

# MICROCOMPUTER APPLICATIONS in Educational Planning and Decision Making

C. KENNETH TANNER  
C. THOMAS HOLMES

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# Introduction

The purpose of this book is to illustrate some well-defined planning methods that are useful in planning for education and other public service areas. An overview of planning concepts, microcomputers, and the related literature is presented in chapter 1. Following this introduction, twelve planning techniques are integrated throughout the five remaining chapters. Each chapter is designed in a systematic, progressive style whereby the reader may move from simple to more difficult problems. The book may, therefore, serve as a learning package, textbook, reference work, or a guide to programming microcomputers. The reader is not required to have a great deal of knowledge of research or organizational and political processes pertaining to public service agencies. Knowledge of computer language or high level mathematics is not necessary, although some quantitative solutions assume a minimal understanding of high school algebra. All the computer programs included in appendix A may be copied onto most microcomputer systems and "saved" with only very minor changes.<sup>1</sup>

Professionals and students in education, public administration, planning, and policy research will find the problems and proposed solution strategies of value in teaching, research, and applied settings. Most of the emphasis in this work is on practice. While theory is acknowledged, the focus is on data collection, problem investigation, and the generation of solutions.

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1. The microcomputer programs are available on diskette for the Apple II-e. The diskette may be obtained by contacting the authors at G-10 Aderhold Hall, University of Georgia, Athens, GA 30602. The cost is \$7.00.

For example: What are the most time efficient ways to plan and manage a program or project? What are the key variables that the researcher should investigate in the community when developing policies for public service agencies? Which models are best for forecasting student population--the major beneficiaries of local tax dollars? How should program development take place and what approaches should be used in the initial phases of facilities planning? What are some appropriate methods and models for locating sites for public buildings? These questions frequently confront the administrative planner and policy maker.

Twenty-eight problems with explicit solutions are incorporated in chapters 2 through 6. Additional problems with their answers are given in appendix B. Solutions are determined in a straightforward manner that leads to the use of the software package. Each major planning model is presented in BASIC, the language most frequently used in the world of microcomputers. The necessary input and output per problem are revealed.

The theme of the book focuses on a basic understanding of how analytical planning methods may be used proactively to complement the mission of an organization. More emphasis is placed on solving problems and generating information for planning new policies than on the evaluation of policies after their implementation. The book deals with practical problems and solutions amenable to planning and decision making. Throughout the book there are special hints to the planner on how he or she can expect plans to be received by policy- and decision-making groups. Special emphasis is placed on long-range planning, since comprehensive planning in advance of policy decisions should be the concern of every decision maker.

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**and Decision Making**

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# Chapter 1

## Introduction to Planning Concepts and Microcomputers

### PLANNING CONCEPTS

Let us begin an investigation of planning and decision-related activities by taking a look at some conceptual dimensions. It is important immediately to recognize that the environment where planning takes place is the most significant variable in the planning process. Within this environment, planning activities are accomplished by people--people living within a political environment where formal and informal organizations exist. The core of any conceptual framework for planning involves a person or a group who work through a set of organized activities designed to influence a decision about the future of a person, a group of persons, an element of an organization, a total organization, several organizations, or various combinations of all these targets.

Planning may be categorized as proactive or reactive. Proactive planning implies the anticipation of a problem before it arises. The results of proactive planning are alternatives that limit negative consequences and maximize positive consequences. On the other hand, reactive planning involves individual or group efforts to solve a set of problems after they have occurred. The obvious alternative to proactive or reactive planning is inaction or to do nothing. Proactive planning is less popular than reactive planning in our political environment because historically we have had difficulty in convincing practicing politicians of the need to analyze or solve problems before they arise. According to Quade,<sup>1</sup> an essential element in planning is the forecast of future events. We agree with this observation and also contend that analysis is not planning, although the plan may result

from analysis. Likewise, a plan may not necessarily result from a forecast.

Conceptual frameworks for planning activities are not difficult to discover in the literature, yet those without decision making as a goal appear to be useless unless one is satisfied to just plan for the sake of planning. A sound framework for planning rests upon the assumption that planning is a process of preparing a set of decisions for future action.<sup>2</sup> If we assume that action involves an element of change, then planning depends upon attitudes reflecting the desire for orderly change and strategies that facilitate change.<sup>3</sup> Within this context we shall acknowledge that the environment influences the knowledge base, the goal orientation, the strategies for planning, and the implementation of plans. We must not forget that planning activities are accomplished by people, not objects, who also influence an organization and its environment. Thus, a complex interactive process is characteristic of an environment where planning is accomplished.

