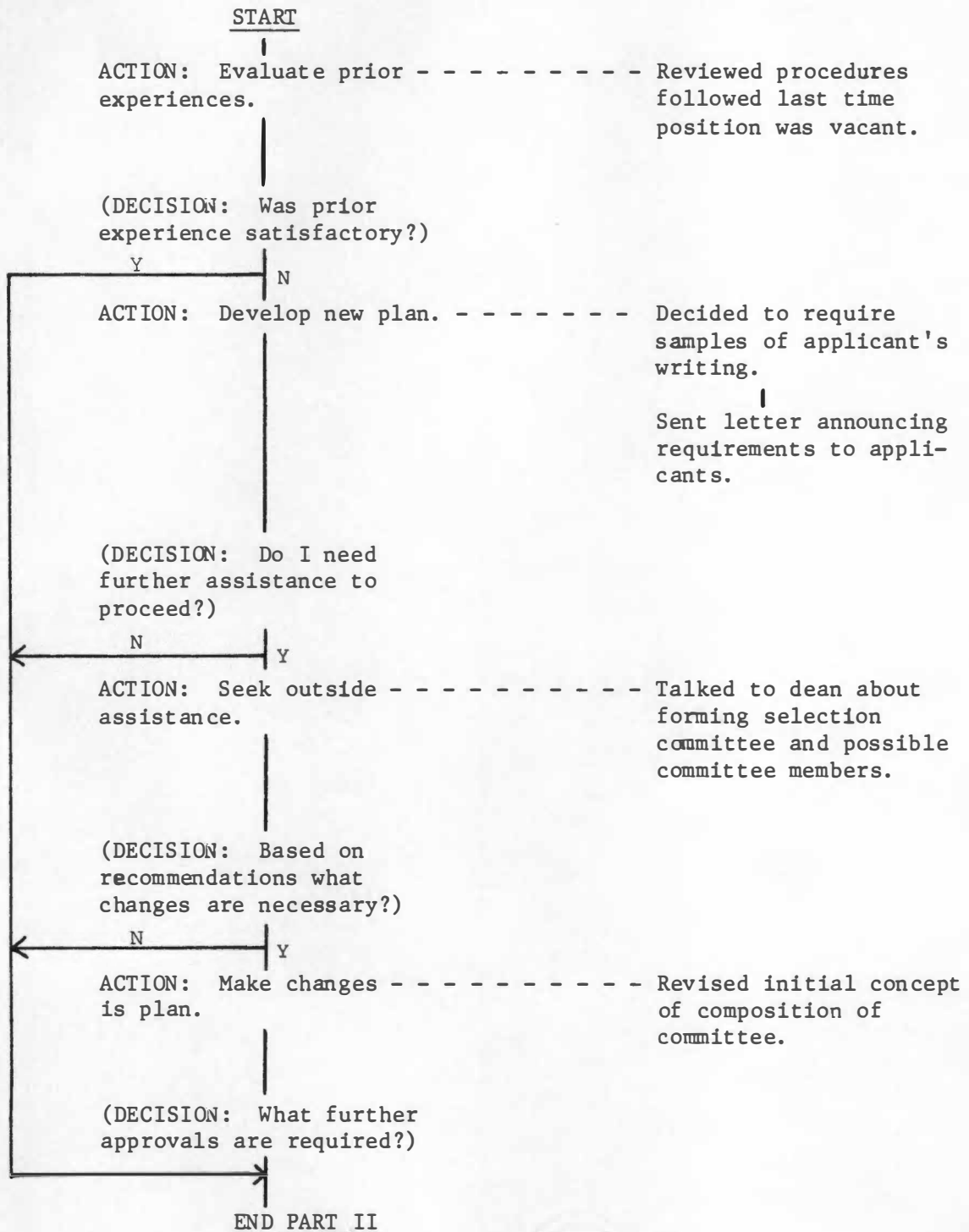
After the job announcement was published I had to decide how to proceed from that point. My previous experience with filling vacancies showed me that an application form really did not tell me enough about the applicant. Therefore I decided to ask all applicants to write a brief paper on their philosophy of continuing education. This will enable me to match the applicant's philosophy with my institution's, and to see if they can write, which my previous employee could not do. I also asked them to send me a letter of interest. I have never done these two things before, although I have thought about doing them. My next step was to draft a letter to the applicants, conveying these requests to them.

While all this has been going on I have also been conferring with the dean about how we should determine the composition of a selection

committee. We came up with some ideas, but after the dean discussed them with the Vice-President for Academic Affairs we had to scratch them. We are now in the process of working on a new plan.



Schematic 3B (Part I)

Schematic 3B (Part II)

CASE 4A

Thematic

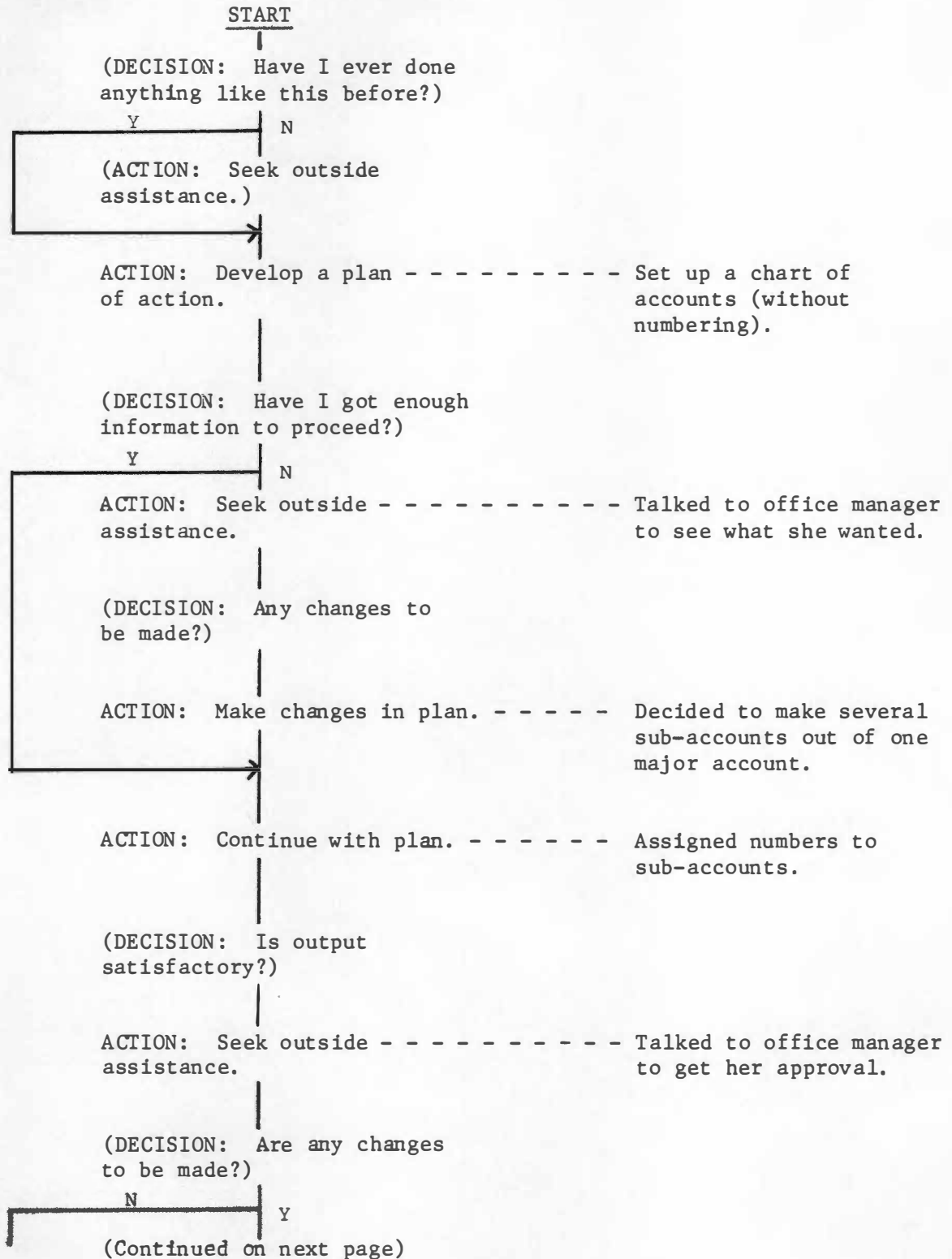
As treasurer and chief accountant for a construction company I had to set up a computerized accounting system. The first thing I did was to set up a chart of accounts, although I did not assign numbers to the accounts, as would be the normal procedure. After that I talked to the office manager I was setting up the account for to find out what she wanted as an end product. I did this because I had to know what was needed and how the system would be used.

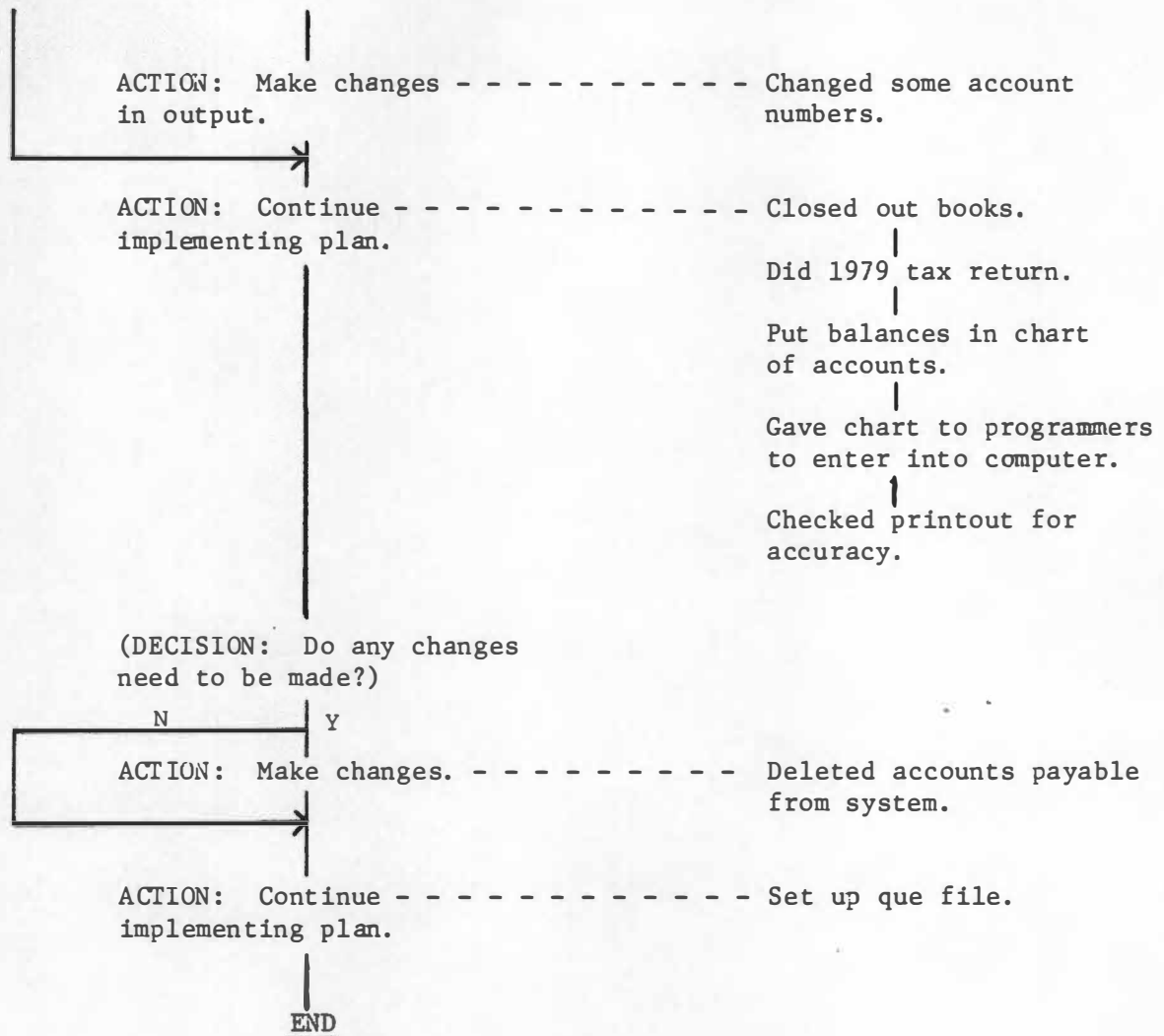
Next I decided to take the major account and make several sub-accounts. After that I had another conversation with the office manager to see if I had created what she wanted. As a result of this conversation I had to change some of the account numbers, which I had by then assigned.

