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AN EMPIRICAL TEST OF THE NOMINAL GROUP
TECHNIQUE AS AN INFORMATION INPUT MECHANISM
FOR THE OKLAHOMA SOLAR ENERGY PLAN.

THE UNIVERSITY OF OKLAHOMA, PH.D., 1978

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GRADUATE COLLEGE

AN EMPIRICAL TEST OF THE NOMINAL GROUP TECHNIQUE AS AN INFORMATION INPUT MECHANISM FOR THE OKLAHOMA SOLAR ENERGY PLAN

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

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BLAIR Y STEPHENSON

Norman, Oklahoma

1978

AN EMPIRICAL TEST OF THE NOMINAL GROUP TECHNIQUE AS AN INFORMATION INPUT MECHANISM FOR THE OKLAHOMA SOLAR ENERGY PLAN

APPROVED BY

DISSERTATION COMMITTEE

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Blair Y Stephenson

ABSTRACT

AN EMPIRICAL TEST OF THE NOMINAL GROUP TECHNIQUE AS AN INFORMATIONAL INPUT MECHANISM IN THE DEVELOPMENT OF THE OKLAHOMA SOLAR ENERGY PLAN

BY

Blair Y Stephenson

Committee Chairman: Dr. B. G. Schumacher

This study empirically investigated the use of the Nominal Group Technique (NGT) as an informational input mechanism into the formulation of a Solar Energy Plan for Oklahoma.

The research experiment was a one-day NGT workshop held in Oklahoma City on July 26, 1977. Two data collection instruments were used to obtain the responses of the 50 workshop participants on selected empirical measures. These measures included five unidimensional measures which assessed perceptions of participation equality, NGT efficiency, idea quality, idea quantity, and sense of accomplishment. Two composite measures of satisfaction and NGT effectiveness were employed utilizing combinations of the unidimensional measures. Eight global measures were used to collect perceptions of whether participants would use NGT in similar situations; anticipated quality of the plan; comparisons of NGT to (a) conferences with unstructured discussions, (b) commissions/boards with citizen participation, (c) commissions/boards with professional planners, (d) Delphi Technique; the most positive aspect of the workshop; and the most negative aspect of the workshop. Three control measures collected data on whether participant responses varied in relation to exposure to NGT prior to the workshop, occupational category (government, university, or private industry), and involvement in state or national planning prior to the workshop.

The results were analyzed by using the Student's t test at $P > .95$. On all unidimensional, composite, and global measures (except the NGT versus Delphi Technique comparison), the sample means were found to be significantly larger than "neutral" means. These neutral means were assumed to represent the responses which would have occurred if the workshop had employed the conventional interacting group discussion process.

The study found that participant perceptions varied significantly in relation to prior exposure to NGT on the measures of efficiency, idea quality, idea quantity, satisfaction, NGT effectiveness composite, anticipated plan quality, and the comparison of NGT to conferences with unstructured discussions. No significant variations in responses were found in relation to occupational category (with one exception; the university to private industry comparison on conferences with unstructured discussions), or to prior involvement in state or national planning efforts.

The primary conclusion of this study was that NGT appeared to represent an effective mechanism to provide representative, reliable input into the process of solving complex problems such as developing a Solar Energy Plan for Oklahoma. The finding that participant perceptions of the effectiveness of NGT varied significantly in relation to prior exposure to the technique identified a major area for future research studies.

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CHAPTER I

INTRODUCTION

The effective use of group problem solving processes has become a critical factor in the performance of modern business and government organizations. The increasing complexity of most organizational environments has forced businessmen and public officials to utilize a range of individual inputs to deal with their problems (Delbecq, Van de Ven, & Gustafson, 1975). This action has become necessary in two respects: First, whenever there is a need to use the required expertise of multiple technical specialists to analyze and solve problems; second, whenever there is a need to meet increasing pressure from claimant-client or constituent groups demanding that their voices be heard in planning and policy-making. In government programs, this demand for citizen participation is often stipulated by law or regulation. The constituencies of government include nearly every organized group of people over which governmental agencies exercise some form of jurisdiction. For business, on the other hand, the diverse pressures may arise from stockholders, consumers, government agencies, employees, local communities, financial institutions, interest groups, minorities, and society in general (Davis & Blomstrom, 1975).

Of the variety of problems faced by business and government organizations, one of the most difficult is long-range or strategic planning (Glueck, 1976). This planning is especially difficult owing to its inherently complex nature and the need for informational input and integration from divergent sources. Nowhere is the extreme difficulty of strategic planning any more evident than in the present efforts by the national and state governments to develop rational plans and policies for the development, production, and use of energy resources. A key problem for both business and government organizations is to design and provide a mechanism to facilitate representative and reliable informational input from diverse constituents or technical specialists into the various component phases of the long-range, strategic planning and policy-making process. Historically, businessmen and public officials have attempted to meet this informational need by utilizing conventional group discussion type processes such as committees, commissions, conferences, and other similar methods (Van de Ven, 1974). In many situations, these conventional or traditional interacting group formats have proved to be considerably less effective than desired.

In recent years, several refinements and modifications of the traditional interacting group process have been developed to combat the problems inherent in conventional, face-to-face group discussions. One such widely acclaimed

refinement, which has been developed to meet information generation and collection needs, is the Nominal Group Technique (NGT) (Delbecq & Van de Ven, 1970). NGT is a structured discussion technique applicable to small-group discussions; it involves both independent, individual activity and face-to-face oral interaction with other group members. NGT was developed in 1968 by Andre Delbecq and Andrew Van de Ven at the University of Wisconsin. Since then, it has been refined and empirically tested primarily in the university environment (Chung & Ferris, 1971; Delbecq et al., 1975; Green, 1975; Gustafson, Shukla, Delbecq, & Walster, 1973; Rotter & Portugal, 1969; Van de Ven, 1974; Yost & Herbert, Note 3). It has also been applied in several business and governmental settings, but these applications were apparently performed without formal measures of evaluation (Grabbe, Note 1; Medin, 1975; Metz, Note 2; Knippen & VanVoorhis, 1974; Mosley & Green, 1974; Voelker, 1977).

Objectives of the Study

The primary objective of this study was to investigate and empirically evaluate the Nominal Group Technique (NGT) as a possible mechanism to facilitate and integrate informational inputs from diverse constituencies, sources, or clients into the development of long-range or strategic plans in complex problem environments. Specifically, this investigation analyzed the application of NGT to the formulation of a state government plan, namely, a Solar Energy

Plan for Oklahoma.

The secondary objectives of the study were as follows:

1. To survey the general background, characteristics, and information requirements of strategic planning in business and state government.
2. To survey the present body of knowledge pertaining to NGT.
3. To analyze variations in participant perceptions of NGT in relation to differences in prior exposure to this technique, occupational categories, and prior involvement in state or national planning efforts.

Significance of this Study

There are several significant aspects to this study. First, it represents an application of NGT in field conditions to a complex problem with vast potential for impact upon the public. Second, based on the literature surveyed by the researcher, it appears to be the only investigation of NGT performed at the state government level which utilized formal, empirical measures of analysis and evaluation. Third, it is apparently the first study of NGT which evaluated the effects of prior exposure to NGT upon the perceptions of participants in the study. Fourth, it is also apparently the first study of NGT which evaluated the effects of occupational category and prior state or national planning experience upon the perceptions of participants in the experiment.

If the application of NGT in this specific situation is appraised as successful, the experimental workshop will serve as a Federal Department of Energy sponsored prototype for use by other states in solar energy planning (Energy Research and Development Administration Grant No. EG-77-G-05-5445).

Method and Scope of the Study

The research experiment in this study was a one-day workshop utilizing NGT. The workshop was held in the State Capitol Building in Oklahoma City on July 26, 1977. The purpose of the workshop was to provide informational input into the development of a Solar Energy Plan for Oklahoma. This Plan required the informational inputs of a variety of technical experts and representatives from diverse interest groups. Fifty selected representatives from various target groups that would affect or be affected by solar energy development attended the workshop. Two data collection instruments were utilized. The first instrument was a pre-workshop questionnaire which established a base reference for the analysis of attitude shifts across the workshop; the second was a post-workshop questionnaire which collected the participants' reactions to the workshop. The responses were analyzed in terms of measures of the overall effectiveness of NGT, perceived satisfaction with NGT, quantity of ideas generated by NGT, response variation owing to demographic characteristics, and attitude shifts between the pre-workshop and post-workshop evaluations.

This study was limited to empirically evaluating NGT as a mechanism to provide informational input into the development of a Solar Energy Plan for Oklahoma. If the results of this study provide evidence that NGT was successful in this specific environment, then implications may be drawn with reference to NGT's applicability to other environments possessing similar characteristics. This study was not designed to provide conclusive evidence of NGT's superiority or inferiority to other mechanisms which provide informational input into planning, although participants were asked to compare NGT to other planning mechanisms. In addition, this study was limited to examining NGT as a device to provide informational input to official business and government planning agencies, not as a process designed to replace those agencies or their function.

Organization of the Study

This study consists of six chapters. Chapter I introduces the topic, states the objectives, describes the significance of the study, and summarizes the research methodology.

Chapter II provides a general synopsis of the major components, problems, and informational requirements for long-range planning in business and state government environments. The intent of this chapter is to acquaint the reader with the subject area and to furnish a perspective which will establish the connection between effective group process mechanisms and effective strategic planning.

The first portion of Chapter III examines the problems and characteristics of group problem solving processes. The chapter then presents a survey of the literature relating to NGT as a means of improving the performance of groups. This survey includes both empirical research and examples of field applications of NGT.

Chapter IV presents the primary research question and hypotheses that were tested in this study. It describes the design of the experiment, the instruments employed, the measures utilized, and the tests used to evaluate the results of those measures.

Chapter V discusses the results obtained from the various measures incorporated in this experiment. Both quantitative and qualitative results are discussed.

Chapter VI presents the conclusions. The relationship of these conclusions to the findings of previous NGT studies is examined. An assessment is also made concerning the implications of the results of this study to possible future applications of NGT, and suggestions for possible future research efforts are offered.

CHAPTER II

LONG-RANGE BUSINESS AND STATE GOVERNMENT PLANNING: A PERSPECTIVE

One needs a general acquaintance with the background and characteristics of business and state government planning to understand how and where the use of NGT might be appropriate. It is especially important to be exposed to the components, problems, and resultant information requirements of planning in both environments. The following problems, associated with the major strategic planning components, have been identified by researchers as critical areas of difficulty in planning efforts in both milieus (Cannon, 1968; Council of State Governments, 1976; Glueck, 1976; Rue, 1973b; Steiner, 1969):

Strategic Planning Components	Associated Planning Problems
1. Definition of problems and objectives	1. Lack of formalized planning 2. Failure to define problems and objectives a. Lack of future orientation and reactive policy-making b. Inability to balance divergent interests of

	multiple claimants/ constituents
2. Assessment of internal and external environments	3. Lack of high quality, timely information for assessing environments
3. Design and selection of strategic alternatives	4. Failure to design and select strategic alternatives a. Lack of systems approach in planning and management b. Inability to handle complex problems
4. Implementation of plans	5. Failure to implement strategic plans a. Inability to cope with the size of the organization b. Inability to coordinate between levels, departments, and agencies
5. Review and evaluation	6. Lack of control and evaluation of plans

The planning informational requirements stem directly from each major strategic planning component and the associated problem areas. Obviously, if the planning effort is

to achieve the desired levels of effectiveness, the information and the mechanisms for obtaining it must be designed to support planning component activities and to counteract the related problems.

Long-Range Business Planning: Perspective and Models

As man has progressed organizationally from the family unit, to tribes, to larger organizations or nations, he has needed more sophisticated methods of planning and management to cope with the higher levels of specialization and division of labor. Planning, the "set of decisions and actions which leads to the development of an effective strategy" (Glueck, 1976, p. 3), was and is an integral element of the management function. As such, planning affected and was affected by the continuing development in the economic, social, and political environments (Wren, 1972).

Long-range or strategic planning arose from the special demands of the economic sector, specifically budgeting and technology. As organizations grew in scale, there was an increasing need for methods to manage the greater capital, equipment, and resource requirements of those organizations. With the advent of budgeting as a formal activity, managers began to develop a higher level of future orientation. From this point, it was a logical step to begin developing economic plans for longer periods in the future. Integral to this development was the recognition by managers of the importance of technology in the success or failure of their

enterprises. This recognition led to the incorporation of technological forecasts into the economic planning process.

Historical Overview

Examples of planning may be found throughout history. The engineering feats of ancient history and the explorations of the Middle Ages have all exhibited varying levels of planning efforts (Scott, 1965). In each of these cases, the planning appears to have been an intuitive action exercised on the basis of common sense and not as a formalized, patterned management function conducted on a continuing basis. The formal study of planning is a relatively recent phenomenon occurring primarily in the past four decades.

The problems of the Industrial Revolution brought about an increasing need for predictability and planning as that period ushered in the age of machines--an age of growing complexity and size in production organizations. Businessmen began to encounter significant problems in melding technological and material aspects of the organization with production efficiency. They also were faced with the human problems of acquiring, training, and directing the efforts of employees toward specific goals (Wren, 1972).

The railroads were the first large business organizations and, as such, had to cope with massive financial, labor, equipment, and facilities requirements. Their "investments in track and rolling stock were immense and required extensive long-range planning to prevent large

fixed capital outlays from being placed in the wrong market area" (Wren, 1972, p. 85). It was, therefore, logical that formal, long-range planning would originate from the railroad environment. Around 1900, the Pennsylvania Railroad began to formalize its long-range planning. The company established several vice-presidential positions, the purpose of which was to concentrate on long-term activities (Chandler, 1962). Harrington Emerson, consultant to the Santa Fe Railroad (1904-1907), has the distinction of first incorporating the planning function formally into the organizational structure. Based upon the general staff concepts of vonMoltke (vonClausewitz, 1943), Emerson developed a staff concept whereby staff heads were appointed to plan, direct, and advise on everything pertaining to employees, equipment, material, methods, or conditions (Emerson, 1911).