Inbar<sup>4</sup> has offered a comprehensive two-dimensional conceptual foundation for planning. The basis of the foundation is represented by two Cartesian coordinates where two types of knowledge and two goal orientations define the axes. Goal orientation is represented on the x-axis. Allocative planning activities dominate the right side of the axis, while the left half of the axis is concerned with behavioral goal orientation. The y-axis is divided into two components. Explicit knowledge dominates the upper half of the y-axis, while tacit knowledge influences the lower part. Inbar contends that most planning activities are allocative in nature. That is, we plan for the allocation of resources needed by the people within an organization. This type of goal orientation is in contrast to the behavioral goal orientation that is directly aimed at the behavior of people in an organization.

Within this conceptual frame of reference Inbar's first quadrant consists of rational planning activities where patterns of implementation are integrated with the allocative goal orientation and explicit knowledge. People within the organization follow a specific course of action influenced by formal objectives sanctioned by the power structure. Legislation and coercive manipulation are power sources that are prevalent in this setting. The second quadrant of the conceptual framework rests upon explicit knowledge and behavioral goal orientation. Planning strategies are defined as "mixed scanning" where patterns of implementation depend upon manipulative persuasion and the objects of planning are the roles and responsibilities of people. Etzioni<sup>5</sup> developed a mixed-scanning model as a synthesis of incrementalist and rationalist planning that

outlines components of decision making. Human judgment, however, is the key ingredient in any planned implementation.

The third quadrant slips into the mode of incrementalism. The goal orientation is behavioral and the knowledge base is assumed or implied. Implementation of plans depending upon a high degree of value choice is essentially a reeducational process. Trade-offs between facts and values are characteristic of decisions resulting from this component of the framework. Bargaining, push and tug, and trial and error are appropriate descriptors of planning activities in quadrant three. Another aspect of incremental planning not emphasized by Inbar is that this typology places emphasis upon decentralized control whereby things get done through a decentralized bargaining process. Our contention is that problems rarely get solved, yet some analysis is done, a decision is made, new problems arise, more analysis is completed, and so forth. Lindbloom<sup>6</sup> described this as the "science of muddling through."

The fourth quadrant provides a foundation for explorative patterns of implementation that draw from tacit knowledge and allocative goal orientation. The planning strategies employed in this element of the conceptual framework are defined as "linkage planning tactics." The primary question answered with this set of tactics is: What are the impacts and relationships of organization and environment upon the educational or any other organizational process involving people with problems to be solved?

Based on this overview one should recognize that planning is goal oriented. Furthermore it is dependent upon the knowledge base of the planner plus the reactions of those persons affected by the implementation of the plans. Implementation of plans implies decision making founded on some conceptual base. Just how planning activities are accomplished, even if rational, analytical techniques are the central focus, frequently depends upon other elements of a conceptual framework such as mixed scanning, incremental, or linkage. Beyond these, advocacy and radical strategies may often be necessary for implementation of the best laid plans.

Even where a set of complex theories exists, planning should be a course of action whereby a set of organized activities leads decision makers to alternative solutions. The purpose of planning is to facilitate the operation of an organization or a subunit thereof, by establishing goals, objectives, policies, and methods aimed at proactive treatment of internal and external variables. Unfortunately, most planning in the United States is like economic policy; Nanus suggests that it is present-oriented and frequently reactive.<sup>7</sup>

Planning and analysis may or may not precede decision making or policy development. Public policies, according to Lindbloom,<sup>8</sup> may evolve from new opportunities, as well as from problems, and may just happen. The planning strategies discussed in this book are best suited for decision making, research, and generating information for solving problems before they arise. Although the emphasis here is on rational analysis, there is no attempt to suggest that planning, decision making, social research, and policy development are exact sciences. This was emphasized in the presentation of the four quadrants representing planning activities. The field of policy analysis, for example, is generally thought of as encompassing planning and analysis strategies such as systems analysis and operations research. Quade<sup>9</sup> indicated that policy analysis places emphasis on implementation and governmental organization. Educational planning parallels this concept. Two major phases in the study of public policy, as discussed by Jones,<sup>10</sup> are getting the issues to government and getting governmental action on the controversial public problem. The latter concept leads to research after policy implementation, and the former focuses on analysis before the decision to implement. Again, it is important to point out that our major emphasis in this work is on research in advance of decision making.

By advocating the formal analysis of problems and the planning of alternative decision strategies, we clash with tradition. The notion of the planning process as serial with clusters of unguided activities parallels Lindbloom's incrementalism.<sup>11</sup> Although he places some limited value on analysis and planning, Lindbloom has some serious doubts about the significance of formal analysis in the policy planning process. As a challenge to the incrementalists, Peter Housel<sup>12</sup> noted that it is the opinion of some that public officials are inept when it comes to decision making and they should rely on the specialists with methods and models for providing analyses for decisions.