The next thing I did was close out the 1979 books and do the tax returns. I did this because I didn't want part of the system to be manual and part to be automated. After doing the tax returns I put the balances in the chart of accounts.

I then gave the chart of accounts to the computer people for them to enter into the computer. I asked them to make a printout of what was entered so I could check their accuracy. The next thing I did was decide that I did not want an accounts payable entry in the system.

The last thing I have done was to begin setting up a que file, which specifies what the final product should look like. This is where I am now.

Schematic 4A

Schematic 4A (cont'd)

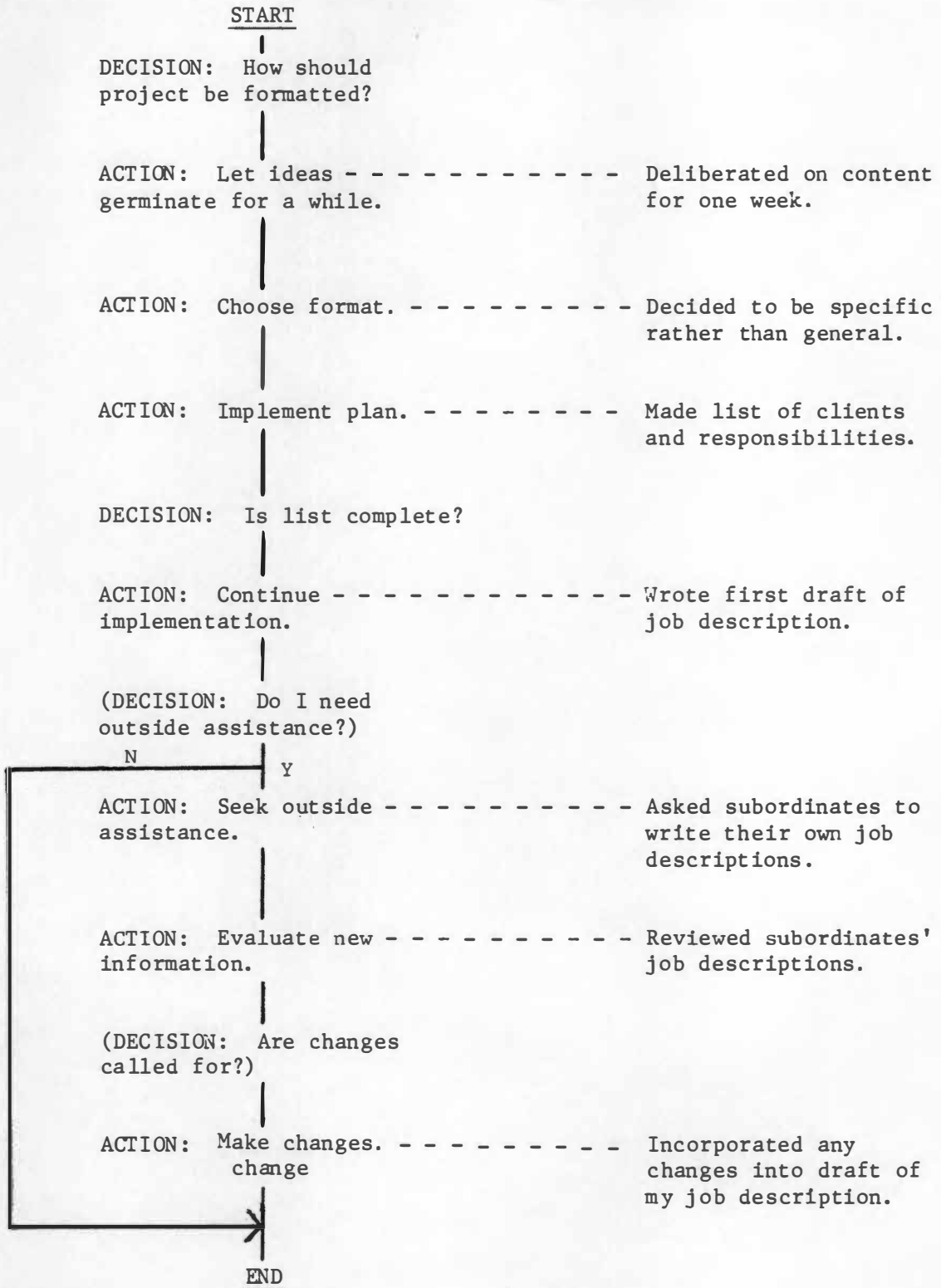
CASE STUDY 4B

Thematic

I am the controller for a conglomerate of very small companies owned by one man. As a part of a management training program all his managers are taking, we were assigned the project of writing a job description for ourselves. When I got the assignment the first thing I did was think about how I should approach the task. Should I be specific or general? I then deliberated on the subject for one week.

After debating with myself all the arguments for each side I decided to be specific. I then made a list of all the businesses I worked for within the conglomerate and what I did for each business. After doing that I wrote my first draft.

After writing the first draft I asked my subordinates to write a detailed job description for their own position. I then used these to help review my draft for completeness, since I am responsible for their activities. I have now begun to plan the changes I will make in my final draft.

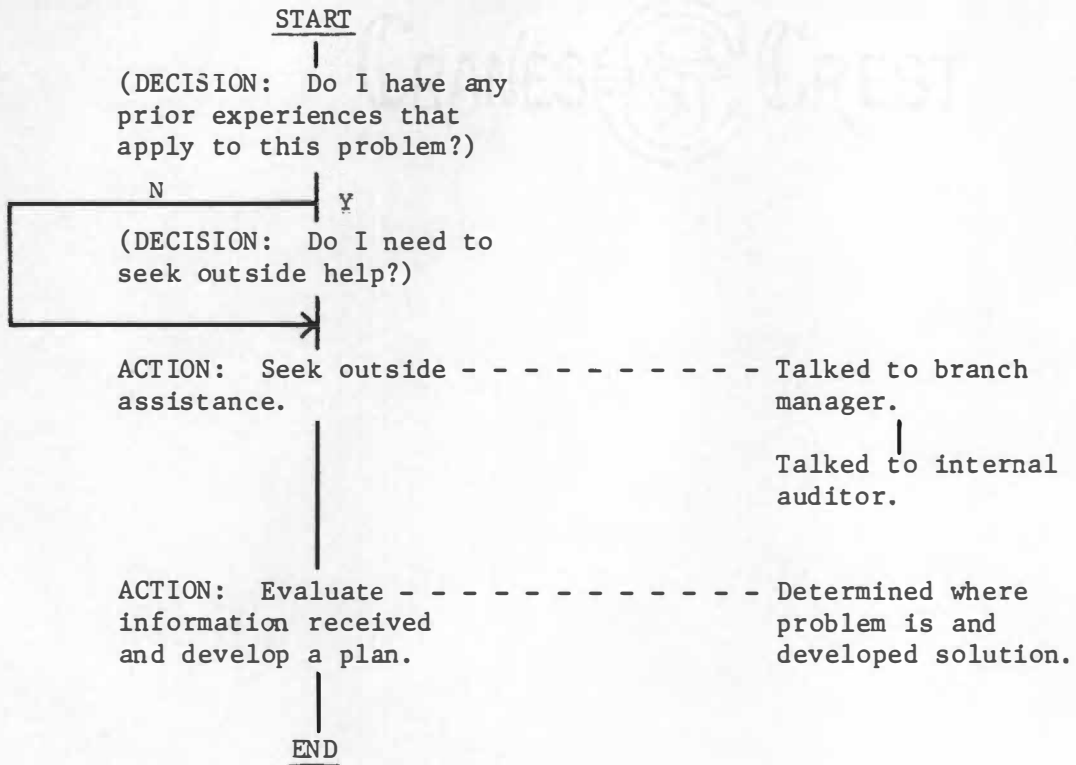
Schematic 4B

CASE STUDY 5A

Thematic

When presented with the problem of how to increase internal control of official checks of the bank, the first thing I did was talk to the manager of the main branch and ask her to tell me how these checks were currently being used. I talked to her first because this area had recently been assigned to me, and I was not familiar with current bank policy on this subject.

The next thing I did was talk to the internal auditor about the problem. I did this because he was knowledgeable about the problem, and because any solution would eventually have to satisfy him. This is all I have done up to this point.

Schematic 5A

CASE STUDY 5B

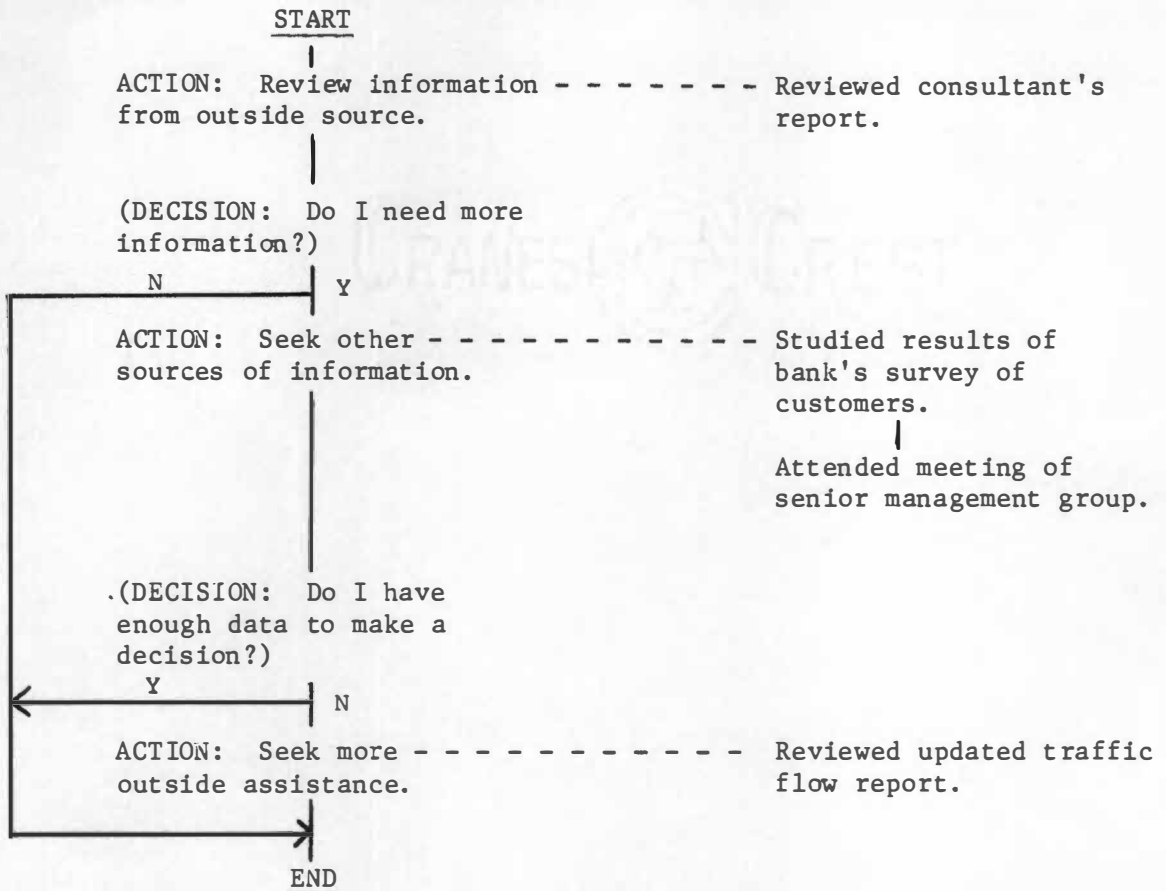
Thematic

I am vice-president of a commercial bank. One of my responsibilities is the operation of our branches. My problem is trying to determine the hours of operation of a new branch.