In 1916, Henri Fayol described the five functions of management as planning, organizing, commanding, coordinating, and controlling. He recommended that an organization prepare daily, weekly, monthly, annual, five-year, and ten-year plans. These plans taken together formed the comprehensive plan for the enterprise (Fayol, 1916). In addition to Fayol, several other major authors in the field of management have identified planning as a major and separate function of management (Wren, 1972).

The first book on long-range planning, Long-Range Planning for Management by David Ewing (New York: Harper

and Row), was published in 1958. Since that time, much has been written and published on strategic planning by authors such as Drucker (1959), Ansoff (1965), Scott (1965), Steiner (1969), Ringbakk (1969), and Ackoff (1970).

In summary, the development of long-range planning has paralleled the growth in size and complexity of human organizations especially in the business sector. As this growth continued, the capacity to integrate and coordinate greater numbers and amounts of organizational components (e.g., materials, capital, equipment, labor, facilities) became more and more important to the success of an enterprise. Improvement in this capacity has been gained through enhancing management techniques, one of which was (is) long-range, strategic planning.

This historical overview provides a perspective on the development of planning as formal function of management. In recent years, several authors have proposed planning models or paradigms for use by managers. A discussion of four such models by Cannon, Steiner, Rue, and Glueck has been included in this study to provide further perspective on strategic planning and to acquaint the reader with the major components, potential problems, and information requirements of long-range planning.

The Cannon Planning Model

One of the early attempts to develop a business oriented planning model was made by Cannon (1968). He defines

business strategy as the hierarchy of prime and supporting strategies which are the directional action decisions required to achieve the company's purpose. Directional action decisions include all established and accepted objectives, plans, strategic policies, and implementing decisions which provide and initiate direction to a business. Cannon includes three elements in strategic decisions. The first is the "why" element or company objective(s). The second is the "what" and "how" element or the course of action plan. The last is the "who-where-when" element or the commitment decisions. In his model, Cannon attempts to relate action strategies (what and how) to result strategies (growth, selectivity, and productivity).

After a business has determined its results strategies (the "why" element), it attempts to evaluate its strategic environment. This step involves assessing factors such as customers, competition, society, government, economy, and technology. The firm then audits the competitive environment and develops a profile of the strategies of competitors.

The next stage of Cannon's model is the development of the "what" strategies and policies. These would normally be in the form of product strategies, market strategies, geographic strategies, and/or distribution-channel strategies.

Once the "what" strategies are defined, the "how" strategies and policies may be developed. These include alternative market development approaches, alternative

product development approaches, and the financing and administration of the strategic plan.

The final step in the model is the "who-where-when" or commitment decisions. These decisions perform the final translation of the strategic plan into reality.

Cannon sees strategic planning as having two almost dichotomous roles: one of risk-taking; the other, unifying.

This model belongs to a generation of business planning models which took rather narrow, functional orientations toward planning. It is oriented primarily toward a marketing rather than a top management perspective. This model is almost exclusively directed at the business environment. Although it does contain some of the key elements found in later models, it does not take a coherent, systems approach to the planning process which would be applicable as a general planning model. It seems to concentrate its attention primarily on medium-range (what and how) strategy development as opposed to long-range planning.

The information requirements implied in the Cannon model center largely on marketing analysis. These requirements include marketing research, customer and competitor profile development, opportunity identification, trend analysis, and analysis of internal strengths and weaknesses. In addition, Cannon identifies the potential information needs of developing corporate objectives (why strategies) and implementing plans which require "who-where-when" decisions.

These needs might include assessments of technological developments, shifts in markets and customer desires, demographic data, and internal organizational communication mechanisms. The informational needs of this model are heavily influenced by the model's marketing orientation.

The Steiner Planning Model

Steiner (1969) defines comprehensive business planning as a future oriented, systematic appraisal and formulation of objectives, strategies, policies, and plans integrated, implemented, and evaluated for the entire company continuously. He sees comprehensive planning as important because it simulates the future, applies the systems approach to management, reveals future opportunities and threats, provides a decision-making framework, and prevents piecemeal decisions. It helps an organization master change and also serves as a basis for control, measurement, resource use, and corporate evaluation. In Steiner's opinion, the foremost difficulties facing a planner are failure to define problems, internal resistance, uncontrollable environmental events, crises, and the difficulty inherent in planning. The Steiner conceptual model for planning is a three-stage model with a planning premises phase, a planning phase, and an implementation/review phase. It is a general model applicable to both business and government planning.

Steiner proposes that the identification of aims should be the initial step of the premise phase in the planning

process. (He notes that the network of aims for business has shifted from a profit maximization orientation towards the idea of corporate citizenship, balancing the divergent interests of the many claimants upon business. In doing so, the operational and planning considerations of businesses are becoming increasingly similar to governmental agencies.)

The second step of the premise phase is the assessment of the relevant factors, strengths/weaknesses, and threats/opportunities contained in the internal and external environments. An important portion of this assessment is the appraisal of the future. Some of the techniques commonly used in this phase are statistics, econometrics, models, simulations, executive opinion juries, and other specialized information input techniques.

The first step of the second phase of planning involves the development of strategic organizational plans. These are the objectives, strategies, and policies which address areas important to the success and survival of the organization. They may include growth strategies, product strategies, market strategies, and financial strategies.

The second step in this phase is the development of medium-range policies and procedures to serve as action guides and channels for organizational thought. The medium-range plans serve as an integrative bridge between strategic plans and short-range plans. These short-term plans and budgets are the third step in this stage and comprise the

action-element or "cutting edge" of the planning process. The fourth element of the planning stage includes planning studies and feasibility testing.

The final stage of the planning process includes the formation of the organizational mechanisms to implement the plans, review and evaluation, and the design of feedback loops to tie the model together. The organizational structure and climate must be formed to fit the chosen strategy. In addition, the plan, planning process, and actual performance must be periodically reviewed to assess the effectiveness of the entire effort. When deviations exist, feedback channels must be capable of identifying the discrepancies, delivering the information to the proper people, and readjusting the plan or operational performance to enable the organization to achieve its objectives.

A notable feature of the Steiner Planning Model is its emphasis upon the systems approach to decision-making. The model recommends and fosters an approach which attempts to account for all or most of the major relevant factors and interrelationships that have a bearing on the organization. It attempts to clarify objectives, discover alternatives, blend the knowledge of many disciplines, utilize the scientific method, perform a cost/benefit analysis, and consider the future context of the subject. In addition, the systems approach may be supplemented and enhanced by the modern computer-based quantitative techniques. This increasing

utilization of the information processing capabilities of the computer is identified by Steiner as a major trend for future years.

The informational requirements of the Steiner Planning Model are typical of "systems approach" models. They require information from all facets of the organization and its environment which might have an impact upon the strategies under consideration. In the first phase of planning, the information system must support the identification of organizational goals and objectives. To support the goal-setting process, there must be some capability to assess the future developments which might impact upon the objectives identified. Steiner acknowledges the growing need for informational devices to allow effective input into the planning process by the many claimants upon both business and government organizations.

In the second phase of planning, the primary requirements for information stem from the need to assess the external and internal environments of the organization. These requirements would include detailed analyses of the present situation, threats and opportunities, strengths and weaknesses, knowledge exploration, economic conditions, and the attitudes and desires of the "public" being served.

The third phase of planning involves the design, development, and choice of strategic alternative courses of action. At this point, the need for creative solution

generation enters the planning process. In addition, the necessity for organizations to solve increasingly complex problems requires that some means be used to gain input from many different specialty disciplines and areas of expertise. This phase also, in many cases, requires the establishment of priorities among objectives and the assignment of different weights to various factors being utilized as decision criteria.

The fourth phase of planning requires information which would facilitate the implementation of plans. This information might include organizational models, pro-forma financial analyses, detailed resource requirements for various plans and programs, and organization coordination and communication mechanisms.

The fifth and final planning phase is control. To accomplish this control, reviews and evaluations must be conducted. These controls require timely, accurate information on the organization's performance and criteria by which that performance may be judged.

The Rue Planning Model

A systems viewpoint planning model with emphasis on quantifying objectives and the short/medium-range action plans was proposed by Rue (1973a). His model includes six distinct but interacting components: the definition of the overall strategy, identification of goals and objectives, assessment of the external environment, consideration of

growth and resources, financial analysis, and specification of controls.

The decision sequence for developing the long-range plan incorporates each of the above components in a logical, step-wise fashion. First, the organization must develop an overall corporate strategy. This strategy specifies "the business" of the organization; what it is trying to achieve, and what it is trying to become. The second step is to identify goals and objectives and express them in quantitative terms to the maximum extent possible; e.g., specified levels of return on investment, earnings per share, capital growth, etc. At this point, a determination is made whether the goals and objectives are compatible with the overall strategy. If not, the objectives are re-worked to insure that they are compatible. When compatibility is assured, the process may proceed to the third component. In this component, the external environment is assessed to identify and evaluate factors relevant to the organization. These factors might include such considerations as population, politics, income, social trends, technology, labor unions, and economic factors.

The fourth component in the planning process is to delineate the organization's intentions for expansion and replacement. These intentions would involve plant expansion, new products, acquisitions, research, and personnel training and development. This step focuses on the internal environment

of the organization and specifies in detail the resources required to accomplish the desired growth. The expansion and replacement step leads directly into the fifth component, the development of pro-forma financial statements. "At a minimum, this would include a long-term pro-forma balance sheet, income statement, and cash flow analysis" (Rue, 1973a, p. 25). As Rue notes, this component is the point where corporate desires must be translated into reality. The firm must ask itself if the expansion and replacement plans are financially sound. If they are not, the plans must be reworked until they appear to be sound.

The sixth component is the development of controls which must be devised to insure that the intent of the plan is becoming reality. Rue recommends the use of periodic reviews and revisions based upon a definite time schedule. During these reviews, any discrepancy between the plan and actual performance is identified. Each discrepancy is carefully analyzed to determine whether it was due to controllable or uncontrollable factors. If the factors were controllable, then a determination is made as to whether the breakdown occurred in the planning process or in operational performance. For uncontrollable factors, the organization determines whether the factors were unforeseeable or whether the planning process failed to identify and evaluate them properly. In either case (controllable or not), the organization assesses the discrepancy's impact upon the plan and

the changes which are necessary to update the plan. This final action "closes the planning loop" by adjusting the present corporate strategy or initiating efforts to develop a new strategy.

The Rue model is a general model, applicable to either business or government environments. It begins with a determination of corporate strategy and the statement of objectives, includes assessments of the external and internal environments, and concludes with an evaluation element to furnish the control function for the plan. Rue emphasizes the quantification of objectives and the development of detailed pro-forma financial statements. The information requirements for this model are identical to those described for the Steiner model.

The Glueck Planning Model

Glueck (1976) identifies three primary reasons for strategic planning. He stresses that it aids an enterprise in anticipating future problems and opportunities in a dynamic, rapidly changing environment; it also provides clear organizational goals and direction for the employees of the enterprise. Lastly, it improves the chances of success for the organization. This position is supported by the Thune and House study (1970), the Ansoff study (1971), the Rue and Fulmer study (1972), and the PIMS Project (Schoeffler, Buzzell, & Heany, 1974).

The Glueck model contains five segments:

1. Strategic planning elements
2. Appraisal of internal and external environments
3. Development and choice of strategies
4. Implementation of strategies
5. Evaluation of strategies

In his model, Glueck includes two basic strategic planning elements. These are the enterprise decision makers and the strategic objectives of the organization. The first element includes boards of directors, top managers, and planning staffs. Strategic objectives, which constitute the second element, are the outcomes of the decisions made by the decision makers. Glueck specifies three reasons for developing objectives:

1. Objectives define the organization in its environment.
2. Objectives help coordinate decisions and decision makers.
3. Objectives provide performance standards.

The appraisal segment contains two elements. Analysis of the external environment is the first element. Its primary purpose is to determine present and potential opportunities and threats in the enterprise's external environment by assessing governmental, technological, competitive, and social factors. Assessment of the strategic strengths and weaknesses of the firm is the second half of the appraisal segment of the planning process. This assessment is also

known as profiling the organization or resource auditing. Glueck defines the strategic advantage profile to be "a systematic evaluation of the enterprise's strategic advantage factors weighted by the significance of each factor for the company in its environment" (Glueck, 1976, p. 88).

The development and choice segment is the first point where there exists the need and opportunity for planning creativity to be exercised. The primary approaches to generating alternatives are active versus passive alternatives, and flexible (contingency) versus programmed strategies. An active strategy is anticipatory. The passive choice reacts to pressures and moves as a result. The flexible, contingency strategy is prepared to be responsive to shifts in environmental conditions. A programmed strategy tends to adhere to a planned pattern with very little flexibility.

The strategic choice criteria originate from the identification of the critical factors in the external environment and the internal strength profile. Ideally, the process involves a systematic evaluation of each proposed strategy against the selected criteria. These criteria, in many cases, are weighted in accordance with their importance.

Glueck makes reference in passing to the availability of information for this process. He implies that the capability of the enterprise to furnish high quality, timely information on the internal and external situation to the

decision maker(s) represents a crucial element in the strategic choice. But the ability to furnish the information in the correct form at the right time is of little value if the manager cannot or will not use the information in his decision-making. Glueck alludes to this problem several times by noting that managers in many cases have been found to rely primarily on informal, verbal information sources, depend on intuition, or completely disregard rational models of decision-making. This difficulty appears to exist in both government and business.