As we move into the areas of research and planning for the purpose of solving problems and forming public policy, we note some difficulties. For example, one major concern for the beginning researcher is the wide range of definitions of planning, research, technology, and policy. Policy is frequently used to refer to highly diverse public actions and decisions. Policy, like systems analysis, is a very dynamic term that is frequently ambiguous unless something is known about the problem to which it is addressed. Hence, we read about energy policy, school board policy, defense policy, legislation, statutes, and regulations that may simply be expressions of rules, decisions, or programs. Heclo<sup>13</sup> considers policy as a course of action or inaction and not a set of specific decisions or

actions. This course of action must be viewed through an environmental and organizational perspective to understand its bounds of influence. Perhaps it is also wise to know the orientation of the analyst as well.

Concepts of planning, research, technology, and decision making have a wide scope. For example, the current literature abounds on topics such as general educational planning, social and economic planning, technological planning, policy planning, urban and regional planning, futurism, and educational facilities planning.<sup>14</sup> These areas represent special academic components and have their own language. All these various disciplines have a common goal--to make a positive contribution toward improving the welfare of people. Organizations representing these areas of planning and research strive to help solve social and economic problems.

Throughout each academic discipline, one method of planning--rational systems--seems to be a common thread, yet as noted earlier in this chapter, there are many theories of planning and decision making. The rational systems method is frequently secondary to mixed scanning, incremental, linkage, radical, or advocacy planning in our politically oriented public service agencies. The rational approach is characterized by a centralized decision-making structure and assumes ample data. It is goal oriented and most frequently depends on deterministic and probabilistic models for generating alternatives.<sup>15</sup> The rational systems method complements the other strategies that share the concept of transactive planning. The concepts discussed in this book favor the rational systems method tied to transactive theory.

Transactive planning places emphasis on individuals having a voice in their own welfare. New ideas are always welcomed. Thus, Friedman has stated that in transactive planning, action validates the continual evolution of ideas.<sup>16</sup> Transactive planning recognizes how decisions are made within the organization and permits face-to-face contact with persons affected by decisions that result from the combined rational and transactive efforts. When one strategy (rational or transactive) is used without the other, there may be trouble at the implementation and operations phases of the planning cycle. That is, people resist plans that are imposed upon them. In summary, the rational approach favors decisions that rely on hard data and analysis, while the transactive theory allows people who apply subjective judgment in decision making to be in charge of or have a voice in the quantitative models that generate alternative solutions.

This book, therefore, lends support to the rational-transactive theory of planning, research, decision making, and policy development. Table 1.1

Table 1.1. The Major and Minor Functions of Rational and Transactive Theories in Planning

Planning Phase	Rational Theory	Transactive Theory
I - Decision to plan	M-	M+
II - Information dissemination	M-	M+
III - Problem awareness	M-	M+
IV - Estimating the scope of the problem through analysis	M+	M+
V - Classifying the solution(s) in terms of goals and objectives	M-	M+
VI - Generating alternative solution strategies	M+	M-
VII - Implementing solution strategies	M+	M+
VIII - Operating under the new strategies	M-	M+
IX - Evaluating progress	M+	M+

Note: M+ = Major functions; M- = Minor functions.

indicates the relationships between the rational and transactive theories in planning. The decision to initiate planning activities, if not an ongoing process already, should be a major function of the people within the organization, since it is assumed that the result of the plan or plans will influence them as well as society. Under the rational theory this decision is generally made by one person. Obviously, it is not implied here that the chief decision maker is left out of the decision to plan. Certainly someone at the top of the organizational structure must advocate the move to plan. There should be policies that support continuous planning efforts within the organization. We shall assume that information sharing is a chief characteristic of this hypothetical organization. Phase II indicates that the transactive theory encourages information flow, in both directions, at each level within the organization. Phases I and II may overlap with each other and Phase III. This overlap or sharing of information may produce feedback. Thus, we note that planning under the rational-transactive theory is, indeed, interactive and dynamic.

With Phase III, problem awareness, we assume that people in the organization are adequately informed so



that the scope of the problem or problems may be estimated (Phase IV). A sound subjective and quantitative data base is needed to establish the magnitude of the problem. Both theories play a major role here since the rational theory assumes ample data and the transactive theory allows face-to-face discussion and subjective evaluation of these data. When the data are analyzed through rational means and then subjectively, we are ready to describe the solutions in terms of goals and objectives. The rational theory makes a contribution in Phase V, but the major contribution comes from the transactive school of thought since people are given the responsibilities of achieving these goals and objectives. The logical phase following the classification of solutions is to generate or seek alternative solution strategies (Phase VI). Again, there is overlap between this planning phase and Phase V since there exists the desire to know hard facts, such as how much the solution will cost. Therefore, more dependence is placed on the rational approach in Phase VI than on the transactive theory.