The first thing I did was review the report of an outside consulting firm to see if it contained any useful information. After that I studied the responses to an informal survey we took of our customers in the vicinity of the new branch.

The third thing I did was to attend a number of meetings of our senior management group to develop new plans for the bank. At these meetings I had to offer a number of recommendations concerning the new branch, the hours of operation being just one of several.

I am now evaluating updated traffic count information to see what impact that should have on hours.

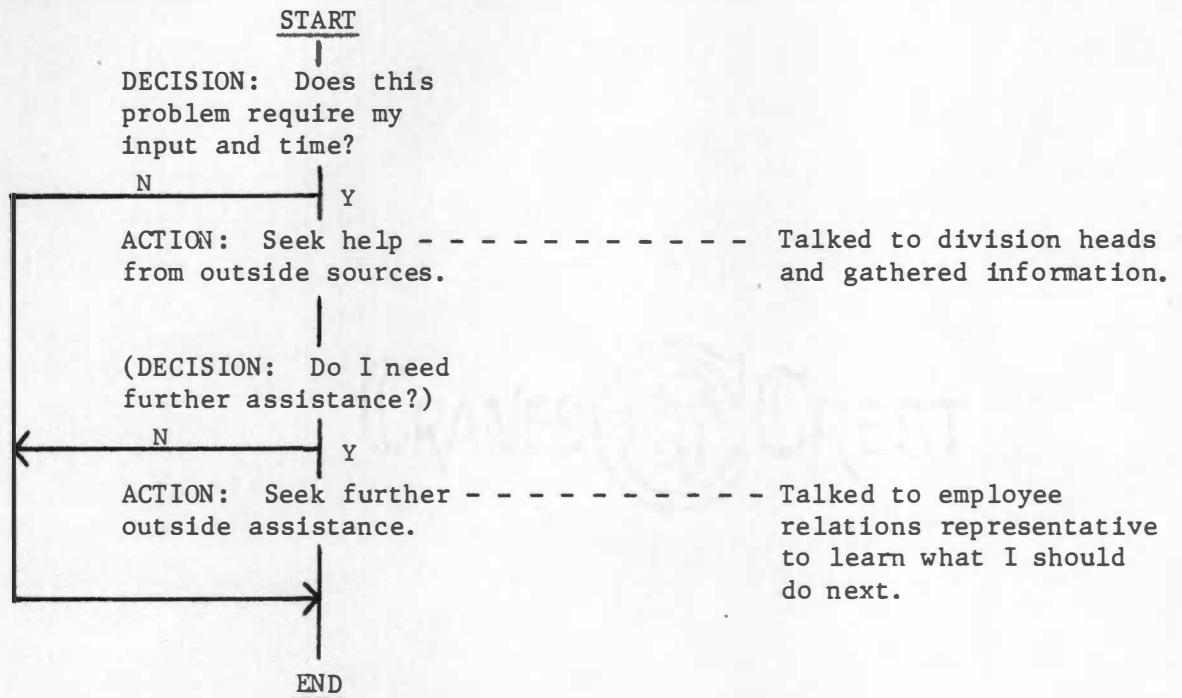
Schematic 5B

CASE STUDY 6A

Thematic

When I was told that a minority employee of mine had filed a grievance with the Equal Employment Opportunity Commission for not getting a position she had bid on, the first thing I did was ask myself if this was something I should be involved with. If a matter can be handled at a lower level I prefer not to be involved. After deciding it was my responsibility, I then talked to the division head whose unit was involved. I did this to get his assessment of the situation.

The next thing I did was discuss the situation with the people in the Employee Relations Office. I did this to get some ideas from them on what to do next. This is where I am right now.

Schematic 6A

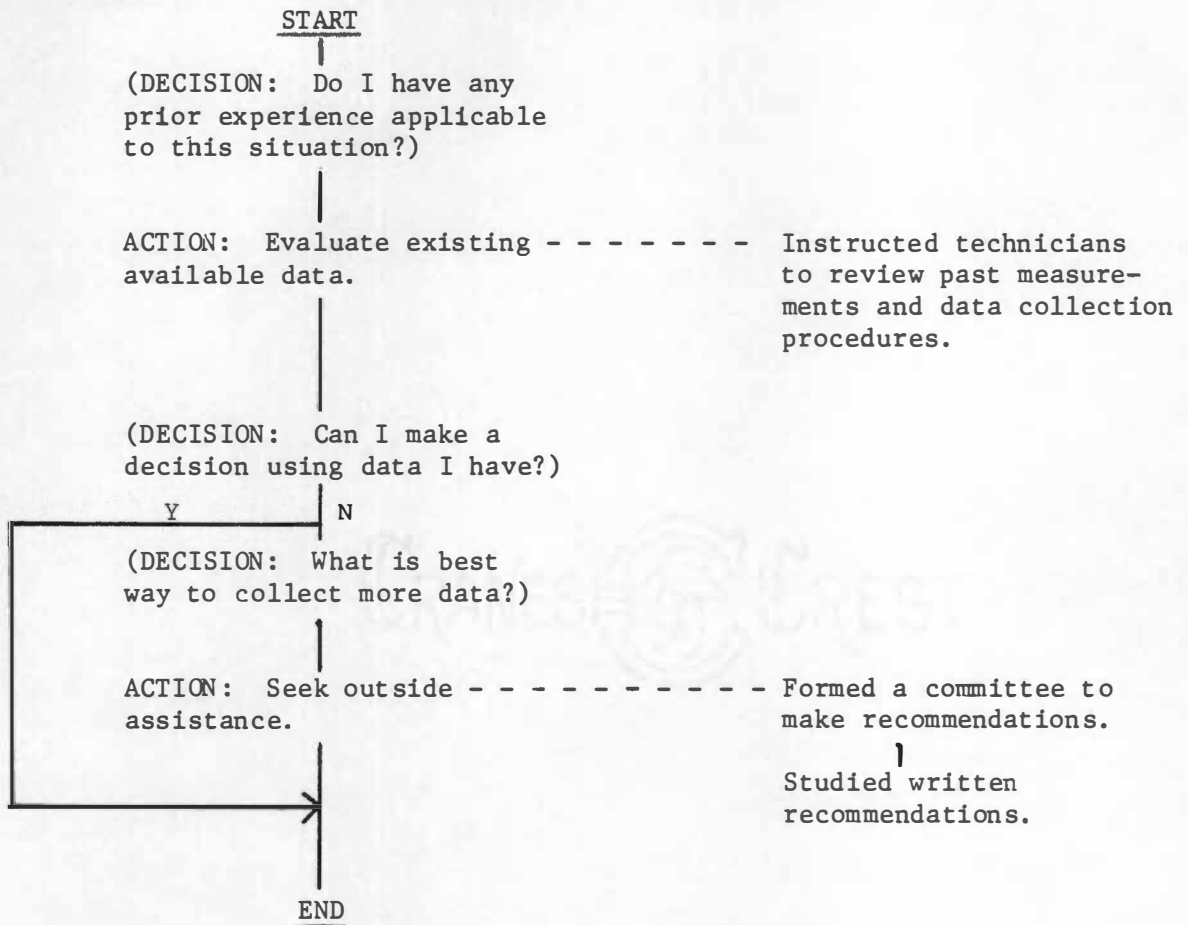
CASE STUDY 6B

Thematic

I am the manager of technical services for a large nuclear energy operation. My problem is that I have to recommend a course of action to top management regarding exposure of employees to radiation.

Since my company conducts a regular testing program for radiation exposure, the first thing I did was have the technicians reexamine their measurements and the procedures they have always followed. After that I formed a committee consisting of technicians, quality control people, and operating personnel. This committee's job was to make recommendations to me on what I should recommend.

The last thing I have done is review a draft of the report the committee wrote. I will use this report to assist me in formulating my recommendations to top management.

Schematic 6B

CASE STUDY 7A

Thematic

As the manager of an insurance agency, recruiting new sales reps was a constant problem. At a recent meeting with other managers I was told the company was putting on a recruiting blitz, and was given a number of recruiting techniques to initiate in my town.

One technique was to go on a "walk and talk" tour. This netted me one interview, and I subsequently administered the necessary examination to the individual.

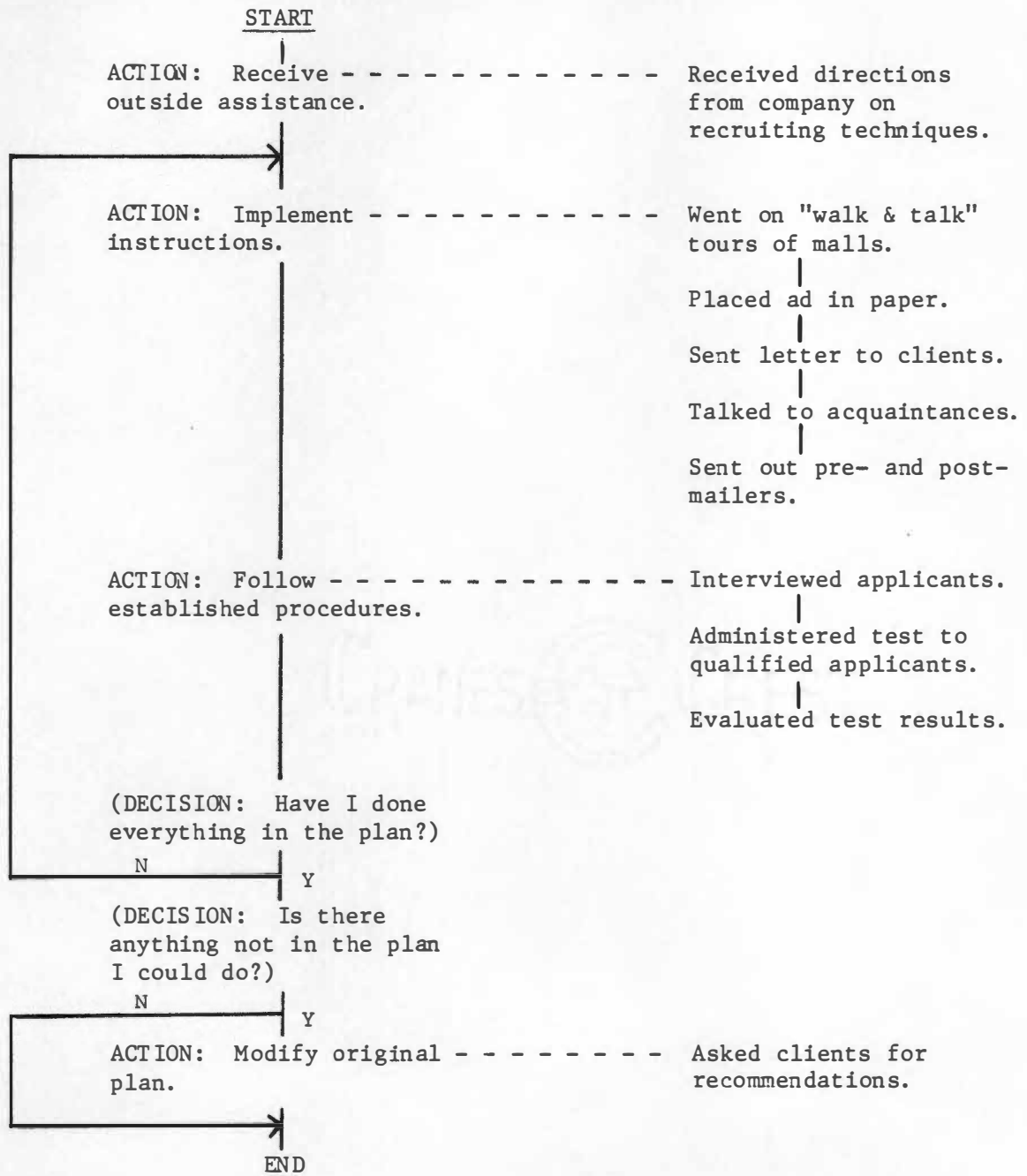
The next thing I did was place an ad in the local newspaper. This brought me several interviews, although none were bright prospects.