After the strategic choice is made, the strategy must be translated into reality. This translation involves two steps: organizational structuring and the development of implementation policies.

The evaluation process contains four elements: the motivation to evaluate, a feedback mechanism, evaluation criteria, and decisions resulting from evaluation. The primary source of evaluation criteria is the compilation of corporate objectives.

Evaluation is the final element in the strategic planning process. It is the connecting link that completes the full circle of planning back to the initial phase, the identification and selection of objectives. The key concept is that the process is continuous with much overlap between phases. To be successful, strategic planning should be systematic and institutionalized within the organization.

The Glueck model, though couched in terms of a business environment, is equally applicable to the government milieu. The appeal of this model is its ability to function as a general strategic planning guide for many organizations. The logical sequence of phases in the planning process, the admonition to formalize and systematize the planning process, the recognition of the continuous nature of the process, and the identification of information handling as a key element in the process contribute to the significance of this model as a tool for any manager who contemplates engaging in strategic planning. The informational requirements of this model are identical to those presented for the Steiner model earlier.

Summary

Although the practice and conceptual roots of strategic planning are quite ancient, the development of planning as a formalized function of management is a fairly recent occurrence. Literature devoted to the subject of planning made its first appearance during this century and has been dealt with extensively only in the past four decades. In general, the historical development of planning has paralleled the growth in size and complexity of business organizations and their operations.

The four planning models presented represent sample planning paradigms. Of the four models, the Glueck and Rue models seem to provide the most logical, concise guides

or planning frameworks. The Steiner model was an apparent forerunner of the Glueck and Rue models and is still considered to be a major development in terms of systematic strategic planning models. The Cannon model is a marketing oriented model which was included to provide a perspective on function-specific models.

The informational requirements were derived directly from the major components or phases of the planning models. The requirements of the Cannon model concentrated on a marketing related planning process. The Steiner, Rue, and Glueck models took a systems perspective on strategic planning; therefore, the information requirements of these models were broad. They included informational needs necessitated by each of the major phases of systematic planning; e.g., objective setting, environmental appraisal, design and choice of alternatives, implementation, and evaluation.

State Government Planning: a Synopsis

This section addresses strategic planning by state governments excluding the planning activities conducted by local or regional governmental entities. Local or regional planning developments will be discussed only in cases where these developments directly impacted the evolution of long-range planning at the state government level.

Historical Overview

State planning has existed in practice as long as there have been states but not as a formal, recognized function

or subject of study. It grew out of development and growth efforts of the states. In the early nineteenth century, state governments were involved in large-scale, sometimes innovative public works projects designed to enhance their economic development. These projects required major planning efforts. The emphasis was on resource acquisition and development and construction projects, not on efficient, equitable allocation of resources (Council of State Governments, 1976).

Early in the twentieth century, the concepts of conservation of natural resources, organizational management, and area-wide planning were introduced into the state planning process. The natural resource conservation movement which started in the late nineteenth century, was a part of the national conservation program. As a result of this interest in natural resources, approximately 50% of the states established conservation commissions.

The interest in management was an outgrowth of the "scientific management" era and manifested itself in the actions taken by several state governors to develop responsive administrations through agency consolidations, gubernatorial staff agencies, and governor-controlled budgets.

The first staff agencies were created to assist in the preparation of state budgets. This attempt by the executive branch of state governments to gain fiscal control of the state's operations was a major initial step toward

state-wide planning efforts.

The area-wide planning movement came about through the recognition of the inadequacy of local planning which normally stopped at municipal boundaries. One approach to overcome this problem was to establish county level planning units; another was to extend local planning methods to a regional or metropolitan scope. ("Regional," in this context, is defined as a substate entity of governmental officials from the counties comprising a region or district.)

The National Industrial Recovery Act (NIRA) (July 1933) included a provision which created the National Planning Board. The mandate given to this board was to stimulate and coordinate planning projects in the public works program instituted as a part of the national plan to aid the nation's recovery from the Great Depression. In 1934, it was merged with the National Resources Board which in 1939 became the planning arm of the President's Executive Office. These boards spawned several state planning boards whose primary responsibilities centered on making surveys and taking inventories of public works projects. (The NIRA was declared unconstitutional in 1935 because of labor union provisions, not due to provisions related to the National Planning Board (Sloane & Witney, 1977).) The state planning that did get accomplished was heavily oriented toward rural resources, rural land use, rural transportation, rural recreation, and municipal finance. For the most part, urban problems

were ignored. As the 1930's drew to a close, loss of federal financing, lack of executive support, and resistance to central planning caused many states to transfer their state planning units to development boards or functional state agencies (Council of State Governments, 1976).

From 1940 to 1945, state planning units were used primarily to prepare reports for various government agencies on war-time problems such as housing, population movement, and industry location. "By 1945, over three-fifths of the original forty-seven state planning agencies had either disappeared or were no longer recognizable as functioning state planning agencies" (Council of State Governments, 1976, p. 136).

During the post-World War II years, emphasis was placed by the states on economic development without concern for the relationship between economic development and state planning. State planning agencies frequently promoted local planning programs to improve the attractiveness of cities to industry. This effort was usually part of a state industrial promotion program.

Title VII (Section 701) of the 1954 Federal Housing Act provided grants to encourage planning programs in small communities, metropolitan planning bodies, and regional planning agencies. In 1959, an amendment to achieve a more equitable balance between state and substate planning efforts was passed to the 1954 Act which extended matching federal

funds to promote the development of comprehensive state plans. The significance of planning at these levels was that the resultant development tended to follow the flow of available funds.

"Between 1960 and 1968, states with active state planning programs at the state level increased from thirteen to thirty-nine" (Council of State Governments, 1976, p. 137). The Section 701 funding caused an increase in interest in state level planning among planning professionals and state officials. This interest was accompanied by a shift of state planning units closer to the governors' offices.

From 1959 to 1969, federal grant-in-aid programs increased from $6 billion to $20 billion. This money went directly to states, directly to localities, or to localities through the states. The overall level of planning capabilities paralleled the growth of this federal aid, usually as a result of federal stipulations which accompanied that aid. This growth in planning capacity caused an increased awareness of the need for coordination of planning activities across agency and functional lines in state government.

The Intergovernmental Cooperation Act was passed in 1968 and implemented via Office of Management and Budget (OMB) Circular A-95. A-95 empowers the governor of each state to establish clearinghouses for review of federally assisted planning and development activities. These clearinghouses provide a mechanism to integrate and

coordinate state and local planning activities. This Act has made a significant contribution in coordinating functional planning activities and in establishing umbrella regional councils to supervise area-wide planning (U.S. Advisory Commission on Intergovernmental Relations, 1973).

The past decade has seen a major growth in the interest of the public for environmental and land use issues as they affect the quality of life for state citizens. A related issue that has become of significant concern to state planners is growth management. Many states have been or are now actively involved in studying development goals and future growth alternatives.

In summary, state planning seems to have developed (a) primarily from the monetary stimulus of the states' demand for economic development and/or federal grant programs, and (b) in reaction to external pressure rather than as an attempt to assess and plan for future contingencies, especially in the long-range time frame. The past decade has seen the first attempts by states to deal in a comprehensive fashion with lifestyle or quality of life issues such as environment, land use, growth management, and energy conservation.

Current Status and Concerns of State Government Planning

By the mid 1970's, state governments found that the premise upon which expectations had been based for many years--that of ever-expanding resources--had been seriously

threatened by inflation, recession, energy crises, and declining confidence in government. For many states, revenues were not keeping pace with costs, a factor which caused states to be unable to meet new demands for service or even maintain present services. This situation has apparently reversed itself in the past 12-15 months for many states due to higher employment, increased tax revenue, and improved cost control (State Budgets Bounce Back into the Black, 1978).

The Arab oil embargo of 1973 and the resultant rise in energy costs impacted the states directly through rising costs of operating state facilities and indirectly through the embargo's effects on farming, manufacturing, transportation, construction, and tourism. Energy producing states were faced with economic, social, and environmental consequences of rapid energy resource development and exploitation. The 1975 National Governors' Conference published the following statement, "In the quest for adequate energy supplies, there must be proper recognition of responsibilities to future generations to protect the quality of the environment and to conserve our non-replaceable natural resources" (National Governors' Conference, 1975).

The combined economic and energy crises have caused states to begin to recognize their vulnerability to the economic results of federal government and private enterprise decisions.

> Faced with the imperative of doing more with less, governors recognize the need to improve their management capability, to operate programs more effectively, and to assure that the activities of government are directed to the accomplishment of priority objectives. (Council of State Governments, 1976, p. 7)

The governors' perspective must attempt to assess the long-range, future implications of present courses of action.

Components of state planning. Mingilton (Note 4) identified the components of state planning as follows:

1. Formulating comprehensive policy and development plans
2. Structuring and coordinating state programs and activities
3. Conducting research and gathering data
4. Assisting local planning efforts

Economic planning. The economic events of the past five years have caused many state planners to take increased interest in economic planning. The evolving concepts of economic development planning tend to stress the management of change in a manner that improves the quality, quantity, distribution, location, and mix of natural and man-made goods and services with the objective of decreasing costs while increasing the quality of life or citizen satisfaction. There are three basic types of economic development planning currently in use by states. First, there is the public

investment approach used by Pennsylvania. It involves projecting future trends against desired expectations, then using public investment to close resultant gaps. The second is the alternative futures method used by Hawaii and Utah. This method uses projections based on past trends or probable future events to construct scenarios upon which policy decisions can be made. The third approach is the strategic approach used by Kentucky. This approach attempts to identify key future problems that would have the greatest impact if eliminated (Council of State Governments, 1976).

Citizen participation. The issue of citizen involvement or participation in state planning has received growing attention in the past decade and has become a requirement for many federal programs (Rodgers, 1977). On the state level, Washington developed an Alternatives for Washington program conducted in 1974-75. This program was a multi-stage process with opportunities for citizen input into the identification of the needs, desires, goals, and critical issues for the state; it featured the participation of the citizens and sought their views.

In theory, the primary avenue for citizen participation in state government is through the state legislature. But in most cases, the interest and involvement in state policy making is on an ad hoc basis and reactive in nature. Most members of state legislatures tend to deal with state problems on a case-by-case basis; they rarely have the opportunity

(or take the opportunity) to develop a broader perspective for the current and long-range implications of their actions (Council of State Governments, 1976). There is an increasing recognition of the importance of the involvement of state legislatures and citizens in the planning process. Legislatures have been moving to become involved more often in the program audit or evaluation phase of the planning process. Citizens are active in the input phase of the identification and selection of state goals and objectives. The Alternatives for Washington Program, Commission on Minnesota's Future, and the Kentucky Environmental and Economic Development Policy Project are all examples of this increased interest in citizen participation in the state planning process. As the number of constituent interest groups becomes greater and/or more vocal, there is an increasing need for development of effective mechanisms to facilitate their input into the state planning processes. At present, these mechanisms include commissions, boards, conferences, public opinion sampling, media polls, Delphi questionnaires, and workshops. This broadening of the constituent base is in evidence in almost every sector of governmental operations.

Information requirements. The informational requirements of planning in the state government environment include nearly all of the requirements of planning in the business milieu. The major components of systematic planning are virtually the same in both situations. The information

system of a state government should include the capacity to forecast future trends and economic conditions, to assess technological developments and their consequences, and to evaluate the positive and negative aspects of the internal and external environments. The state government planning effort also requires input into public policy making from many constituencies. This requirement is increasingly being mandated by laws and regulations. The problem facing state planners is how to obtain broad, representative, and reliable input from multiple constituent interest groups, many of which have opposing demands and viewpoints. This informational problem extends into the identification of objectives and issues, priority setting, weighting of decision factors, and policy evaluation criteria.

The information system of state government planners should also furnish timely, relevant information on demographics, census data, commercial and private population data, and state natural resource information. It should be able to assess the impacts of governmental programs on social, economic, and quality of life criteria. Lastly, it should be able to effectively deal with planning to meet and manage complex problems such as energy policy, land use planning, environmental protection, and growth management. One state which has attempted to develop such a system is the state of Georgia (Office of the Governor, Note 5).

Coordination and continuity. States are increasingly making distinctions among coordination or policy development, functional planning, program planning, project planning, and implementation. They are realizing that coordination at each level of government can make a contribution to the other levels (U.S. Advisory Commission on Intergovernmental Relations, 1973). To put this coordination into effect, many states are using variations of the cabinet structure.

One of the most pervasive and critical problems of state planning is the lack of continuity. Structural instability, program discontinuity, and constant personnel turnover do not lend themselves to continuous, smoothly functioning state planning activity.

The need for coordination among the many agencies and multiple levels of government is obvious; but there has been a definite lack of recognition of this need on the part of state functional agencies. This lack seems to be due to their independence and self-containment. The increased public service demands and the proliferation of federal programs has called attention to the need for greater awareness of the interrelationships in state activities. States are finding that the development of some form of coordination mechanism is necessary for effective management. This mechanism must recognize and be able to handle coordination efforts at all levels: policy, functional planning, program planning, and project planning.

In summary, the bulk of the state coordination difficulties stem from the administration of federal programs at the state and local levels. State officials have been frustrated by inconsistent guidelines, program requirements, funding cycles, accounting methods, and reporting requirements. Even though these problems exist and are significant, the general attitude of federal-state relations seems to be shifting from hostility to collaboration.

The State Planning Committee, in its 1967 report to the National Governors' Conference, stated that state planning was the best available means to enhance the management capabilities of the governor (Committee on State Planning, 1967). It is a critical tool in insuring that the state's overall program encompasses local, regional, and metropolitan planning.