Equal emphasis on the two theories is needed in implementing solution strategies (Phase VII) because we need people--people who have contributed to the total planning process. We also need the hard, cold facts that are generated under the rational theory. That is, the rational theory helps minimize multiple guessing with respect to the right strategy. Since the new solution strategies must be operated and managed by people, Phase VIII is dominated by the transactive theory. The rational data are needed, however, but the greater need is the cooperation of the total organization and a more decentralized set of responsibilities if the total plan is to be successful. Finally, the evaluation phase (IX) is dependent upon both the rational theory and the transactive theory. That is, most evaluations should depend upon quantitative as well as subjective information. All of these phases are usually necessary for planning and implementation activities. The technological tool (the microcomputer) complements these planning phases and theories as indicated throughout the book.

## MICROCOMPUTERS

As we review these planning functions for the purpose of practical application in the world of public service, the following question is posed: Where can computer technology be of greatest assistance in planning, research, policy studies, and decision making? Before we answer this question our point of view concerning the microcomputer should be made clear. We

perceive the microcomputer and technology to be the servants of persons who are involved in planning, research, and decision making--not their masters. Hence, the microcomputer is a sophisticated hireling, where the sophistication is dependent upon the master as well as the servant.

Based on the planning phases outlined in Table 1.1, the microcomputer may provide assistance in each of the nine components that are outlined. Perhaps this developing technological wonder can render the most support in the phases of information dissemination, establishing the scope of the problem through analysis, generating solution strategies, operating, and evaluating progress. If the microcomputer is used primarily as a word processor, then its greatest assistance would be in information dissemination. On the other hand, if the microcomputer is employed to process statistical or mathematical models, Phase IV, analysis for the purpose of estimating the magnitude of a problem would become its greatest contribution. In sum, we emphasize that the applications of the microcomputer in the field of education and public service are really left up to the imagination, sophistication, and tenacity of the persons in charge of planning, research, and decision making.

For approximately two decades we have studied and discussed the implications of computer-assisted instruction (CAI). In 1966 CAI was indeed very popular, but for reasons such as prohibitive costs and the requirement of large areas for data processing and storage, the concept was kept on the back burner. With the developments in technology during the past five years, cost and storage have been eliminated as constraints on computer use in small jobs and in instruction. Thus, the term "educational computing" is replacing terms such as computer-assisted instruction and computer-based learning.<sup>17</sup> Educational computing has entered a phase of popularity that has been spurred by the development of microcomputers.

The concern for the development of packages of computer programs (software) is with us today, but it is not as serious as it was in the 1960s. Students and parents are forcing teachers to learn how to utilize the microcomputer, and teachers, students, and parents are putting pressure on educational administrators and governing boards to purchase and use computers in all phases of education. We cannot agree with W. L. Somervell, Jr., who contends that the United States appears to be losing its high-technology lead to other nations.<sup>18</sup> In support of our optimistic view, we cite the popularity of microcomputers, the simplicity of skills needed to program them, and the declining cost of hardware and software. However, we do believe that there is inefficiency in the way newly acquired knowledge is transferred to



those who would make use of it, for manipulating the technology is simpler than learning the concepts of planning models. For this reason, we have designed this book so that the concepts are presented through problems accompanied by appropriate software. The microcomputer helps to make use of planning models, research, policy studies, and assists in decision making.

Planners and decision makers do not have time to study and conduct research in all the different areas that complement the profession. For example, Judd<sup>19</sup> acknowledged that the realities of time pressures on educators have resulted in a strong interest in pre-recorded computer programs. That is, if people have good examples of computer programs and the methods and models behind those programs, uses of microcomputer programs and authorship of new or modified programs are greatly facilitated. We have made a concerted effort to present our material so that the creation of new or modified computer programs is made easier for the planner and decision maker. Spread sheet programs and concepts are excluded since their role is in the area of accounting. There are two positive outcomes that can be expected from the concepts outlined in this work and from microcomputers: (1) proper use of a microcomputer can greatly improve the quality of information for decision making and planning, and (2) operations within an organization will improve.<sup>20</sup>

Presently there is an unprecedented wave of development in microcomputer hardware and software. The rapidly changing market competition is outlined monthly in Educational Technology. During the past two years most professional journals have devoted at least one issue to what microcomputers can do for each discipline. In education, Melmed<sup>21</sup> has perhaps captured the perception of the computer revolution by stating that it is as important as the invention of printing. Few will disagree with this statement. One caution is in order: How will microcomputers affect educational practice? It is suggested that microcomputers on their own are unlikely to promote any particular outcomes.<sup>22</sup>

## SUMMARY

Chapter 1 has provided an overview of some concepts of planning endorsed by the authors of this book. We have noted a variety of theories of planning and suggested the rational-transactive theory as a sound approach to planning and decision making. In the last section some perceptions of the microcomputer were presented. Background, the need for the microcomputer in planning, capabilities, and the rapidly changing market were briefly discussed.