During these activities I also was talking with several acquaintances in the town my agency was located in.

Another technique I implemented was to send letters to all the policyholders in my town, asking for referrals. I feel this is one of the better techniques suggested, if used properly. I got some interviews out of this effort, and have given the test to those people.

The next thing I did was send out what are called pre-and-post mailers, a series of letters that are supposed to let the customer know me before I call on them in person. This resulted in no applicants.

The next thing I did was not in the company manual. at the end of a field call I would ask the client if he could recommend someone to be an agent. I have done this on several occasions, and have had some interviewees who have gone as far as taking the test. I am now awaiting the results of the tests.

Schematic 7A

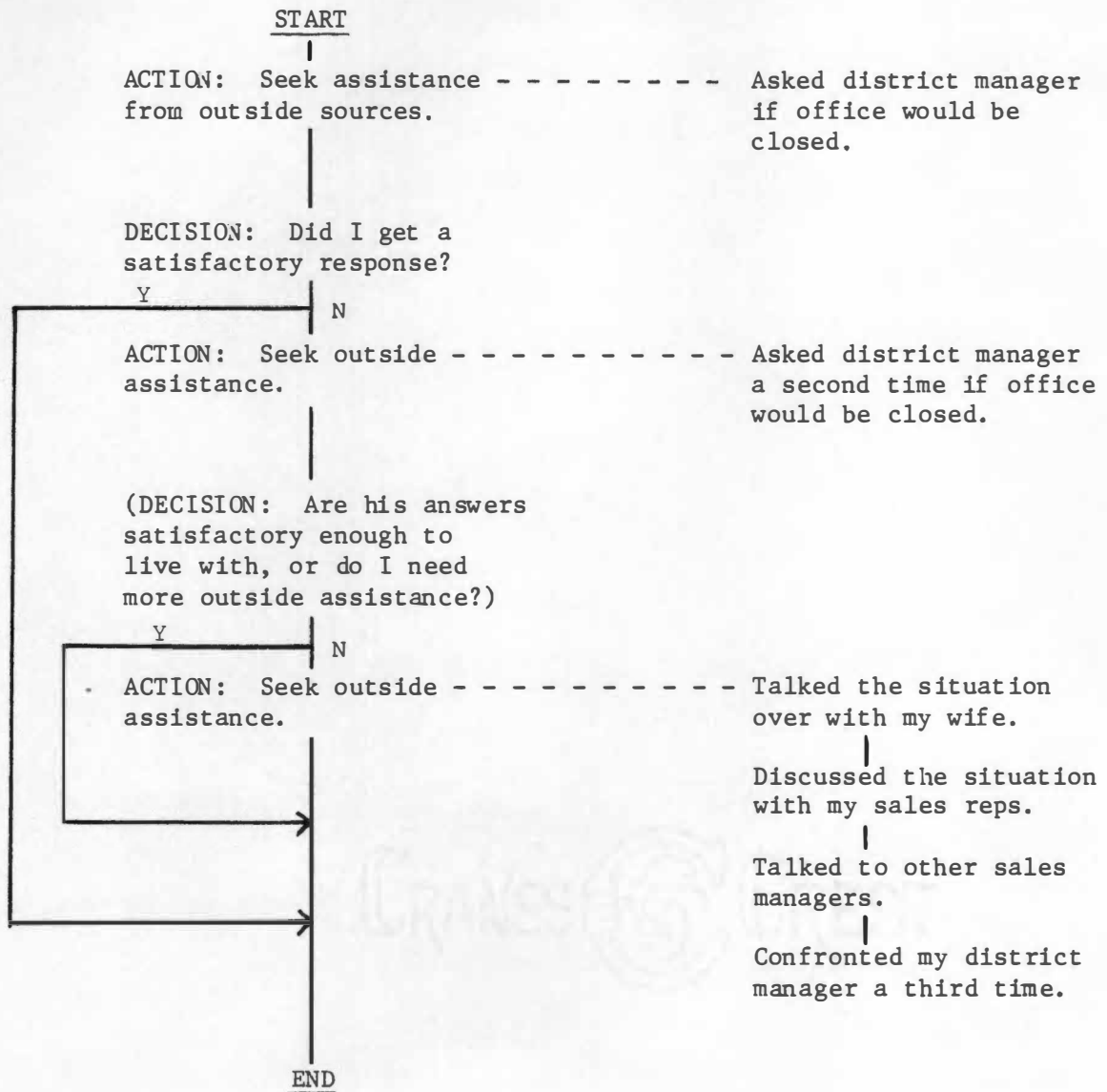
CASE STUDY 7B

Thematic

I am the sales manager for the local office of a large insurance company. Recently I have been hearing rumors that the company is going to close my office, and I cannot get any confirmation or denial from my district manager.

The first thing I did was to confront him by asking him when we would be closing and how it would be done. He told me he did not know. I then waited a week and asked him again, and got the same answer.

At that point I began discussing the situation with my sales reps, other sales managers, and my wife, to get their opinions. After a few days I asked him again when we would be closed and how it would be done. This time he gave me an answer.

Schematic 7B

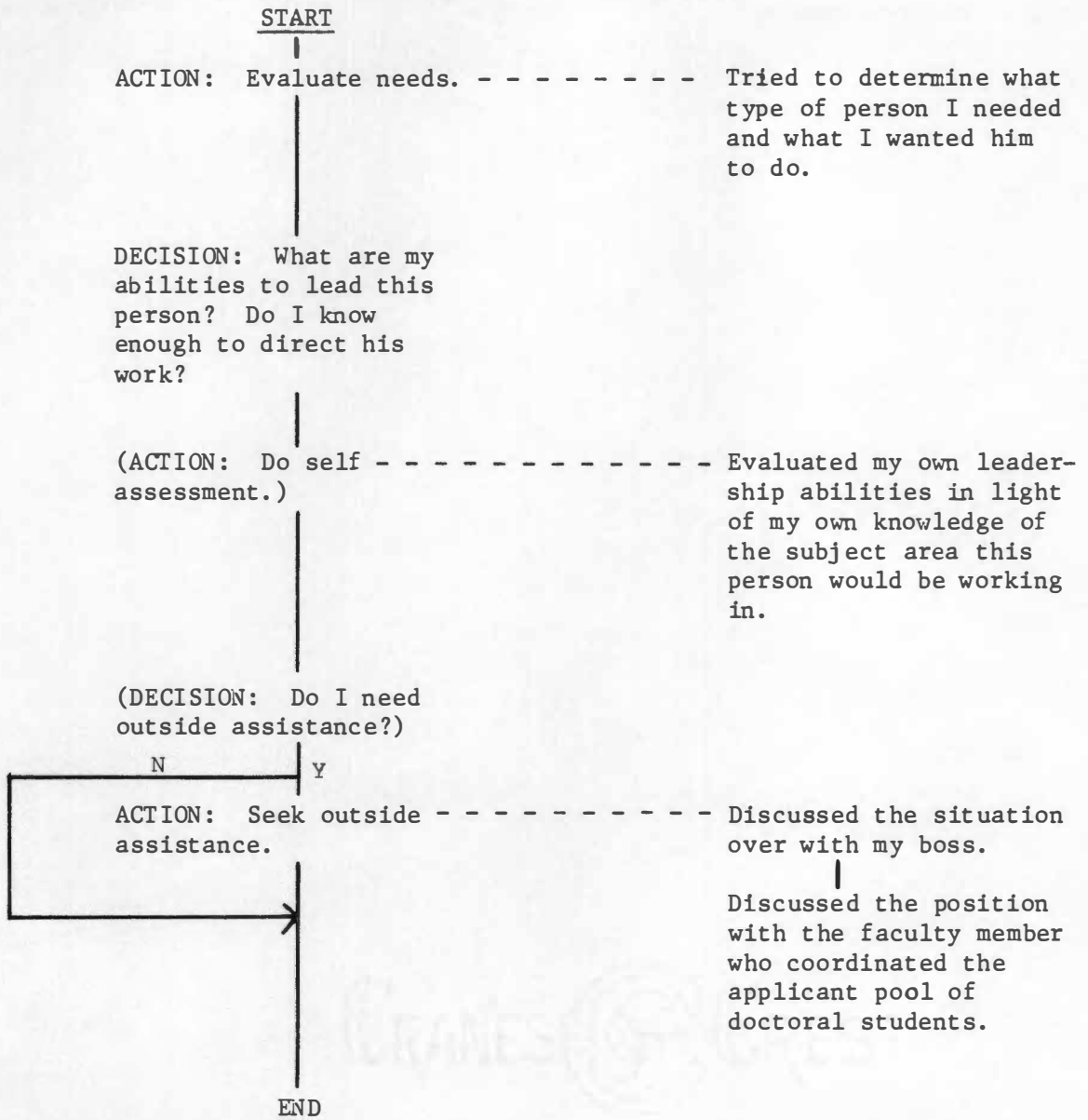
CASE STUDY 8A

Thematic

When faced with filling a vacancy on my staff, the first thing I did was give the subject some very deep thought. I asked myself what type of person did I want to fill the position. What did I want the replacement to do in the way of job responsibility? I also wondered about my own ability to guide the new individual, since I really do not know much about the area this person will be working in.

The next thing I did was talk to my boss. I did this because I wanted to get his perception of the situation. I also wanted to discuss the selection process.

After that I talked with Dr. Larsen. Larsen coordinated the applicant pool the last time the position was vacant, and I felt he might be able to make some good suggestions, which he did. This is where I am right now.

Schematic 8A

CASE STUDY 8B

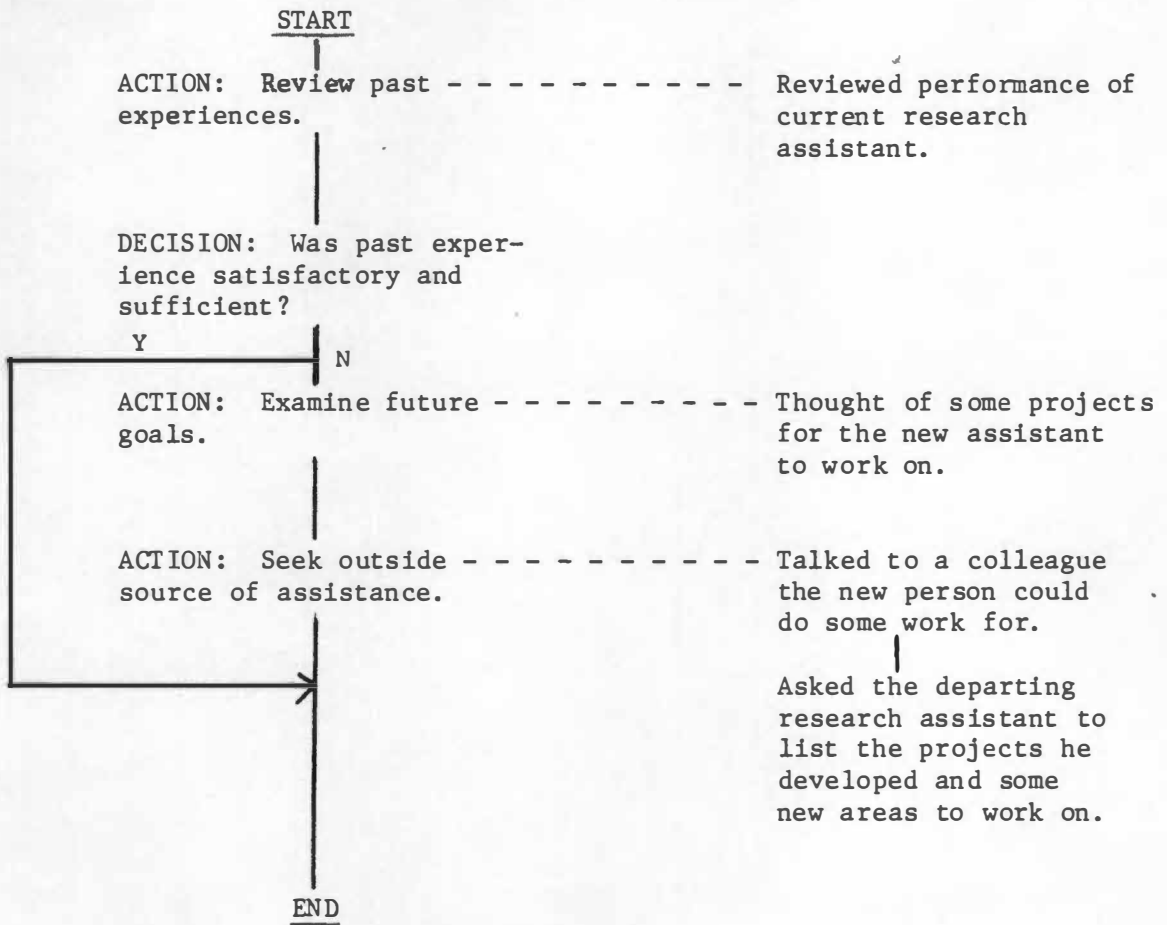
Thematic

I am the training director for a state university. I have to hire a person to replace my current research assistant, who is graduating, and I am trying to determine what type of individual I need.