Planning, Programming, Budgeting System. From 1965 to 1970, many states attempted to adopt the Planning, Programming, Budgeting System (PPBS) as a formal, integrative system. PPBS in government originated from weapons systems research by Rand Corporation in the 1950s. In 1965, President Johnson directed federal agencies to use PPBS (Nigro & Nigro, 1977). By 1971, most federal agencies and state governments abandoned PPBS as unworkable. But the legacy of PPBS remains in the recognition that planning, programming, and budgeting functions must be closely coordinated and interrelated to achieve an effective governmental operation. As a general

rule, the process now being used by many states involves objective or goal setting, the translation of goals into major programs, and the division of programs into program categories which are further divided into quantifiable subcategories that contain program elements. This structure, which organizes policy and budget decisions across all agencies of state government, serves as a method for states to accomplish the efficient use of available resources. The final step is program evaluation. It concentrates on program review, resource application and efficiency, and extensive data collection and analysis.

Summary

The foregoing general survey of the background and characteristics of long-range planning in business and state governments, identifies the major components of systematic planning, the problems associated with each component, and the resultant informational requirements. These problems and information needs are summarized in Tables 1 and 2. In each table, the problems and information requirements are organized according to major planning components. For example, under the planning component of identifying organizational objectives, the problems of failure to define organizational objectives, lack of future orientation, and failure to balance divergent claimants' interests can be found in Table 1. In Table 2, under the same planning component are the information requirements of identification

and definition of objectives, future forecasting, and multiple constituent/claimant input into the planning process. Each of the remaining planning components (environment appraisal, design and selection of alternatives, implementation, and review) are treated in a similar fashion.

When the planning process is examined, four basic information generation or collection processes can be isolated. These are individual manager's/official's perceptions and decisions, conventional information system data collection and analysis (census data, demographics, and trade journals), combination of the expertise of several technical specialists, and representative assessment of the views of divergent constituents of the organization. Table 3 summarizes the relationships of the major planning components to each of the four information processes. Each of the information generation or collection processes may be applied to any of the major planning components; but in a systems approach to planning, the relationships depicted in Table 3 represent the most likely application of each process. One notes that inputs from a variety of sources must be obtained and integrated in the process of long-range planning in modern business and governmental organizations.

Table 1

Strategic Planning Problems

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1. Lack of formalized planning and ad hoc policy making.
2. Failure to define organizational objectives and problems.
   a. Lack of future orientation and reactive policy making.
   b. Failure to balance divergent interests of many claimants or constituents.
      1) Lack of involvement of all affected parties in the planning and decision making processes.
      2) Lack of broad representative input into planning and decision processes.
      3) Lack of commitment of affected parties to selected courses of action.
      4) Internal resistance in the organization.
3. Failure to assess the internal and external environments owing to the lack of high quality, timely information.
   a. Failure to utilize available information.
   b. Reliance on intuition, informal communication, or biased opinion data.
   c. Imposition of preconceived ideas upon "public" without assessing their desires; e.g., marketing research.

Table 1--Continued

4. Failure to design and choose strategic alternatives.
   a. Lack of coherent systems approach in planning and management.
      1) Piecemeal decisions.
      2) Lack of comprehensiveness in plans and policies.
      3) Lack of integration of technological, material, and human resources.
      4) Inability to handle complexity in operations or problems.
      5) Lack of top management perspective.
   b. Inability to handle complex problems.
      1) Energy policy.
      2) Environmental policy.
      3) Land use policy.
      4) Quality of life considerations.
5. Inability to implement strategic plans.
   a. Scale or size of the organization.
   b. Lack of coordination between levels, agencies, and functional departments.
6. Lack of control and evaluation of plans and policies.

Table 2

Information Requirements for Strategic Planning

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1. Identification, definition, and exploration of goals, objectives, needs, problems, and issues.
   a. Future forecasting and appraisal.
      1) Trends and problems.
      2) Technological developments.
      3) Technology assessments; first, second, third order consequences.
   b. Constituent or claimant input into planning and decision making.
      1) Attitudes and perceptions.
      2) Demands, desires, and expectations.
      3) Objectives, problems, and issues.
      4) Priority setting among objectives, problems, and solutions.
      5) Weighting of decision factors.
      6) Evaluation of strategic plans.
2. Assessment of internal and external environments.
   a. External environmental assessment; threats and opportunities.
   b. Internal environmental assessment; strengths, weaknesses, and resources.

Table 2--Continued

3. Design and choice of strategic alternatives.
   a. Systems approach.
      1) Broad, representative, reliable input into planning and decision making.
      2) Knowledge exploration.
      3) Program design and implementation.
      4) Impacts of governmental programs; social, economic, quality of life.
   b. Complex problems.
      1) Multidisciplinary/interdisciplinary expertise focused effectively on planning and decisions.
      2) Creative solution generation; single ideas, combinations of new and/or old ideas.
4. Implementation.
   Organizational communications mechanisms to facilitate coordination.
5. Organizational strategic objectives utilized as control and evaluation criteria.

Table 3

Applications of Information Processes to Planning

Planning Components	Information Processes			
	Individual Perceptions and Decisions	Conventional Information Systems Data Collection	Combination of Expertise of Technical Specialists	Assessment of Views of Divergent Constituents
Identification and Definition of Objectives	X			X
Environmental Assessments		X	X	
Design and Selection of Alternatives			X	X
Implementation of Strategies	X	X		
Review and Evaluation		X		X

CHAPTER III

SURVEY OF RELEVANT LITERATURE: NOMINAL GROUP TECHNIQUE

By mandate of government regulation or pressure from interested publics, increasing numbers of public and private organizations are attempting to facilitate "maximum feasible participation" in program planning and administration. Such endeavors are troubled by the problems of conflict, confrontation, and inability to establish meaningful dialogue.

There also exists a growing need to bring the power of the combined expertise of many individual specialists to bear on complex problems. In today's environment of technical and academic specialization, specific individuals often do not command sufficient knowledge to develop solutions to complex problems. It is only through the effective application of some communication mechanism that heterogeneous disciplines can be brought together to generate solutions for such problems (Delbecq & Van de Ven, 1970). The need for multidisciplinary resources occurs whenever one deals with major issues such as energy planning, energy resource development, land use planning, environmental protection, urban renewal, and education.

Limitations of Interacting Groups

The informational requirements of planning stem directly from each specific planning component and its associated problems. Many commonly utilized mechanisms employed to meet these requirements are based upon traditional, face-to-face, interacting group processes. Historically, attempts to meet these planning information requirements have included individual actions, committees, discussion groups, boards, commissions, professional staffs, public hearings, workshops, conferences, and various forms of verbal and written communications. These processes have been found to be deficient in several aspects of their operation and performance. For example, Daniel P. Moynihan has described client involvement that uses conventional group techniques as "maximum feasible misunderstanding" (Moynihan, 1969). On a more specific level, Van de Ven identified the following interacting group process problems:

1. A "focus" effect wherein interacting groups "fall into a rut" and pursue a single train of thought for long periods.
2. The "self-weighting" effect, wherein an individual will participate in the group to the extent that he feels equally competent with others.
3. The fact that covert judgments are made but are not expressed as overt criticisms.
4. The inevitable pressure within most organizational

groups of status incongruities, wherein low-status participants may be inhibited and "go along" with opinions expressed by high-status participants even though they feel their opinions are better.

5. Group pressures for conformity and the implied threat of sanctions from more knowledgeable members.
6. The influence of dominant personality types upon the group.
7. The amount of time and effort spent by the group to maintain itself. As orientation to maintaining group interaction increases, quality of solutions decreases.
8. A tendency to reach "speedy decisions" before all problem dimensions have been considered. (Van de Ven, 1974, p. 16)

In addition, the difficulty of planning is increased by problems of low organizational readiness for new programs, the large number of individuals or groups which must review and approve new programs, major organizational re-alignments, or significant changes in resource allocations.

Attempts to refine the traditional interacting group process format to improve its effectiveness have led to the development of techniques such as the Delphi Technique and NGT.

Group techniques such as Delphi and NGT are applicable to several critical processes in program planning including

problem exploration, knowledge exploration, preliminary review, design and implementation, and evaluation and review. The principal criteria for application are the need for problem solving, idea generating, pooled judgment, and creative decision making.

Interacting Groups, Delphi Technique, and NGT

An interacting group process is a face-to-face group discussion with no explicit restrictions to guide or limit the discussion process. It may be considered as synonymous with the terms conventional or traditional group discussion formats. Under normal circumstances, the group would have a group leader who would attempt to guide the discussion. The format of the discussion would normally vary owing to the personalities of the group leader and the group members.

The Delphi Technique was developed by N. C. Dalkey and his associates at Rand Corporation in the early 1960's (Dalkey & Helmer, 1963). The Delphi Technique is a multi-stage question-and-answer process which involves the use of selected experts or specialists in particular fields. These individuals normally remain geographically separated and anonymous to each other during the Delphi process. The Delphi project staff formulate and transmit the question to the experts who respond within a specified time period on an individual basis without interacting with the other expert participants. The project staff synthesizes the responses and transmits this summary along with the second-round

question to all the selected experts. The process is repeated as many times as the project staff desires in accordance with project objectives. Normally, the final iteration requires the respondent experts to vote independently on the priority of the ideas by a rank ordering or rating procedure. This vote will be used by the project staff to calculate an aggregate judgment.

NGT is an advanced modification of the brainstorming technique. NGT was developed in 1968 by Andre Delbecq and Andrew Van de Ven (University of Wisconsin) as a result of their studies on decision making and aggregating group judgments in addressing problems involving citizen participation in program planning for community action programs (Delbecq et al., 1975). NGT is a special purpose procedure appropriate to situations that tap judgments of each member of a group, then combine the inputs into a group decision. (Osborn (1957) found that the average person can generate approximately twice as many ideas when working in a group as when working alone.) NGT is especially applicable to problem solving, idea generation, or program planning tasks.

The variation of NGT addressed in this study is described by Van de Ven as follows:

> Imagine a meeting room in which seven to ten individuals are sitting around a table in full view of each other. However, they are not speaking. Instead, each individual is writing ideas on a pad of paper in front of him.

> At the end of ten to twenty minutes, a very structured sharing of ideas takes place. Each individual in round-robin fashion provides one idea from his private list. This is written by a recorder on a blackboard or flip-chart in full view of other members. There is still no discussion, only the recording of privately generated ideas. This round-robin listing continues until each member indicates he has no further ideas to share. The output of this nominal process is the total set of ideas created by this structured process. Generally, spontaneous discussion then follows for a period (in the same fashion as an interacting group meeting) before nominal voting. Nominal voting simply means that the selection of priorities, rank-ordering, or rating (depending on the group's decision rule) is done by each individual privately, and the group decision is the pooled outcome of the individual votes. (Van de Ven, 1974, p. 2)

In summary, the sequence of activities in an NGT group discussion follows these steps:

1. A specific question to be addressed by the group
2. The silent generation of ideas in writing
3. A round-robin polling of group members to present each idea and record it in brief form on a flip chart
4. A sequential discussion of each idea for clarification

Table 4

Comparison of Interacting, Delphi, and NGT Group Process Structures

Group Characteristic	Interacting	Delphi	NGT
1. Specific subject for discussion	Yes	Yes	Yes
2. Individual generation of ideas without interaction	No	Yes	Yes
3. Face-to-face setting	Yes	No	Yes
4. Presentation of ideas to group	Yes	Yes	Yes
5. Equal opportunity for presentation	No	Yes	Yes
6. Idea recorded in front of group	No	Yes	Yes
7. Group discussion of ideas for clarification and evaluation	Yes	No	Yes
8. Individual voting to establish aggregate group decision	Maybe	Yes	Yes
9. Vote aggregation by pre-established rank order or rating procedure	No	Yes	Yes

and evaluation

5. Individual voting on idea priority to permit an aggregate group decision to be derived

(Huber & Delbecq, 1972)

The title of this process is derived from the fact that during steps 1 and 5 above, the participants are a group in name only (a nominal group); they perform strictly as individuals during these activities without interacting with other group members.

Characteristics of Effective Group Processes

There are seven significant characteristics of interacting, NGT, and Delphi techniques which either facilitate or inhibit group performance. These are as follows:

1. Task versus group maintenance orientation of group members
2. Proactive versus reactive search behavior
3. Conformity pressures on group members
4. Equality of participation in the group
5. Conflict resolution methods used by the group
6. Sense of closure to the decision process
7. Administrative time and cost of the methods

The orientation of group members toward social roles or task-focused roles is the first characteristic. Because NGT and interacting groups involve face-to-face contact, group members perform in both roles. Campbell (1968) concluded that the greater the amount of effort a group

must devote to maintaining its social-emotional relationships, the less time remains available for task-oriented problem solving.

Van de Ven (1974) found that members of interacting groups enjoyed the group cohesion and interpersonal relationships but were dissatisfied with the task accomplishment of their group(s). On the other hand, he found that the lack of social interaction inhibited performance in the Delphi groups owing to a lack of clarification and feedback. In looking at NGT groups, he found a balanced role orientation and a much higher level of satisfaction among participants.

The second characteristic is the search behavior of groups. The quality of group performance has been found to improve significantly when problem identification is separated from solution generation in group processes (Delbecq & Van de Ven, 1971). Interacting groups tend to follow a reactive search process where members react to comments of others instead of generating their own ideas (Delbecq et al., 1975). As a result, these groups are characterized by short periods of problem focus, frequent interruptions, tangential discussions, and pursuit of single trains of thought for extended periods. The NGT and Delphi processes are characterized by proactive searches owing to their requirement for each member to write his ideas before allowing group reaction or evaluation.

The third characteristic is the effect of pressures to conform to group norms upon individual behavior. Such pressures limit the perceived freedom to express ideas and inhibit creative decision making. These pressures take the forms of covert judgments, status differences, threatened sanctions, and dominant personalities. NGT attempts to circumvent these pressures via the silent generation of ideas in writing, round-robin idea presentation, serial review of ideas, and independent voting. This procedure reduces the salience of the connection between ideas and their source.

The fourth characteristic is equality of participation. Interacting groups tend to polarize on a limited number of issues and be dominated by more outspoken members (Myers & Lamm, 1975). Both Delphi and NGT have been found to foster more equal participation (Van de Ven, 1974). Research has indicated that generally the greater the number of heterogeneous inputs made into a group decision, the higher the quality of the decision (Hoffman & Maier, 1961). Therefore, if NGT and Delphi conferences were composed of heterogeneous participants, they would tend to generate better quality decisions than the interacting groups owing to the greater probability that each individual would input his ideas into the group's discussion.

The fifth characteristic of group processes is the method used by the group to resolve conflict. Research has

found that conflict can lead either to hard feelings (resentment, personal animosity, distrust) or creative decision making (Filley, 1974). Situations where disagreements are permitted to become personalized or are smoothed over tend to result in high levels of dissatisfaction. Conversely, whenever personalities are separated from the problems, the disagreements tend to be attacked in a constructive fashion with a more objective perspective (Van de Ven, 1974).

The sense of closure to the decision process is the sixth major characteristic. When comparing the three decision processes, Van de Ven (1974) found less perceived closure, lower felt accomplishment, and lower interest in future phases of problem solving in the interacting groups than in either NGT or Delphi groups.

The seventh characteristic to be considered is the utilization of resources. Van de Ven (1974) found that the total administrative hours needed to prepare, conduct, and follow through for one group was 4.2 hours for interacting, 4.4 for NGT, and 7.1 for Delphi at an average cost per group of $11.00, $11.50, and $22.00, respectively. The average working hours per participant were .5 hours for Delphi, 1.25 hours for interacting, and 1.5 hours for NGT groups. Calendar time required to generate the same information via each method was four consecutive evening meetings for NGT and interacting groups while the Delphi process required five months to complete. Obviously, administrative time and

cost would favor the NGT or interacting process, but participant time criteria would favor Delphi.

Empirical Research Issues

A search of the literature published in the past ten years since NGT was developed reveals the existence of two distinct categories of publications. One contains discussions of empirical research experiments designed to test various aspects of NGT and its supporting assumptions. Most of these experiments have been relatively limited in scope and level of application; i.e., conducted in university environments with student subjects. The other consists primarily of case study reports on practical, field applications of NGT with few, if any, evaluation measures utilized.

The following list contains the major issues which have been tested in some manner by the empirical NGT research studies that have been published to date:

1. Overall group process methodology
2. Satisfaction of group members with the process utilized
    a. Quality of ideas generated
    b. Pressure to conform to group norms
    c. Equality of participation
    d. Social versus task role orientations of group members
    e. Closure to decision process
    f. Decision quality

3. Quantity of ideas generated

4. Method of problem solving

Overall Group Process Methodology

Based upon qualitative evaluation measures (open-ended "most positive/most negative aspect" type questions), Van de Ven (1974) found that group participants and group leaders perceived NGT groups to have low flexibility in group process structure and low variability in the behavior of groups. The Delphi Technique also experienced low variability in respondent behavior. In contrast, interacting groups were seen to have highly flexible structures and high variability in the behavior of groups. The low variability from group to group of member and leader behavior would tend to develop higher consistency in decision making. (See Table 5 for the summarized results of the Van de Ven study.)

Van de Ven (1974) conducted his research in the Division of Student Affairs at a large midwestern university. That division employed about 250 house fellows or dormitory counselors to supervise students in university housing. The object of the research was to develop an operational house fellow job description which would clarify the role of the house fellow. Twenty nominal, twenty interacting, and twenty Delphi groups were formed with seven members in each group. Each group was to identify specific job activities that should be performed by house fellows. Each group contained two Student Affairs staff members, one house

Table 5

Comparison of Qualitative Differences between Three Processes Based Upon Evaluations of Leaders and Group Participants

Dimension	Interacting Groups	Nominal Groups	Delphi Technique
Overall Methodology	Unstructured group meeting High flexibility High variability in behavior of groups	Structured group meeting Low flexibility Low variability in behavior of groups	Structured series of questionnaires & feedback reports Low variability in respondent behavior
Role Orientation of Process	Socio-emotional Group maintenance focus	Balanced focus on social maintenance and task role	Task-instrumental focus
Relative Quantity of Ideas	Low; Focused "rut" effect	Higher; Independent writing & hitch-hiking round-robin	High; Isolated writing of ideas

Table 5--Continued

Dimension	Interacting Groups	Nominal Groups	Delphi Technique
Relative Quality & Specificity of Ideas	Low quality Generalizations	Higher quality High specificity	High quality High specificity
Search Behavior	Reactive search Short problem focus Task-avoidance tendency New social knowledge	Proactive search Extended problem focus; High task centeredness; New social & task knowledge	Proactive search Controlled problem focus; High task centeredness New task knowledge
Normative Behavior	Conformity pressures inherent in face-to-face discussions	Tolerance for non-conformity through independent search and choice activity	Freedom not to conform through isolated anonymity

Table 5--Continued

Dimension	Interacting Groups	Nominal Groups	Delphi Technique
Equality of Participation	Member dominance in search, evaluation & choice phases	Member equality in search & choice phases	Respondent equality in pooling of independent judgments
Method of Problem Solving	Person-centered Smoothing over and withdrawal	Problem-centered confrontation and problem solving	Problem-centered Majority rule of pooled independent judgments
Closure to Decision Process	High lack of closure Low felt accomplishment	Lower lack of closure High felt accomplishment	Low lack of closure Medium felt accomplishment

Table 5--Continued

Dimension	Interacting Groups	Nominal Groups	Delphi Technique
Attitude Toward Task Problem	Low task motivation	High task motivation	Withdrawn task motivation

Note. From Group decision-making effectiveness by A. H. Van de Ven, 1974, p. 96. Copyright 1974 by Kent State University Center for Business and Economic Research Press. Reprinted by permission.

fellow, two student residents, and two dormitory officers selected and assigned by a stratified random sample. The comparisons made between groups were based on quantity of ideas developed, perceived satisfaction of groups, and the positive and negative evaluations of group participants and leaders. Each of the nominal and interacting groups met one time. Each member of the Delphi groups received two questionnaires.

Van de Ven stated that the purpose of his research was "to make a formal experimental comparison between interacting, nominal, and Delphi decision-making processes in a field situation on a difficult applied problem that has no known solution, and where any derived decision directly or indirectly affects the organizational behavior of the decision-makers" (Van de Ven, 1974, p. 4).

Satisfaction with Group Process

Van de Ven used quantitative measures to assess the perceived satisfaction of NGT, interacting, and Delphi participants with respect to "(a) the felt freedom to contribute ideas; (b) the extent to which their time was well spent; (c) the quantity of ideas; (d) the quality of ideas; and (e) the extent to which the decision-making method was an effective way to deal with the problem" (Van de Ven, 1974, p. 25). Each of these five measures was assessed by evaluating participant questionnaire responses on a 5-point ordinal scale. The Van de Ven study was

looking for contrasts between nominal and Delphi, Delphi and interacting, and nominal and interacting processes.

Van de Ven (1974) used Walster's computer program, SAMFIX, to determine the sample size and critical value (Walster & Tretter, 1972). SAMFIX required the researcher to input the contrasts to be tested, the size of effects considered trivial and important, and the desired probability of drawing correct conclusions. Van de Ven chose magnitudes of effect less than .75 times the standard deviation to be trivial and greater than 1.50 times the standard deviation to be important. The size of these measures was based upon the perceptions of the practitioner who is reluctant to change his traditional decision processes unless convincing evidence can be offered that another method is more effective. Van de Ven chose a .85 level of certainty for deciding an effect was trivial and .95 level of certainty for identifying an important effect.

The analysis of the differences between treatments with respect to perceived group satisfaction showed that the differences between nominal and Delphi treatments and nominal and interacting treatments were significant. The difference was not significant between the Delphi and interacting treatments. Contrary to predictions, the expressed satisfaction of the Delphi participants was somewhat higher than that of the interacting groups. All other predictions were supported.

The literature search did not reveal any other published applications of the NGT where the perceived satisfaction of the participants was measured in a formal manner.

Quality of ideas generated. Van de Ven (1974) found that NGT group participants and leaders felt that the opportunity to think through and write down ideas resulted in a tendency for those ideas to be high in quality, problem centered, and specific. Participants in the Delphi process indicated that their ideas were also high in quality and specificity. Interacting group members categorized their ideas as low in quality and generalized. These findings were based on qualitative measures.

Pressure to conform to group norms. Van de Ven (1974) found that NGT seems to emphasize tolerance for conflicting ideas through the independent expression of ideas by individuals without interruptions during the search and choice periods of the process. Delphi respondents experienced freedom from conformity through physical isolation and anonymity. Interacting group members complained of pressures to conform in their discussions. As with the previous issue, these findings were based on qualitative measures.

Equality of participation. Chung and Ferris (1971) tested the validity of the principal assumption underlying Delbecq and Van de Ven's premise that the use of the nominal group process in a problem-solving situation yields a

superior decision. Delbecq et al. (1975) assumed that unless equality of participation is assured, there may be some group members with better knowledge or information who are unable to make an effective input.

The subjects were 12 graduate students in a state university. They were given two cases to analyze and discuss. They were required to submit a written analysis before each case was discussed and to write an after-discussion synopsis. The written analyses were graded on a 10-point scale. The interaction patterns of the subjects were recorded (during discussion) on a who-to-whom sociometric chart. The groups were given some limited direction prior to beginning the discussion but were leaderless during the actual discussion phase.

Three subgroups were identified as the high-talkers (interacting), medium-talkers (in-between), and low-talkers (non-interacting). Two of the six non-interacting group members were high scholastic performers.

The results were that the inputs of the high performers of the non-interacting sub-group were not used by the group. The group decision was less superior than the quality of the decision of some group members. The non-interacting members failed to make input owing to the dominance of interacting members and inhibitory personality makeups (determined by a standardized personality profile test). Chung and Ferris support the recommendation of Delbecq

et al. (1975) for the use of a recorded round-robin idea presentation in the NGT format to insure participation equality.

Van de Ven in his 1974 study stated,

> The structured process forces equality of participation among members in generating information on the problem. While dominant members are more expressive during the discussion period, their ideas are simply included in the sample of ideas already listed on the chart. Finally, the silent independent voting on priorities forces equality of participation in choice of group product. (Van de Ven, 1974, pp. 98-99)

The Delphi technique, by virtue of its structure, required equality of participation, whereas the interacting group was found to be susceptible to member dominance in the search, evaluation, and choice phases of the group process.

Social versus task role orientations of group members. Van de Ven (1974) found that NGT groups demonstrated a balanced concern for socio-emotional group maintenance roles and performance of task-focused roles. This balanced concern seemed to provide social and task related rewards to group members. Interacting groups focused on social role orientations and group maintenance while Delphi respondents indicated a complete task-instrumental focus. These findings were based on qualitative measures.

Closure to decision process. Van de Ven (1974) also found that NGT groups experienced a strong sense of closure to their task. Delphi respondents, too, indicated a strong sense of closure, but the interacting group members felt a high lack of closure. NGT and Delphi participants indicated interest in future phases of the problem; the interacting group members did not.

Decision quality. In 1973, Gustafson, Shukla, Delbecq, and Walster published the results of a study comparing the differences in subjective estimates made by individuals, interacting groups, Delphi groups, and nominal groups. Eighteen groups of students were randomly assigned to each of the four treatments. The students were given a single physical characteristic; e.g., an observed height of 64 inches and asked to make subjective likelihood estimates of the sex of a person. The researchers measured the deviation of the estimate responses against the known anthropometric data probability of a person's sex given a certain physical characteristic. They found a statistically significant difference between each of the four treatments with the nominal group treatment having the lowest mean error across the eight questions.

Gustafson et al. (1973) concluded that a combination of nominal and interacting group processes is desirable in judgmental problem solving. In this respect, it supports the previously discussed work of Delbecq et al. (1975) and

Van de Ven (1974). It differs from Van de Ven's (1974) research in several important respects: the solution in this case was known; the solution was relatively simple (not complex); and the decision did not directly affect the decision makers.

The experimental design of Van de Ven's (1974) research used two dependent variables to measure overall effectiveness: (a) the quantity of unique ideas generated, and (b) the perceived satisfaction by participants with respect to the five measures discussed earlier.

The existence of two dependent variables and three treatments would suggest a multivariate analysis, but Van de Ven (1974) stated that statistical distribution theory was insufficiently developed to determine an appropriate sample size and critical value of the variance ratio statistic. Therefore, he combined the two dependent variables into one composite measure and assigned equal variances to the two component measures.

On the composite dependent variable, Van de Ven found that the difference between nominal and Delphi treatments was not importantly large (1.5 times the standard deviation), but it was in the predicted direction. The difference between nominal and interacting treatments was importantly large and in the predicted direction. The third comparison of Delphi and interacting processes found the difference to also be in the predicted direction and importantly large

although not so large as the difference between nominal and interacting groups.

Van de Ven found that the variances between the two component measures were not equal as he had originally assumed. The greatest amount of variance in the overall composite measure was due to the variance of the quantity of ideas. Perceived satisfaction accounted for about 13% of the variance in the composite. He also found that the two component variables were positively correlated in interacting groups (.53) but negatively correlated for nominal (-.14) and Delphi (-.21).

Although this composite measure of effectiveness is not a precise surrogate for decision quality, the relationship appears to be quite close. Both components of the composite measure (idea quantity and satisfaction) are key factors in the quality of the decision developed in a group environment.