The first thing I did was mentally evaluate the person currently in the position. I had not decided if I was satisfied with his performance, so I thought I'd best make that determination.

The next thing I did was look at the projects I might like the new person to work on. After that I talked with a colleague to determine if she had any projects the new person could work on.

My latest activity on the problem was to ask the departing research assistant to write down his accomplishments and what he saw the next person doing.

Schematic 8B

CASE STUDY 9A

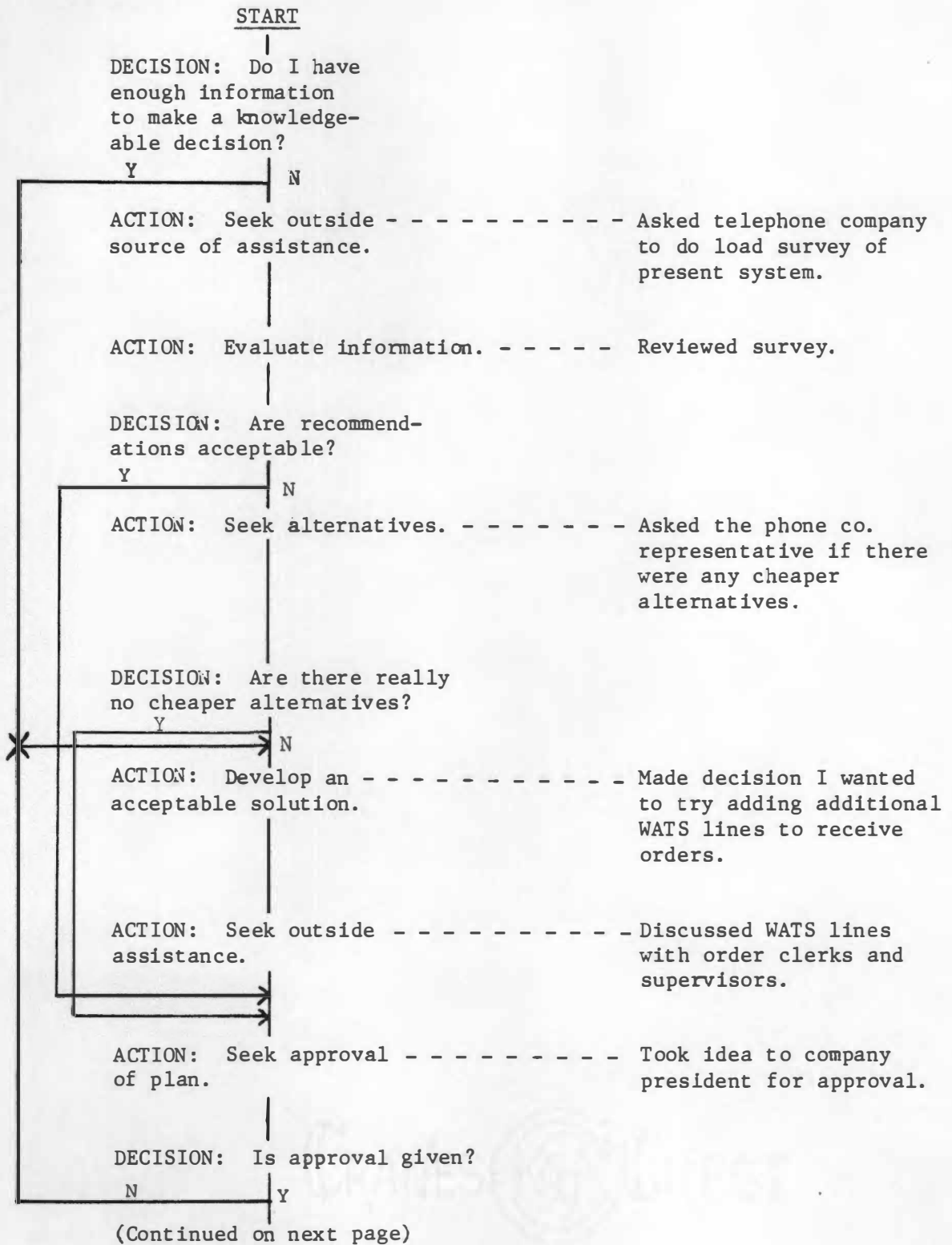
Thematic

When the problem of my company's high telephone cost was presented to me the first thing I did was ask myself if I had enough information to make knowledgeable decisions. To do this I needed to know if new equipment would handle the volume of service we were experiencing, so I asked the telephone company to do a survey of our system. The survey indicated we should consider a larger system.

The second thing I did was evaluate the recommendations of the phone company. I then asked the phone company if there were any cheaper alternatives. My service rep told me there were no cheaper alternatives, and I knew we could not afford the system recommended by the phone company rep. I then began to think about the feasibility of simply adding one or two incoming WATS lines.

After deciding that this was what I wanted to do, I met with the people in my company who would be responsible for making the new system work to enlist their support. Afterwards I took my idea to the company president for his approval. I then had the additional lines installed, and am now observing the results.

Schematic 9A



Schematic 9A (cont'd)

|
ACTION: Implement plan. - - - - - Had WATS lines installed.

|
ACTION: Evaluate plan. - - - - - Observed usage and
telephone charges.

|
END

CASE STUDY 9B

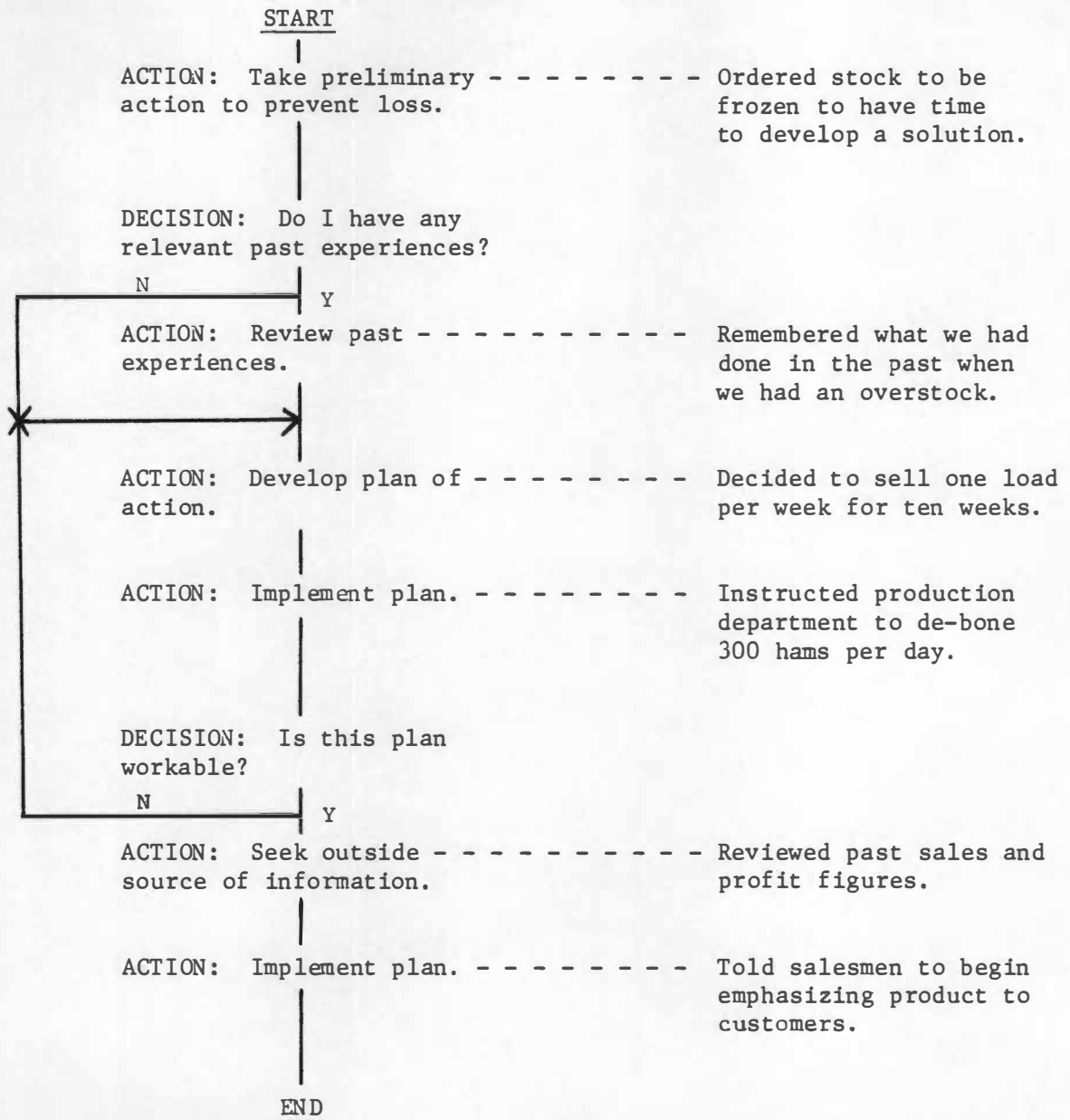
Thematic

I am the vice president of sales for a meat-packing company. Recently we came up with an overstock of hams. My problem was to come up with a way to get rid of the oversupply and still earn a good return.

The first thing I did was order the stock to be frozen. That gave me a little time to think. After reviewing mentally what we had done in the past when this happened, I decided to sell one load of frozen hams per week for ten weeks.

The next thing I did was tell the production people to prepare to de-bone 300 hams per day. After that I began to review past sales and profit figures to convince myself I was doing the right thing.

After being sure we had enough profit margin on each ham to justify my plan I instructed my sales department to begin pushing frozen boneless hams to certain customers.