Yost and Herbert (Note 3) compared the decision quality of NGT groups and interacting groups under two separate treatment conditions of different leadership styles. Using Fiedler's Least-Preferred Coworker (LPC) measure (Fiedler, 1967), the researchers selected eight low LPC leaders and eight high LPC leaders from a university student class. These leaders were placed in charge of 16 groups in such a manner that four high LPC leaders had NGT groups, four low LPC leaders had NGT groups. In a similar fashion, four high

LPC and four low LPC leaders were assigned to the eight interacting groups. Each of the 16 groups was given a specified, structured problem upon which to work; namely the NASA Decision-Making Problem in which a spaceship has crashed landed on the moon and the crew must decide upon a priority among items of equipment needed for survival.

Yost and Herbert (Note 3) found that NGT groups made significantly better use of their best existing resource (most knowledgeable person) than did the interacting groups. They found that group decision format was not significantly (.10 level) related to decision quality although the NGT groups did achieve better rankings than the interacting groups.

High LPC-led groups achieved better rankings than the low LPC-led groups but the differences on all measures used failed to reach significance at the .10 level. Yost and Herbert found that the strongest significant difference occurred between high LPC NGT groups and low LPC interacting groups across all measures.

Yost and Herbert (Note 3) conclude that the best approach for structured problem solving is to use a high LPC-led NGT group. They identify the advantages of the NGT group as the ability to use the group's resources and to apply group interaction to reduce conflict among members.

Quantity of Ideas Generated

In 1969, Rotter and Portugal published the results of their study on the performance of different combinations of

individual and group processes in problem solving in relation to the number of ideas produced. Their hypothesis, based on the previous research findings of other authors, was that the number of solutions found to a problem would be greater where the subject works both in a group and in an individual setting than where the subject worked either in a group or as an individual. The subjects were 64 male and 64 female university students who were divided into 32 same sex groups of four members each. Eight groups were assigned to each treatment: Condition I, working individually; Condition G, working in a group; Condition I-G, working individually the first ½ of the session and in a group during the second ½; Condition G-I, working in a group for the first ½ of the session and individually during the second ½. Each group generated responses to one of two specified problem situations. The responses were listed and each distinct idea was scored.

As predicted, the mixed conditions I-G and G-I produced significantly more solutions than the Condition G. Contrary to predictions, the Condition I produced significantly more solutions than the mixed conditions. Condition I produced significantly more solutions than Condition G, as predicted. The researchers concluded that mixed conditions were superior to the group condition because they allocated time for individual problem solving, not because they combined working conditions. Their conclusions seem

to support Delbecq et al. (1975) in the requirement for individual idea generation during the initial phase of the NGT meeting. But their findings seem to contradict the Delbecq et al. (1975) position that the brainstorming or idea hitch-hiking effect that should occur during the round-robin presentation of ideas, causes the NGT format to be superior to the individual idea generation process in the number of ideas produced.

Van de Ven (1974) used the Scheffe (1958) multiple comparisons among treatment mean differences in terms of the quantity of ideas and found that no significant difference existed between nominal and Delphi processes. There was a significant difference between the nominal group and interacting group treatments with NGT generating more ideas than the interacting groups.

Van de Ven's qualitative measures indicated that NGT with its silent generation of ideas followed by the hitch-hiking effect of the round-robin procedure, resulted in the generation of a high number of ideas in the perception of the participants. In contrast, the interacting group was characterized as producing a low number of ideas and being susceptible to focusing on one train of thought for extended periods ("rut" effect). The Delphi Technique produced a high quantity of ideas, but its participants made both positive and negative comments about writing when isolated from other people.

Green (1975) addressed the hypothesis that nominal groups are superior to interacting groups in identifying problems in a given situation. He further postulated that this hypothesis would hold true regardless of the leadership style employed in the interacting groups: permissive, democratic, or authoritarian. The subjects were 70 student volunteers from a population of 300 students taking a course in electronic data processing. These students were divided into six five-man nominal groups, three five-man permissive groups, three five-man democratic groups and two five-man authoritarian groups. The groups were led by research assistants who had been extensively prepared in the NGT and the three leadership styles. The specific question was, "In your EDP course, what problems have you noted?" The NGT followed the Delbecq and Van de Ven format except that it did not include a discussion phase. The interacting groups followed an unstructured discussion format under the direction of the three different leadership styles. In each treatment, the subjects individually selected the top five problems identified by their group. The individual votes were tabulated to select a top five problem set for each group. These problem sets were then presented to a combined assembly of all groups in that treatment category for individual voting to select the top five problems for that treatment. The groups were scored on the basis of total number of distinct ideas identified, total number of unique

responses, and a 5-point rating scale on the quality of each problem (on the criteria of pervasiveness, frequency, and severity). ("Unique" was defined as a problem identified by only one group.)

Green (1975) found that the total number of ideas produced was essentially equal across the groups. The number of unique responses varied more than the total number, but the variance was not significant between groups. Additionally, no significant variation was found among the treatments in terms of the three quality criteria. He acknowledged two conditions which may have influenced the results. The subjects were very well acquainted with the problems associated with the situation in question. Also, the subjects were volunteers, therefore probably more willing to communicate and share knowledge.

Green's study contradicts the main thrust of Delbecq and Van de Ven's research; i.e., the superiority of NGT over interacting group idea generating capabilities.

In addition to the limitations mentioned by Green in his experiment, the problem was one with known dimensions and the scope of the study was limited to examining the quantity of total responses and unique responses. The quality comparisons are highly suspect since Green did not follow the prescribed NGT format which calls for a discussion period for idea clarification and evaluation. Green does bring to attention the possibility that research is needed to identify

conditions where NGT may or may not be superior to other processes.

Person-Centered Versus Problem-Centered Problem Solving Method

Van de Ven (1974), utilizing qualitative measures, found the problem solving method used by interacting groups tended to be person-centered and characterized by smoothing over conflict or withdrawing from it. The Delphi process was problem-centered with problems resolved by majority rule of the independent judgments of the respondents. NGT, too, tended to be problem-centered but, unlike the other processes, the problems were confronted and handled directly.

Field Applications of NGT

The striking characteristic of each of the foregoing empirical tests of NGT is that each was accomplished in a university environment in fairly controlled experiments. If these tests were the total extent of NGT applications, one would tend to question its practicality when applied in field test conditions in uncontrolled environments. Fortunately, NGT has been used in several such situations with reportedly successful results. Seven examples of such applications are Grabbe (Note 1), Knippen and Van Voorhis (1974), Mosley and Green (1974), Metz (Note 2), Medin (1975), Ford and Nemiroff (1975), and Voelker (1977). Attention is invited to the conspicuous lack of empirical evaluation measures in these field tests.

Grabbe

Grabbe was a project manager for the Hawaii State Center for Science Policy and Technology Assessment, Hawaii Department of Planning and Economic Development. In 1973, he presented a paper to the International Congress on Technology Assessment on "Short-Term, Low-Cost Technology Assessments in Hawaii." In this paper, Grabbe discussed the use of NGT in Hawaii to aid in technology assessment activities. Hawaii used NGT for problem definition and actions on policy formulation. At the time of this presentation, Hawaii had conducted three assessments:

1. Legal and administrative aspects of an aquaculture policy for Hawaii
2. Exploration and utilization of manganese nodule deposits in the Pacific
3. Regional and urban systems modeling analysis and decision making

In all cases, Hawaii used preworkshop questionnaires to define the problem areas and formulate the questions to be considered at the NGT workshop. The results of the assessments were used for administrative action and as support for legislation. Each assessment cost $10,000 or less.

Grabbe identified the advantages of NGT in this environment to be:

1. Involvement of a multidisciplinary group
2. Broader representation in the selection of priorities

3. Incorporation of political aspects into factors considered
4. Tendency to develop policies which are more generally accepted socially, environmentally, and politically

He noted one obvious problem of bias being introduced into the NGT process in the selection of the participant group. He noted also that participants must be knowledgeable in the field in question for NGT to be successful.

Knippen and Van Voorhis

In the Academy of Management meetings in Seattle in 1974, Knippen and Van Voorhis presented a paper calling for the use of NGT for increasing the effectiveness of organizational communication and problem solving. These men had used NGT in a variety of firms to enhance organizational communication specifically in the development of management education and supervisory training programs. In addition, their research indicated that there was a strong similarity between the high priority problem areas identified through the use of NGT across a broad sample of organizations.

Mosley and Green

In 1974, Mosley and Green published an article and Green presented a paper suggesting the use of NGT as an organization development (OD) technique. They first utilized NGT in an OD effort for a state anti-poverty program and later applied it to businesses, churches, and universities. Specifically, they used it in research

diagnosis (fact finding), action planning (idea generation), and evaluation. They noted that the frequent participative involvement of organizational members enhances the organizational change process. In the research diagnosis phase, the authors used NGT to not only identify problems, but also to examine organizational strengths. This usage of NGT tended to generate a more positive mental perspective and receptiveness to the OD effort. They also used NGT to isolate training needs as a part of the diagnosis phase. In the action planning context, NGT aided in developing action plans (solution components) to the top priority problems identified earlier.

Mosley and Green (1974) identify several advantages in using NGT in an OD context:

1. NGT is faster, less expensive, and involves more people in a shorter period than other OD methods.
2. NGT is congruent with the OD objective of creating an open and above-board communications climate.
3. NGT tends to generate high quality data and a sense of satisfaction and involvement on the part of the participants.
4. NGT is very good at initiating the team-building process common to much of the OD effort.

The authors state that NGT appeared to be an appropriate OD tool when used in combination with other types of interventions. They caution that in some situations (high

conflict and distrust), NGT might have an adverse effect, therefore, it should be applied only where the situation would warrant its use.

City of Middletown, Ohio

The city of Middletown has used NGT as a citizen input device since 1974 (Metz, Note 2). When city officials or city planners identify a subject area which needs citizen input, that subject is advertised as a topic for consideration in a citizen meeting. Letters may be sent to a particular neighborhood requesting input on critical neighborhood needs or major restraints against development in a specific area. As people arrive at the meeting, they are seated at tables of eight to ten participants. Each table has a leader/recorder trained in the use of NGT. After a speaker presents 15-20 minutes of background information on the selected subject, the groups proceed with the standard NGT process. The ranked output is especially useful to city staff, elected officials, and professional planners. In addition, the NGT process has the benefit of providing direct involvement of the public in city policy decisions.

City of Fond du Lac, Wisconsin

In 1975, a task force of 156 people met once a week for six weeks to aid city officials in identifying and placing priorities on community needs and alternatives to meet those needs (Medin, 1975). The task force, which was divided into twelve groups of eight, used NGT to perform its task.

Initially, 280 invitations were sent by city officials to representatives of all known segments of the community, including low income groups. In the first meeting, the groups identified a total of 428 problems. Following this meeting, staff members reorganized the problem list and reduced the number to 78. Subsequent meetings selected 13 top priority problem areas. City officials found that NGT was exceptionally well suited for soliciting public input on problem identification and solution generation.

Ford and Nemiroff

In the 1975 Annual Handbook for Group Facilitators, Ford and Nemiroff recommend the use of NGT as an experiential learning technique and as a method applicable to group problem solving activities in general (Jones and Pfeiffer, 1975). The NGT format that they discuss is based directly on the work of Delbecq et al. (1975).

Voelker

The Oak Ridge National Laboratory published a report in February 1977 by A. H. Voelker on the use of NGT in the evaluation of prospective sites for nuclear power plants. Although this field test was not a quantitatively analyzed experiment, it does represent a major field application of NGT. Specifically, nuclear power plant siting involves a complex problem with no known solution, with multiple constituent/client groups attempting to influence the decision, with a high requirement for the involvement of

experts from many disciplines, and with the scope and dimensions comparable to state solar energy planning. Voelker discusses the use of NGT to identify and rate factors important in siting nuclear power plants. He notes that NGT allowed the incorporation of social, economic, and environmental factors and the quantification of their relative importance.

The purpose of the study was to identify both obvious and subtle factors which could affect plant siting and incorporate those factors into a systematic site screening and evaluation procedure. The participants in the process were asked to identify both exclusionary factors (those which would eliminate a site from consideration) and non-exclusionary factors. The specific question posed was:

> "What are the ten most important factors to be considered when selecting a site for a nuclear power plant of two unit configuration, 1100 MWe per unit, cooling tower option?"

In the selection of participants, Voelker deliberately chose not to mix technical experts and members of the public. The participants invited included engineers, ecologists, economists, natural resource specialists, regulatory personnel, utility representatives, university staff, and researchers.

Although quantitative evaluation measures were not employed, the session organizers and participants considered

the sessions successful. The siting factor lists tested well for comprehensiveness, reasonableness, agreement with siting literature, and internal consistency. The primary benefits of using NGT identified by Voelker were:

1. NGT allows a utility to employ a systematic procedure which permits competing interests to be heard as the utility attempts to meet the demand for electricity.
2. NGT allows the groups to be educated by various experts in the group.
3. NGT generates a high level of satisfaction among the group members.
4. The silent generation of ideas and round-robin presentation were justified from the standpoint of the quality of ideas and the prevention of conversation dominance by more influential individuals in the group.
5. The interactive nature of NGT enabled Voelker and his associates to test their hypothesis that the siting process was complex.

Voelker identified the following limits on the use of NGT in this environment:

1. The methodology for systematic siting requires that all factors be defined at the same scale and that they be quantifiable. NGT does not assure that this comparability of scale will occur. A group

might identify one general ecological factor and six specific water related factors which could not be compared on the same scale.

2. A siting selection model would normally be constructed in a hierarchial fashion with each layer of factors becoming more detailed. In its traditional format, NGT does not lend itself to structuring a multilevel model. The group leader cannot demand the consistency of scale and level necessary to build the model without having a serious negative impact on creativity and participation in the group.
3. In some cases, factors were technically difficult to understand, thereby rendering some participants incapable of making an informed judgment in rating those factors. Voelker suggests the use of a minicourse on the technical problem under consideration to improve the understanding of the participants before starting the NGT process.

Voelker suggests that the optimal use of NGT in model building is to use a series of iterations between the modeler and NGT groups. This process would first call for an NGT group to identify an unstructured factor set. The modeler would then develop a preliminary model structure based on the NGT group's output. The NGT group would meet again to identify factors within the constraints of the model's structure. The process would continue until the model was completed.

Summary

The first section of this chapter discussed the limitations of interacting groups. Among the limitations identified were misunderstanding, focus effect, covert judgments, status differences, pressures to conform, dominant personalities, and time spent on group maintenance. Attempts to overcome some of these problems have led to the development of techniques such as the Delphi Technique and NGT.

The empirical research studies discussed in this chapter have examined several aspects of the NGT process. A significant finding is that NGT is characterized by low flexibility in its structural requirements and low variability in behavior between groups. On tests of perceived satisfaction, NGT groups scored significantly higher than Delphi respondents and interacting groups. On specific components of satisfaction; (a) the specificity and quality of ideas generated were found to be higher in NGT groups than in either interacting or Delphi groups; (b) less pressure existed in NGT groups to conform to group norms than in interacting groups; (c) the structured nature of NGT facilitates equal participation, thereby enabling better use of group resources and enhancing the group's decision quality; (d) it was determined that interacting groups tend to focus on social and group maintenance roles, Delphi focuses on task roles, and NGT tends to balance the social versus task role orientation; (e) NGT was found to provide a strong sense of closure to the

decision process; and (f) decision quality was found by several researchers to be better for NGT than for other group process methods. The research results on the question of whether NGT generates a higher number of ideas than other methods is mixed. In one test, NGT was superior to other processes. In another test, an NGT-type process was superior to interacting groups but approximately equal to individuals. The third study concluded that no significant difference existed between NGT and interacting groups in number of ideas generated.

It was noted in one study that NGT tends to use a problem-centered method of problem solving; interacting groups, on the other hand, tend to use a more person-centered approach. Another area of research interest was administrative time and cost. NGT was found to be about equal in both categories to interacting group methods but much lower than the Delphi Technique.

Although these studies have provided substantial support for the application of NGT to group problem solving situations, there are some obvious deficiencies. First, all of these experiments are limited in their level of application. Each study was conducted in a university environment with students as group members or participants. The problems addressed were limited to simple issues such as defining a dormitory counselor job description and identifying problems in a computer course. With the

exception of the Van de Ven study (1974), these studies were also limited in scope in terms of the number of aspects of the NGT process investigated, for most of the experiments limited their testing to only one or two factors.

The examples of the field applications of NGT provided some important evidence of the practical usefulness of the technique in the solution of problems in both business and government environments. These have included various types of problems ranging from organizational training programs to those evaluating sites for nuclear power plants.

The major deficiency in the field applications has been the lack of formalized evaluation measures. The ratings of success in these cases have all been subjective, based on the opinion of the person who supervised the application or reported on its use. In addition, most of these cases are limited in level of application, ranging from local community planning to organizational development. There are two major exceptions: the technology assessments in Hawaii and the nuclear power plant siting in Oak Ridge, they represent the application of NGT to high level, complex issues.

CHAPTER IV

EXPERIMENTAL DESIGN

The primary purpose of this study was to evaluate the effectiveness of NGT as a mechanism for obtaining input relevant to a major complex problem with no known solution. This problem was the development of a Solar Energy Plan for the State of Oklahoma.

The survey of the current literature has disclosed that there have been at best, limited attempts to evaluate empirically the effectiveness of the NGT process in dealing with similarly complex problems. The empirical measures included in the current study were overall effectiveness of NGT, perceived satisfaction of participants, quantity of ideas generated, and decision quality. In addition, the extent to which participant perceptions of the NGT process were moderated by prior exposure to NGT, occupational category, and prior involvement in state or national planning was examined.

Hypotheses, Expectations, Rationale

Primary Research Question

Does NGT represent a viable, effective mechanism to provide representative and reliable input into the process of solving major complex problems such as developing a Solar Energy Plan for the State of Oklahoma?

Based on the literature cited in Chapter III, expectations were that the participants in the Oklahoma Solar Energy Planning Workshop experiment would perceive NGT to be an effective input device for planning. The viability and effectiveness of NGT were assessed by examining twelve hypotheses.

Effectiveness Hypotheses

1. The participants in the Oklahoma Solar Energy Planning Workshop experiment will perceive that NGT fosters a significantly greater amount of participation on the part of each group member than that produced by traditional interacting group discussion formats.

Previous studies have indicated that NGT group members expressed high levels of satisfaction in terms of their felt freedom to participate in the group's discussion (Van de Ven, 1974). It was expected that participants in this workshop experiment would react to NGT in a similar fashion and that they would perceive the level of participation to be significantly greater than that found in interacting groups.

The rationale for this expectation is based on research which found that the NGT format encourages equal participation among group members (Delbecq et al., 1975). This degree of participation is due to the initial phase of NGT where individuals silently and independently generate ideas, to the round-robin idea presentation-without-evaluation phase, and to the reduction of the dominance of discussion by a

few aggressive individuals. It is also supported by the final NGT phase where individual group members independently evaluate each idea.

2. The participants in this workshop experiment will perceive that NGT is significantly more efficient in terms of the amount of information generated for the time and effort expended than the efficiency of traditional interacting groups.

Previous research findings have noted that members of NGT groups perceived that their time was well spent in the NGT group discussion format (Van de Ven, 1974). It was predicted that the respondents in this study would react similarly and that they would indicate that they believed NGT was significantly more efficient than interacting group process formats.

The rationale for this prediction is based on research which concluded that the structured approach of NGT prevents digressions from the primary question under consideration, allows each group member an equal opportunity to input ideas, discourages discussion degeneration owing to personal conflict, decreases the time and effort spent on group maintenance, and permits the independent evaluation of each idea presented. NGT groups have been found to retain a strong focus on the specified task (Van de Ven, 1974).

3. The participants in this workshop experiment will perceive that NGT will generate significantly higher quality

ideas than those generated by traditional interacting groups.

Previous studies have found that NGT group members and leaders felt that NGT generated high quality ideas (Van de Ven, 1974). This reaction was based upon their feeling that NGT provided the opportunity to think through and write down their ideas, a procedure which resulted in a tendency for those ideas to be high quality, problem centered, and specific. The expectation in this workshop experiment was that participants' perceptions would be comparable to those of Van de Ven's research (1974).

4. The participants in this workshop experiment will perceive that the sense of accomplishment which they felt as a result of the NGT workshop will be significantly greater than the sense of accomplishment they would have felt in an interacting group discussion format.

Prior research studies have indicated that participants in NGT groups experienced a strong sense of accomplishment based upon their ability to contribute to the discussion, the positive sense of task closure, the number and quality of ideas the group was able to produce, and the reduced pressure to conform to group norms. Based on this rationale, it was expected that the participants in this study would experience a sense of accomplishment significantly greater than that which they would have felt in an interacting group environment.

5. The participants in this workshop experiment will perceive that the quantity of unique ideas generated was significantly greater than that which would have been generated in a traditional interacting group format.

Previous research studies have found that the NGT format generates significantly more ideas than the interacting group format of discussion (Rotter & Portugal, 1969; Van de Ven, 1974). It was expected that similar findings would occur in this study.

The rationale for this prediction is based upon the research discussed earlier which found that brainstorming groups tended to produce more ideas than conventional group discussions, and that persons working in groups tended to produce more ideas than when working alone (Osborn, 1957). NGT, as an advanced variation of brainstorming, combines the advantages of individual idea generation capabilities and the stimulation of face-to-face, verbal interaction. The round-robin phase of idea presentation specifically is designed to take advantage of the brainstorming concept through the hitch-hiking of ideas as each group member presents his ideas to the group.

6. The perceived satisfaction of participants in this workshop experiment with the NGT process will be significantly greater than the level of perceived satisfaction which would have been found in interacting groups but it will not vary significantly from the levels of satisfaction

found in earlier research studies.

Previous studies have indicated that NGT group members expressed high levels of satisfaction in terms of their felt freedom to participate, feeling of time well spent, satisfaction with the quality of ideas generated, feeling that NGT was an effective way of dealing with the problem, and satisfaction with the quantity of ideas generated. It was also found that the satisfaction expressed by NGT groups was significantly greater than that of interacting groups (Van de Ven, 1974). Therefore, it was expected that the levels of satisfaction in this study would be significantly greater than those in interacting groups and would be comparable to those found in earlier studies.

The rationale for these expectations was based upon previous research which found that the capability of the NGT format to encourage equal participation among group members enhances each person's feeling that he is contributing to the group's effort (Van de Ven, 1974). Various studies have also indicated that NGT group members tend to experience a positive sense of accomplishment and task closure as a result of two factors: (a) the NGT format's structured approach to presenting, clarifying, and discussing each idea; and (b) the final step of aggregating the group members' individual judgments (Van de Ven & Delbecq, 1974). Lastly, these studies have also found that NGT groups react positively to the number and quality of the ideas they generate.

This reaction is due to the initial NGT phase of silently generating ideas independently and to the round-robin idea presentation-without-evaluation phase. This round-robin phase encourages brainstorming and hitch-hiking ideas and enhances the quantity and quality of ideas to be considered (Van de Ven & Delbecq, 1971).

7. Participants in this workshop experiment will perceive that NGT is an effective mechanism when utilized in a complex problem such as Solar Energy Planning for Oklahoma.

Expectations were that the participants in the Oklahoma Solar Energy Planning Workshop would perceive NGT to be an effective input device for planning. This prediction was based on the anticipated quality of the Solar Plan and the participants' opinion on whether they would use NGT in a similar situation. In addition, the viability of NGT would be further assessed by evaluating participant responses when asked to list the most positive and most negative aspects of the workshop.

If effectiveness is measured as a composite of the satisfaction measure and the idea quantity measure of Hypotheses 5 and 6, it was expected that the results would be comparable to the findings of previous studies; i.e., that NGT is an effective group discussion format and that it is superior to the traditional interacting group process.

The rationale for this expectation was based upon the reasoning proposed in the satisfaction and idea quantity hypotheses. The assumption was that the satisfaction of group members and the quantity of ideas generated represent the two major measurable components of effectiveness. If participants indicated a positive perception of NGT on this composite measure, then the results of this study would tend to support previous research findings (Van de Ven & Delbecq, 1974).

8. The participants will perceive the NGT as a significantly more effective tool to generate input into the planning process than the following alternative input generating or problem solving processes commonly in use, but will not perceive NGT as significantly more effective than the Delphi Technique:

1. Conferences with small unstructured group discussion sessions.
2. Commissions or boards composed of business/ government officials with citizen participation.
3. Commissions or boards composed of business/ government officials and professional planners as members (no citizen participation).
4. Delphi Technique.

Research has indicated that NGT is perceived as more effective than small, unstructured group discussions (interacting groups) owing to a greater quantity and quality

of ideas generated, greater perceived satisfaction (in terms of participation, time well spent, and sense of accomplishment), decision quality, and overall effectiveness of the processes (Van de Ven, 1974). These findings should hold true in this study. The same reasoning was used in asking the participants to compare NGT to the Delphi Technique. In this comparison, it was expected that participants would indicate NGT was superior to Delphi, but the difference would be smaller than that found in the comparison between NGT and interacting groups. This difference would not be significant.

It was expected that NGT would be rated superior to commissions or boards composed of business or government officials with citizen participation owing to indications in previous studies (especially those on local policy making) that NGT provides a more effective mechanism for citizen participation from a broad range of citizen groups, thereby enabling a more representative citizen input (Medin, 1975). In addition, these studies indicated that NGT allowed participation in nearly all phases of the policy making process from initiation of priority setting to evaluation (Metz, Note 2).

The fourth alternative mentioned in the hypothesis substitutes professional planners for citizen participation. The expectation was that participants would indicate that NGT was more superior to this alternative than it was to the

commissions or boards with citizen participation. Again, this prediction was based on prior studies which have found that NGT effectively permits broad, representative citizen input into policy making at many points during policy development (Delbecq et al., 1975).

Control Hypotheses

Apparently, no other research study has explored the possibility that participant perceptions of the effectiveness of NGT might vary in relation to various characteristics of the participant population. This study examined differences in participant responses on measures of satisfaction, idea quantity, and NGT effectiveness in relation to prior exposure to NGT, occupational category, and prior involvement in state or national planning.

NGT has been used in a variety of environments including government, industry, community planning, health planning, and others. Participants have included people of varying ages, levels of education, races, and occupations. Material published on NGT indicates that it has been successful in the foregoing situations (Delbecq et al., 1975). Therefore, one would expect that the results of this study would not deviate from this pattern.

1. There will be no significant variation in the participant response patterns owing to differences in prior exposure to the NGT process.

2. There will be no significant variation in the

participant response patterns owing to differing occupational categories.

3. There will be no significant variation in the participant response patterns owing to differences in prior involvement in state or national planning efforts.

4. There will be a significant positive change in the opinions about NGT of participants who had not been exposed to NGT prior to this workshop across pre-workshop and post-workshop evaluation measures. Correspondingly, there should be no significant change in the opinions of those with prior exposure to NGT.

The expectation in this prediction was that those participants who had not been exposed to NGT prior to the workshop would show a significant change in their attitudes about NGT across measures of participation equality, idea quantity, process efficiency, and anticipated plan quality. In contrast, it was not expected to find an important shift of opinion among those who had been exposed to NGT before the workshop. This attitude shift has not been specifically tested in prior research studies.