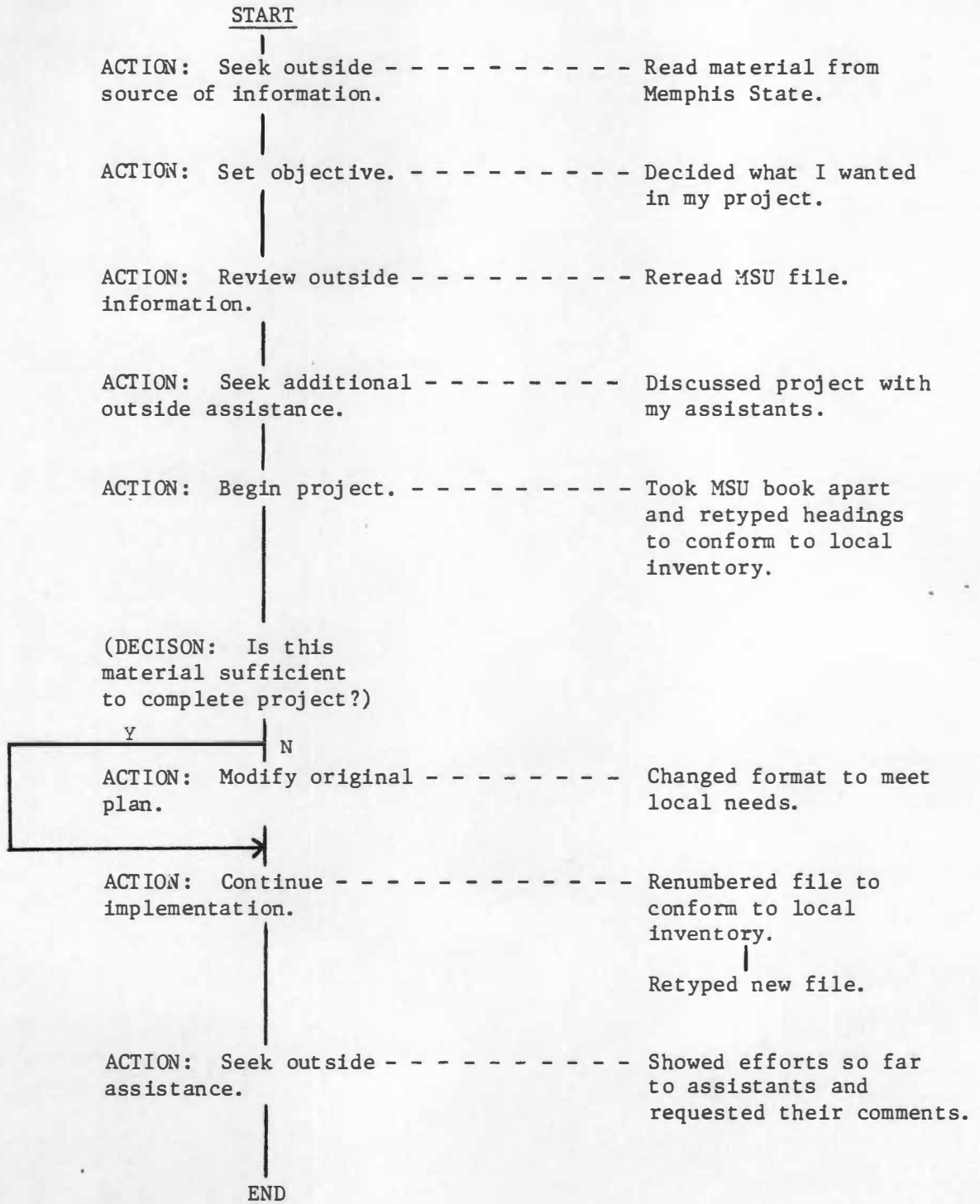
Schematic 9B

CASE STUDY 10A

Thematic

I recently obtained a copy of another university's vendor commodity file, which is something I have been working on for several years. Upon obtaining the file I read it and reread it, becoming familiar enough with it to decide that this one basically fit my needs. I then studied it some more to determine how I would modify it.

I then gave it to my assistants to get their comments. After getting it back I took the file apart, breaking it down into its component categories. I retyped the broad headings and began to fill in the items relevant to my institution, and deleting those that weren't relevant. I then modified the original numbering system and assigned numbers to the file listings. The next step was to retype it, which I did myself so I could make additional changes as I went along. The last thing I did was show the new file to my assistants and ask them to look it over and give me any suggestions they might have.

Schematic 10A

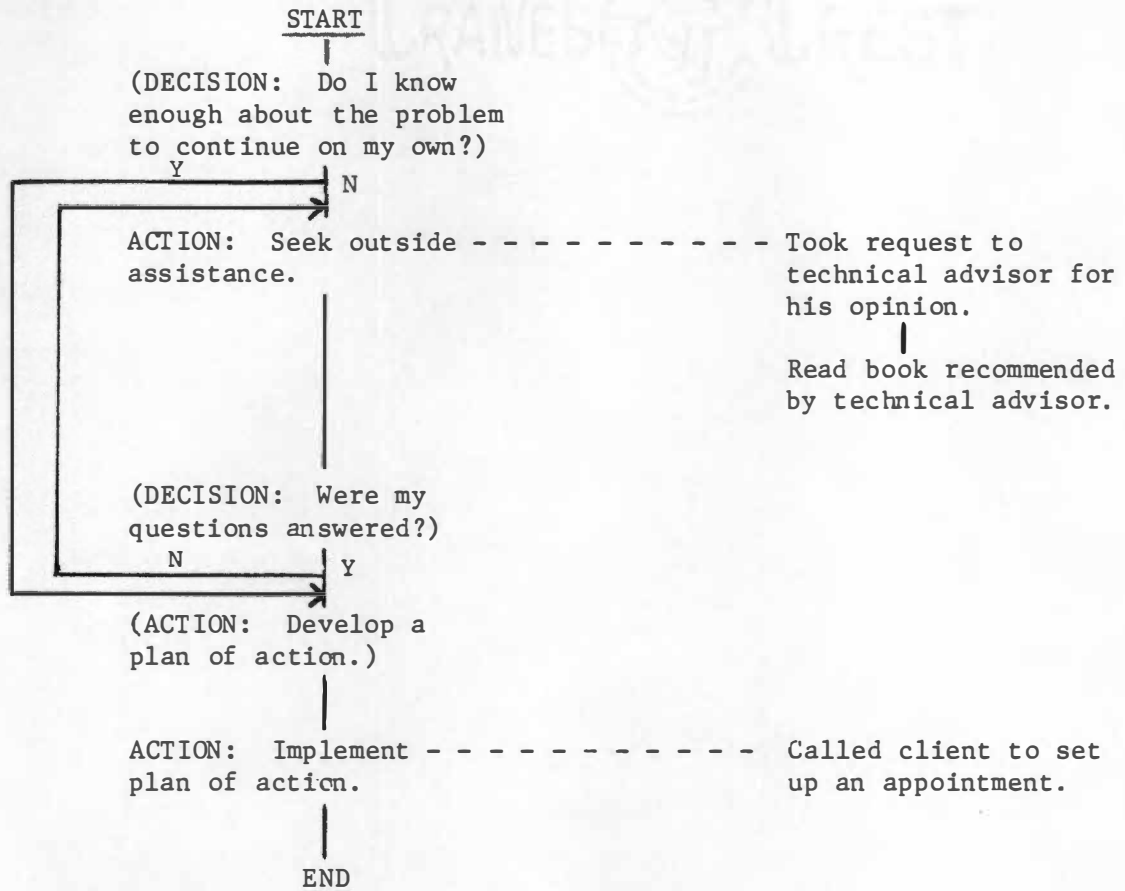
CASE STUDY 10B

Thematic

I am the purchasing agent for a state university. Recently, one of our people asked me to cancel a purchase request, I think because the recommended vendor did not get the bid. She then resubmitted her purchase request, with the specifications altered to try to eliminate all equipment except the one she wanted. My problem is this is not allowed under state law. The law says if cheaper equipment can do the job then you must buy it, even though it isn't exactly what the buyer wanted.

The first thing I did upon receiving the request to rebid was show it to the director of our computer center, who acts as my technical advisor. He told me she was getting overly specific in her specifications. After that he showed me a book containing comparisons of all equipment like she wanted. It was obvious from the descriptions that the low bidder's equipment would do everything she wanted, and more.

The next thing I did was call her to set up an appointment to discuss this situation with her. She was not in, so I will have to call her again.

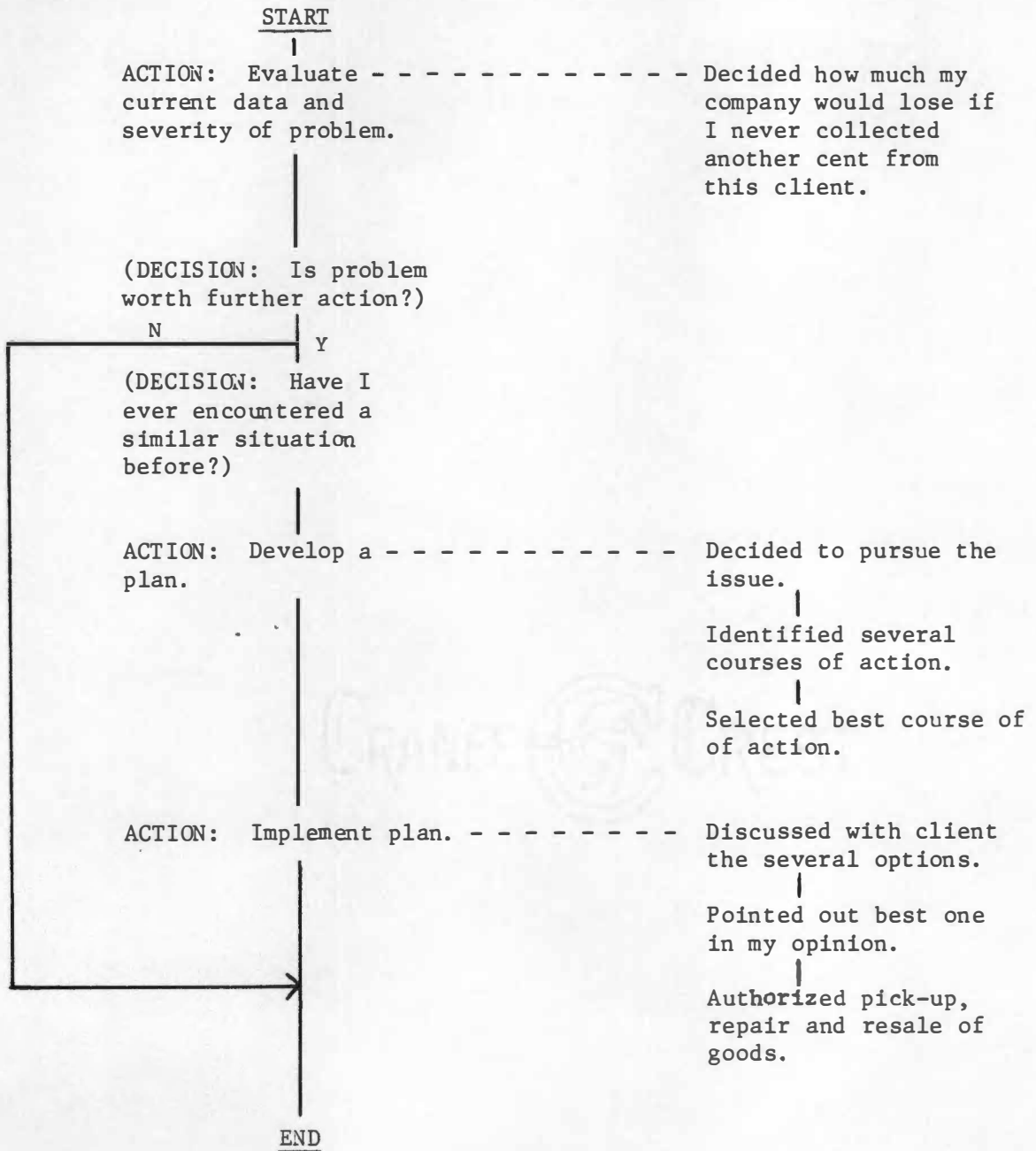
Schematic 10B

CASE STUDY 11A

Thematic

I am a person who does not like the people I deal with to fail to live up to their obligations. I am currently working with a former client-dealer who has stopped paying on a large debt. The first thing I did was determine how much my company would lose if I never received another penny from this dealer. I then reviewed my past experience to see how I had handled situations like this before. Since the company would lose a great deal of money by simply writing off the debt, I decided to pursue the issue. I developed on some alternative courses of action and selected the one I preferred the most.

I then went to the dealer, and presented the options to him, pointing out the one I liked the best. After discussing it a while the dealer agreed with me, and I authorized the dealer's men to begin picking up some of the mobile homes, having them repaired and placing them on the dealer's lot for resale.

Schematic 11A

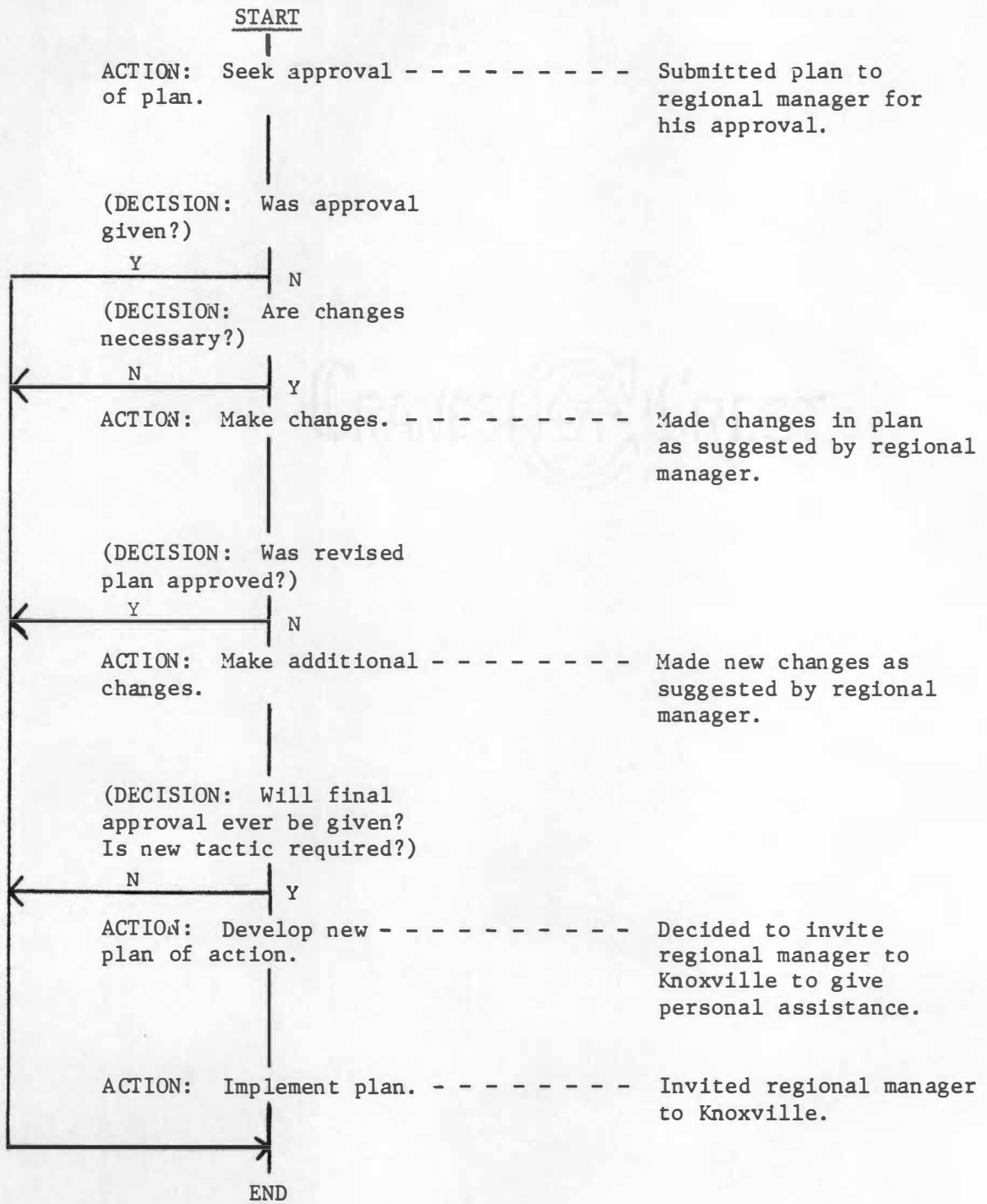
CASE STUDY 11B

Thematic

I am the district manager for a large credit company. Recently I got informal approval from headquarters for a new program. The problem is I had not presented it to my boss, the regional manager, for his prior approval. Now his feelings are hurt, and he is giving me a hard time with the formal approval. I had not intended to get approval from headquarters first; it just came up in conversation while I was there on other business.

The first thing I did was submit the plan to my boss in writing, as usual. He sent it back with several changes suggested. I made the changes and returned it to him. When I had not received anything back from him in two weeks, I called him. He suggested more changes and returned it to me. I made the change and sent it back to him.

At this point I realized this could go on forever. I began to think about my past experiences with this person, and how he operated. It dawned on me that he was a lot like my children, so I decided to treat him like one. I had often motivated my kids by asking them to help me, so I tried it on him. I asked him to come to Knoxville and help me with this plan. He has accepted my offer, and I am waiting to see what happens.

Schematic 11B

Comparison of Solution Processes

The next step in the overall analysis was to compare the interviewee's problem-solving processes with each other to determine if any trends, patterns or systematic methodology emerged. The results here could be used to point out any variation across the sample and possibly to explain these variations.

One clarification needs to be made at this point. In all but three cases the interviewees seemed to omit at times from their descriptions at least one step which appeared to the analyst to be necessary to perform the next step. In the schematic diagrams these omissions are inserted and enclosed with parentheses, and are known as hidden premises. It should be understood that these hidden premises are the interpretations of the analyst and not actual steps described by the interviewee.

In the section on the ACTS analysis it was noted that many of the interviewees made either direct or indirect mention of past experience as a factor of some kind in their beliefs, fact-intentions, and hypothetical norms. Comparison of the schematics indicates that in six instances the subject reviewed his past experiences as an initial step. Three of these were direct references and three were in the form of hidden premises. In Case 8B, for example, the subject was attempting to find a way to cut telephone expenses in his company. In his own words, his very first step was to ask himself if he had ever done anything like this before.

In addition to these six instances, there were five other cases where the subject asked himself if enough information was available to make a decision, or to evaluate the current situation or the data on

hand. It could be inferred that answering these questions could involve a search of past experiences. In determining if enough information was available to make a decision the subject could conceivably check all the direct and indirect past experiences he could think of to locate every relevant piece of information. Evaluating the current situation could involve evaluation with respect to past experiences in the same or similar circumstances.

In two other cases there were references to past experience in later stages of the process. There were several cases where there was a possibility that past experiences were considered somewhere in the process, but there was not enough direct evidence to even make inferences.

Some form of outside help, human or non-human, was sought thirty-six times in seventeen of twenty-two cases, for an average of 2.1 times per case. Seeking outside assistance was listed as a first step in four cases, as a second step eight times (five actual references, three hidden premises), and three times as a third step. The remainder of references are further down in the process. It is interesting that one interviewee sought no outside assistance in either case he discussed. One of these cases involved a problem in gaining approval from a superior for a proposal which, given the broad guidelines of this project, could be considered outside assistance, although not by this researcher.

As mentioned above, in three cases there were no hidden premises. There were five cases where hidden premises were the first step. In four cases there was only one hidden premise. Out of a total of 191 problem-solving steps, fifty (26 percent) were hidden premises.

No patterns of problem-solving processes across individuals emerged. This could be the result of several factors. One, the subjects were not in similar positions in similar organizations or industries. Two, they all had disparate backgrounds and varying levels of training and/or education. Third, and probably most important, is that they all described very different problems. In most cases they did not discuss similar problems in their two individual interviews. As a result, it could be implied that different problems require different solution processes. Only one subject, interviewee #5, described a somewhat similar process in both his interviews. This finding supports Newell's and Simon's view of the human being as a processor of information, where the problem-solving process is dependent on the situation the problem appears in. It also supports Greeno's work concerning the knowledge/problem-solving relationship.

For all but two sets of cases (10 A&B, 11 A&B), if the first problem had at least seven steps, the second had at least as many. Conversely, if the first problem had six steps or less, the second did also. This seems to say that even though an individual may not follow the same steps for solving various problems, there may be a pattern for each individual as to how complicated the solution process is in terms of number of steps involved in the solution process.

The next two steps in the analysis involved comparing the sample group's problem-solving processes with established models of problem solving. The purpose here was to determine if the subjects followed any published systematic model for problem solving, and to gain further knowledge of the problem solvers' reasonings and strategies.

Comparison With Kepner's and Tregoe's Model

In Chapter II Kepner's and Tregoe's steps for problem analysis and decision making was discussed. These steps are listed below.

Problem Analysis

1. Compare what should be with what is;
2. Recognize that what is (the problem) is a deviation from standard;
3. Precisely identify, locate and describe the deviation from standard;
4. Look for what sets apart that which was affected from that which was not;
5. Consider only those changes connected with distinctive areas of the deviation;
6. Deduce possible causes of the deviation;
7. Apply all the facts to the deduction to confirm the cause.

Decision Making

1. Establish the objectives of the decision;
2. Classify the objectives as to importance;
3. Develop alternate courses of action;
4. Evaluate the alternatives against established objectives;
5. Choose the alternative best able to achieve all objectives;
6. Explore the tentative decision for possible adverse consequences;
7. Take action to prevent possible adverse consequences from becoming new problems.

By comparing each schematic to Kepner's and Tregoe's model for problem analysis and decision making (Kepner and Tregoe, 1965, pp. 46&48) it was found that none of the interviewees rigidly followed the Kepner and Tregoe model. This can be attributed to several factors. First, the subjects were not chosen for the study on the basis of prior knowledge of Kepner's and Tregoe's work. An interviewee could not apply their model if he had never been exposed to it. Second, the definition of problem used in this study (see Chapter I) was rather broad, while Kepner's and Tregoe's is fairly specific. Not all situations defined in this study would fit Kepner's and Tregoe's definition of a problem.

Third, the interview instrument designed for this study was not created with the Kepner and Tregoe model in mind, nor was the interviewer trained to seek information specifically related to the formal model. Questions may not have been structured or asked in a way that would elicit a response concomitant with Kepner and Tregoe. For example, when asked to describe the first step in the process, in five cases the response was an equivalent to the term "analyze the problem." This was accepted as the first step, whereas Kepner and Tregoe break down analyzing the problem into seven steps.

As a result of making these comparisons some general findings were evident in the sample. As stated above, five cases started by analyzing the problem, which is the first phase of Kepner's and Tregoe's two-phase model. Taken from the right side schematic, which reflects the actual steps taken, the following actions detail the initial analysis of the problem by the five interviewees mentioned above.

1. I inspected the house to assess the damage.
2. I looked at the various parts of this problem, how they were related, and the results of these relationships.
3. I reviewed the situation to determine if it required my input and time.
4. I tried to determine what type of person I needed and what I wanted him to do.
5. I decided how much my company would lose if I never collected another cent from this client.

The first step in Kepner's and Tregoe's decision making stage is to establish the objectives of the decision. While only one interviewee specifically stated an objective or implied one strongly enough for the

researcher to infer a hidden premise, it seems very likely that each subject had an objective in solving each problem. This objective could be simply meeting the request or assignment of a superior, or saving the company hundreds of thousands of dollars. Regardless of the specific situation, all subjects appeared to have some objective in mind when they initiated their problem-solving activities.

An important part of the decision making phase of Kepner's and Tregoe's model is evaluating alternatives. While only one of the schematics specifically stated "select from alternatives" as a step, in five others statements were made which implied that one or more alternative actions were considered. It can be assumed that part of that consideration could be a search for adverse consequences which is one of the last steps in Kepner's and Tregoe's model.

Comparison With Peters' Model

Peters' three-step model of problem solving states that, when presented with a problem, an individual will:

1. search his past experience for a directly related solution and apply this solution to the new problem. Failing, he will
2. search for indirectly related past experiences from which a solution may be created. Failing, that, he will
3. go to outside resource (human or non-human) for assistance in solving the problem.

In seven cases the first thing the subject did was refer to past experiences. It could not be determined from the answers given if these were references to step 1 or step 2 above. It seems logical to assume they were referring to step 1, for why would one try to create a new

solution before examining the possibility that a solution already exists? In four of the seven cases the subjects asked themselves if they could accomplish the task by themselves with the information at hand. It also seems reasonable to infer from this that to make that determination they would have to search their past experiences for similar situations. If this were not so, they would always be entering what for them would be a new experience. It seems unlikely they would ever get the confidence required to make the decisions expected of them.

Case 11B provides an example of a search through indirect past experience for a solution to a problem. The problem in this case was soothing the injured ego of an immediate supervisor. After many ill-fated attempts to resolve the problem, the manager decided to employ a technique on his superior that he often had used with success on his children. This, of course, was after he had found unsuccessful all directly related past experiences.

In only three cases was seeking some form of outside assistance the first step in the process. In ten cases it was the second step. It appears from this that even though they may first check past experiences, there exists a tendency early in these managers' problem-solving process to turn to something else, or someone else, for assistance. In most cases, it is to obtain more information to make a better decision, or to get another opinion or a confirmation for a decision or action. This may be a result of the competitive nature of their job, where a poor solution or decision may cost their organization resources and would "set back" the manager in his efforts to advance. In six of seven cases where reviewing past experience was the first

step, seeking outside assistance was the second step. The implication here is that either their past experiences were unsatisfactory for this problem, or that they wanted confirmation of the correctness of their potential solution. These findings support Peters' theory that assistance is sought after past experiences are reviewed.

There were two instances where the subject appeared to follow Peters' model exactly. In Case 8B the manager started out reviewing his direct past experiences to see if they were applicable. Determining that he did have applicable prior experiences, he evaluated them, and finding them relevant he determined what his goal was and then sought additional input from a colleague. In Part II of Case 3B the manager examined his past experiences (assumed to be both direct and indirect), evaluated them, set his objectives, and then decided he would seek outside assistance from his superior. He then continued his process.

The two cases cited above describe instances where the interviewee's description of the problem-solving process overtly mentioned all the steps in Peters' model. There were nine other cases where by adding a hidden premise or making an inference from a broad statement, the subjects' problem-solving process would have fit Peters' model. This means that in 50 percent of the cases Peters' model was applicable even though the subjects had no prior knowledge of the model or its supporting theory.

Summary

As a result of the frequency counts, it was learned that for this group the most often occurring psychological modes were facts, beliefs, fact-intentions, and hypothetical norms, in that order. From the ACTS

analysis it appears that beliefs lay the foundation for the higher-level modes. These beliefs are the result of many different influences in the individual's life. These include parental teachings, past experience, common sense, and, to a minimal extent, policies and regulations.

Policies and regulations did have an impact on fact-intentions for this group. Many of their problem-related actions were influenced by these factors. Fact-intentions seemed to be dictated by the situation, especially if time was a constraining factor.

Hypothetical norms provided little toward understanding problem-solving behavior. This was due to their low incidence of occurrence in the subjects' problem-solving processes.

Comparison of the solution processes emphasized the importance of past experience to the problem solvers. In 50 percent of the cases studied, the subjects reviewed their past experience before doing anything else. In most cases, the subjects reported seeking some form of outside assistance at a later point in the process. This comparison also indicated the existence of some type of structure relative to complexity in each subject's problem-solving strategy.

In comparing the problem-solving processes in this study with Kepner's and Tregoe's model for problem analysis and decision making, it was found that there were similarities in the steps taken by the subjects and those contained in the model. It appears that as a group the managers do have some systematic format for their problem-solving efforts.

Peters' model of problem solving compared favorably with the processes described by the subjects in one-third of those problems

discussed. In two of those cases it appears the subjects followed Peters' model exactly. The model was further supported by the fact that in only three cases did the subjects seek outside assistance as a first step.

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CHAPTER V

CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

As stated in the Introduction to Chapter I this study was exploratory in nature. It was designed to provide some additional insight into the problem-solving activities of a particular sample of the adult population and to present some additional avenues of inquiry for future research. It had as its objectives the following: (1) to describe the problem-solving steps followed by selected managers; (2) to examine the supporting reasons behind the problem-solving activities; and (3) to compare managers' problem-solving processes with selected models of problem solving. In light of these purposes and objectives, several conclusions have been formulated.

Conclusions About the ACTS Analysis

The ACTS model of analysis was an effective technique for transforming narrative data into separate thought units. By paraphrasing and eliminating tangential information, the analyst was able to work with the "lowest common denominator" of data. Even though atomizing and categorizing were tedious tasks, when they were completed, the analyst could easily develop the thematic and schematic summaries in an orderly fashion.

The thematic summary provided a useful context within which to examine the specifics of the problem-solving process. By creating the thematic, the analyst pulls together in a cohesive narrative the schematic and the subject's stated reasonings underlying his problem-solving activities.

The schematic diagram proved to be an effective way of making comparisons of and conjectures about the problem solving processes of the subjects. By creating these flow charts, the analyst had a visual description of problem-solving activities to refer to at any time in the analysis. This was especially helpful when relating the subjects' activities to the structured models of Kepner and Tregoe, and Peters.

From the findings of the ACTS analysis, it is evident that the environmental factors Peters discussed are of paramount importance in each of these subjects' problem solving process. These environmental factors included time, people, money, and especially the organization each was employed by. As a member of an organization, each was affected in some way by the organization itself. For some it was simply the goals of the organization that had an impact; for others it was the structure of the organization. Some were influenced by various components of the organization--its people or its policies. In any case, all of these factors played a role, either directly or indirectly, in how these individuals chose their problem-solving strategies. From this, it appears that problem-solving types could be identified by studying the organization in which the subject operates.

Past experience is vital in developing problem solutions. This seems apparent from the number of direct or implied references to past experience, both in the schematic and in the general discussion of the interview. More data on past experience and their impact on problem-solving could possibly be obtained if more probing is done in this area in future studies. Along with the organizational influences, the individual's past experience was more instrumental in the problem

solving process than anything else. None of these managers wanted to spend their time "reinventing the wheel." They wanted a solution as quickly as possible. Given this, it seems logical that the first place to look would be past experience. If nothing is there, then they go on to other sources.

The results of the frequency count suggest that when asked to verbally describe a behavior, most of what the respondents related were objective descriptions of states of affairs. In most cases, much of the irrelevant discussion could have been eliminated through a second reduction process, and little or no damage would have been done to the data relevant to the study. The high number of facts appearing in the analysis could be caused by the nature and subject of the questions asked in the interview.

The frequency count also points out the fact that norms were seldom identified in the discussions of problem-solving behavior. This could be the result of the focus of the questions asked or the way they were worded. In any event, if norms are to be the focus of further study, another instrument for getting at those norms will have to be developed. This instrument did not allow the deep probing necessary for bringing awareness of norm up from the depth of cognition.

Comparison of the subject's problem-solving processes with each other revealed little significant data. The influence of past experience was reaffirmed. Also discovered was a propensity by the managers for seeking outside sources of assistance, mostly from other individuals, which could be the result of time constraints or competitive pressure to always be right.

The applicability of Kepner's and Tregoe's model of problem analysis and decision making was emphasized by comparing their model with each schematic. With so many of the subjects using steps similar to, though not necessarily in the order of, those suggested by the originators of the model, it appears that many of the managers in this group do follow some kind of systematic process. What remains to be discovered is the structure of each individual's model and the reasonings behind it.

The importance of past experience in the interviews lends credibility to Peters' theory of problem solving. With 50 percent of the cases included in this study having a search through some form of past experiences as the first step, it seems apparent that Peters' sequence of problem solving has some validity. More study of this model is definitely indicated.

At this point something needs to be said about the methodology. Using a naturalistic method of research for this type of inquiry was an effective means of obtaining data. Given the limited background of the researcher in psychology and cognitive theory, it is unlikely that any insight into the underlying themes and reasons for behavior would have been obtained using traditional research methodologies. It also would have been very difficult to secure the cooperation of the subjects if traditional techniques had been employed, for these managers would not have allowed the researcher to "follow them around making observations." Using this methodology was valuable in another way, in that data were obtained not only about the actual process itself but about the underlying reasonings, which could then be verified.

Recommendations and Implications for Further Study

The results of this study are far from conclusive. The potential is there for several research projects based on these findings. Before these implications for further study are discussed, however, some recommendations should be made.

First, the definition of problem should be more narrowly stated. In this study almost any activity could be considered a problem, which creates a problem in itself. Some of the subjects in this study had difficulty developing topics for the interview because they weren't sure what the researcher wanted to discuss, especially early in the project.

More intensive training of the interviewers needs to be conducted before sending them into the field. Interviewers need a solid background in the theory guiding the project to be sure they are not missing vital data when interviewing. They also need to be thoroughly familiar with the interview technique. One-on-one practice and role play should be mandatory, allowing at least one month for training.

More research is necessary into the role of past experience in problem solving. How far back do individuals go in their past to search for possible solutions? Are their impressions of their past experiences always correct? Answers to these questions would add to the existing data on problem solving.

In using this methodology for future studies, a better way of identifying the reasonings behind behavior needs to be developed. This process should be able to take each specific action and somehow break it down, or reduce it, until the rationale behind the behavior is apparent.

Another interesting research project would involve applying the ACTS model to Kolb's cyclical model of learning. The purpose of this would be to attempt to confirm or reject Kolb's theory by identifying the reasonings behind learning behavior. The structure of this study did not lend itself to this issue, but it could hold promise for tasks other than problem solving.

Summary

Being an open-ended study, this thesis had no hypothesis to prove or disprove. Its purpose was to add to existing data on problem solving and naturalistic methods of research. Most of the conclusions at this point are significant only for the sample population in this study. More research in this area is indicated. What the study did find was that the eleven managers interviewed used past experiences and outside resources to aid them in solving problems. Many of the subjects appeared to follow a similar format in selecting their solution approach. This format involves past experiences and sources of assistance found outside the individual problem solver. The subjects did not follow the systematic problem-solving approach espoused by Kepner and Tregoe, although they did use many of the steps included in the researchers' model. This implies that there is some systematic structure to most manager's problem efforts.

As a result of these findings, the objectives of the study as stated in Chapter I were met. Much more research in this area could be done to build on the work started here.

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LIST OF REFERENCES

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APPENDICES

APPENDIX A

INTERVIEWER GUIDELINES

1. Introduce yourself, chat a few minutes to set the climate.
2. Explain the purpose of the project.
3. Explain the interview procedure.
4. Discuss a range of problems being experienced by the interviewee.
5. Choose a problem that has recently occurred—within the past month if possible.
6. Help the interviewee define the problem and then repeat it in your own words for confirmation.
7. Further clarify and qualify the problem by probing, asking the interviewee questions relating to the origin of the problem, when the problem first became apparent, how, and why the interviewee determined the situation to be a problem for him.
8. Trace the development of the problem solving process by probing into the sequence of steps and decisions that marked the interviewee's attempts at arriving at a solution.
9. Your probing should reveal the first thing the interviewee did and/or thought. This might take several attempts on your part, to ensure the interviewee's recollection of the first event, because the tendency will be for the person to remember first the events most salient to him, but not necessarily the initial event. Ask the interviewees to explain why each event occurred.
10. When you are satisfied that you and the interviewee have identified the first thing done or thought, probe for the next event.

(Note: The response already made by the interviewee may provide clues, as you trace back from the person's answers given to your questions in (9) above.) Be certain to ask why the interviewee took specific steps/decisions.

11. Trace event after event until you reach the present time.
12. When finished with a review of the events, ask which, if any, event(s) would the interviewee do differently, if at all. How and why?
13. Summarize the essence of the problem, its solution thus far, and what was learned. Ask for additional comments, if any.
14. Close and remind interviewee that you will contact him in a few weeks for an appointment and another interview.

APPENDIX B

INTERVIEW QUESTIONS

1. When did you first notice this was a problem?
2. Why was this a problem for you?
3. How did it start?
4. What was the first thing you did (about the problem)?
What was the second, third
5. Why did you do that?
6. Tell me about it.
7. How did you feel about it?
8. What are you doing about it?
9. What have you done about it?
10. What are you planning to do?
11. Is there anything you would do differently? Why?

VITA

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