The rationale for this supposition is that NGT represents a major change from the traditional group discussion format. Therefore, one would expect that persons not previously exposed to NGT would experience a major shift in attitude about the process. Based on previous research, one would expect this shift to be positive, indicating approval of

the NGT (Van de Ven & Delbecq, 1974). For those who had been exposed to NGT, there would not be a similar change of opinion since they would have previously seen the application of NGT effectively utilized; their expectations would correspond closely with their actual experience in this workshop.

Workshop Experiment Description

In May, 1977, the Oklahoma Department of Energy and the Environmental and Resources Assessment Branch, Division of Solar Energy, Energy Research and Development Administration (now the Department of Energy) agreed to jointly fund an effort to develop a Solar Energy Plan for Oklahoma. The objectives of the project were twofold: to develop the plan and to evaluate the feasibility of NGT as a vehicle for providing input into the development of energy plans in other states. The project team consisted of Dr. Bruce V. Ketcham, University of Tulsa (Project Director); Mr. Ralph C. Martin, University of Oklahoma; and Dr. Jerald D. Parker, Oklahoma State University. The author of this dissertation served as research assistant to Mr. Martin and had primary responsibility for planning and conducting the NGT workshop. (See Appendix I)

Six issues were selected by the project team as the topical areas to be addressed by the workshop participants. These issues included planning methodology, legal and public policy implications, user group impact, information/technology

transfer, demonstration program, and research and development program. (See Appendix II for major objectives of the workshop.)

The first step toward the development of the plan and the organization of the workshop was the identification and selection of the members of an Advisory Board. These people represented the following categories of society (target groups) which the project team felt would directly affect or be affected by the development of solar energy in Oklahoma:

1. Legislative/Legal/Department of Energy (Oklahoma)
2. Financial/Management
3. Builders/Developers
4. Utility Companies
5. Media
6. Architect/Engineers
7. Technical Research
8. Energy Industries
9. Manufacturing
10. Consumers

The project team identified, selected, and contacted 55 individuals to act as participants in the planning workshop. The project team used the following criteria to select participants:

1. Interest in and/or knowledge of solar energy
2. Possesses useful information to offer

3. Availability
4. Representative of target group
5. Balanced representation of target groups
6. Reputable--not opportunistic for personal gain
7. Geographical location
8. Potential contributions to the workshop
9. Multidisciplinary representation
10. Multiorganizational
11. Balanced representation of universities and communities
12. Representation of those who will administer the plan, who will be consumers of the plan's output, or who will be impacted by the plan
13. Cost of attendance

The participants were selected and assigned to the previously mentioned topical groups according to the project team's perception of their interest and expertise. The groups were kept at nine members or fewer in accordance with the guidance for NGT workshops specified by Delbecq et al. (1975).

The discussion leaders for each group were selected on the basis of status, reputation, ability to command respect from the group, and accessibility. They were not chosen on the basis of familiarity to the NGT process, but they did receive detailed written guidelines (Delbecq et al., 1975, Chap. 3) and participated in a three-hour afternoon training session approximately one week prior to the workshop. The

choice of high status individuals was based upon the subjective opinion of the project team that such leaders would command more respect and be more effective leading groups with high status members than would leaders with lower status but better training.

Each group, addressing one of the topical areas, was to examine its topic during three 90-minute sessions scheduled in the one-day workshop. The project team formulated questions for each session for each group to address specifically. (See Appendix III) With the exception of the planning methodology group, each group was asked to identify and then establish a priority for objectives, problems, and solutions relating to solar energy development and their specific topic area. Because the question formulation is a principal factor in the success or failure of an NGT workshop, the project team had the questions reviewed by the Advisory Board, three professors of management and one professor of regional planning at the University of Oklahoma, one technical research writer from the Office of Research Administration (University of Oklahoma), and the six group discussion leaders.

Two instruments were used to collect data from the workshop. The first instrument was a pre-workshop questionnaire (Appendix IV). This questionnaire was administered during the opening session of the workshop which was attended by all the participants. It contained four closed-ended, 5-point response scale questions and five questions requesting

demographic data (prior involvement in state or national planning, occupation, work location, prior exposure to NGT, and name).

The second instrument was a post-workshop questionnaire which was administered at the end of the closing session of the workshop (Appendix V). Two of the questions were open-ended, comment-type questions asking the participants to identify the most positive and most negative aspects of the workshop. The questionnaire contained 11 closed-ended, multiple response scale questions and repeated the five demographic questions contained in the pre-workshop questionnaire.

Evaluation Measures

Effectiveness Measures

Unidimensional measures. The unidimensional measures were based on the responses to questions relating to particular aspects of the participants' perceptions of the NGT workshop format. The responses to all five unidimensional measure questions were scored on 5-point ordinal scales. The sample size for these measures was 43 observations. The responses to these questions were analyzed by comparing the sample mean with a hypothetical mean of 3.0 which represented the neutral response expected if participants perceived no difference between NGT and traditional interacting groups. (See Table 6)

1. The measure of perceived participation was based

on this question:

> How much participation (each group member entering his/her ideas into the discussion) did this kind of process foster compared to that of group discussion situations you have experienced prior to this workshop?

2. The measure of efficiency was based on this question:

> How efficient (amount of information generated for the time and effort expended) was this workshop format in selecting goals, identifying problems, and generating ideas compared to that of alternative planning methods you have used or seen used before this workshop?

3. The measure of idea quality was based on this question:

> How would you rate the quality of the ideas selected by your group in this workshop?

Although the question did not ask the respondent to compare specifically his perception of the idea quality in this experiment to that of interacting groups, it was assumed that his response would have been the 3.0 response of "average" quality if the quality did not differ between this NGT workshop and the traditional interacting group discussion conferences.

4. The measure of a sense of accomplishment was based on this question:

As a participant in this workshop, how much of a sense of accomplishment do you feel in relation to your efforts today?

As in the third question, there was no requested comparison. The assumption made in choosing the 3.0 mean was that the normal response of persons attending a conventional workshop using interacting group discussions would be that "some" sense of accomplishment had been felt. The Van de Ven study (1974) infers that persons involved in NGT group discussions experienced a significantly stronger sense of accomplishment than those participating in interacting groups.

5. The measure of quantity of ideas generated was based on this question:

How many unique ideas did the workshop format generate compared to the number generated in group discussion situations you have experienced prior to this workshop? (Unique ideas were defined as separate or distinct ideas.)

The actual idea count record from the groups in this study was not complete because of the failure of some groups to record fully in writing all of the ideas suggested, or because of the incomplete tape recordings of certain group sessions.

This question involved two critical assumptions: (a) the participants were qualified to judge the quantity

of unique ideas generated and (b) the participants were capable of comparing the NGT format to previously experienced group discussion situations.

Composite measures. The composite measures involved combinations of the unidimensional measures.

1. The measure of satisfaction was based upon a combination of the five unidimensional measures. The responses of each participant on the five measures were added to derive a total satisfaction score. A sample mean was calculated based on these totals (sample size of 43). A comparison was made to evaluate the difference between the sample mean and the mean which would have existed if the participants had perceived no difference between NGT and traditional group discussion formats. If this latter perception had existed, one would have expected neutral responses (3.0) on all five component questions included in this measure. Therefore, the mean value would have been 15.0. The sample mean was expected to be significantly greater than 15.0.

Van de Ven (1974) arrived at a mean of 21.1 across 20 NGT groups, combining his five components of perceived satisfaction. While acknowledging that the measure was not replicated exactly in this study, the similarity appeared to have enough strength to expect that the means calculated from the two studies would not be significantly different.

A comparison between the components of the Van de Ven measure of satisfaction and the components of the

satisfaction measure used in this study are listed below:

Van de Ven	Solar Workshop
1. Felt freedom to participate	1. How much participation
2. Felt time was well spent	2. How efficient
3. Satisfaction with idea quality	3. Rate the quality
4. Effective way to deal with problem	4. Sense of accomplishment
5. Satisfaction with idea quantity	5. How many unique ideas

In addition, this study made a correlational analysis to determine whether the five specific measures could validly be combined into one composite measure. The Van de Ven study reported no such evaluation.

2. The composite measure of NGT effectiveness is based on a combined measure incorporating the quantity of ideas and satisfaction measures.

Van de Ven (1974) combined the perceived satisfaction measure and the quantity of ideas measure to arrive at a composite measure of effectiveness. The two dependent measures were combined directly assuming equal variance for both measures. To build a similar composite measure, this study took the sum of each of the idea quantity responses multiplied by 4, plus the sum of the satisfaction scores to

equal the composite effectiveness score on each observation. For this test, the satisfaction measure did not include idea quantity responses. An evaluation was made to detect a significant deviation from a composite mean of 24.0. The number 24.0 was based on eight possible responses of the mid-point response (3.0) which signifies that there was no difference between NGT and conventional group discussion formats. It was expected that the sample mean would be significantly larger than 24.0.

Global measures. The global measures were selected measures evaluating the overall effectiveness of the workshop.

1. The first global measure of NGT effectiveness was based on the following question in the post-workshop questionnaire:

> If you were in charge of a major planning effort at this level, would you use this particular workshop process?
>
> a. Yes b. Not Sure c. No

Response "a" was scored 3; "b", 2; and "c", 1. The object in this evaluation was to determine whether the sample mean was positive and significantly different from 2.0. If so, this finding would be an indication that NGT is a viable mechanism in the experimental situation.

2. The second global measure of effectiveness was based on the following question:

> How would you expect the quality of the Oklahoma Solar

Energy Plan (developed using this workshop format) to compare with the quality of the same plan if it were developed using alternative planning methods with which you are familiar?

An analysis was done to determine whether a significant difference between the sample mean and 3.0 existed in a positive direction. It was felt that the participants' anticipation concerning the quality of the plan would be directly related to their perceptions of the success or effectiveness of the NGT workshop. If they saw NGT as equally effective as traditional planning methods, then one would expect to find a sample mean close to 3.0, the neutral response value. If they indicated that they believed the quality of the plan would be much higher owing to the use of NGT, then one would expect a mean significantly above 3.0.

3. The third global measure of effectiveness was based on the following question:

As a tool to generate input into the planning process, how would you rate this workshop format compared to the following methods:

a. Conference with small unstructured group discussion sessions

   1) better 2) the same 3) worse 4) don't know

b. Commission or board composed of business/government officials with citizen participation

   1) better 2) the same 3) worse 4) don't know

c. Commission or board with business/government officials and professional planners as members (no citizen participation)

1) better 2) the same 3) worse 4) don't know

d. Delphi Technique

1) better 2) the same 3) worse 4) don't know

All "don't know" responses were deleted from the sample. Whenever NGT was perceived to be as effective in generating input as each of these methods taken separately, one would expect a mean value of 3.0 (the number "2" or neutral response). Whenever NGT was seen as more effective, then the sample mean should be larger than 3.0.

4. Fourth, workshop participants were asked on the post-workshop questionnaire to identify the most important positive and negative aspects of the specific workshop format they had just experienced. These questions read as follows:

In your judgment, what were the most important positive aspects of this specific workshop format?

In your judgment, what were the most important negative aspects of this workshop format?

These comments were categorized and evaluated according to these criteria: creativity, participation, efficiency, task-focus, and satisfaction. In addition, their comments were analyzed in terms of overall methodology and NGT process mechanics. These comments provided a direct insight into

the perceptions of the participants as to the successes and failures of this specific NGT application.

Two of the general measures of NGT effectiveness required the combination of the unidimensional measures of effectiveness. Correlations between measures were computed to determine whether the combination measures were disguising important positive or negative relationships between measures. A summary of these correlations is presented in Table 7. Cronbach's alpha, a measure of internal consistency reliability, was computed to be .798 for the satisfaction measure and .918 for the composite measure of effectiveness.

Control Measures

The control measures were designed to analyze the participant responses to determine whether certain major background characteristics might have an influence on reactions of the participants to the NGT workshop. Information on the participants' backgrounds (prior exposure to NGT, occupation, and involvement in state or national planning) was obtained via questions on the pre-workshop and post-workshop questionnaires. (See Appendix IV)

1. Three control measures were used to determine if significant variations existed in the response patterns on measures of participation, efficiency, idea quality, sense of accomplishment, idea quantity, satisfaction, and overall NGT effectiveness. These control measures were prior exposure to NGT, occupational category (government,

Table 6

Measures of NGT Effectiveness

Measures	Sample Size	Sample Mean	Standard Deviation	Neutral Mean	Response Range
Unidimensional					
1. Participation	43	4.023	1.123	3.0	1.0 to 5.0
2. Efficiency	43	3.907	.996	3.0	2.0 to 5.0
3. Idea quality	43	3.907	.750	3.0	2.0 to 5.0
4. Sense of accomplishment	43	3.465	.909	3.0	1.0 to 5.0
5. Idea quantity	43	3.837	.898	3.0	2.0 to 5.0
Composite					
6. Satisfaction	43	19.140	3.509	15.0	11.0 to 25.0
7. Composite measure of effectiveness	43	30.651	5.904	24.0	17.0 to 40.0
Global					
8. Use NGT again	43	2.535	.702	2.0	1.0 to 3.0

Table 6--Continued

Measures	Sample Size	Sample Mean	Standard Deviation	Neutral Mean	Response Range
9. Anticipated plan quality	41	3.415	.805	3.0	2.0 to 5.0
10. Conferences with unstructured group discussions	40	3.525	.716	3.0	2.0 to 4.0
11. Commissions/boards with citizens	36	3.667	.676	3.0	2.0 to 4.0
12. Commissions/boards with planners	38	3.342	.847	3.0	2.0 to 4.0
13. Delphi Technique	22	3.136	.774	3.0	2.0 to 4.0

Table 7

Pearson Correlation Coefficients between Measures of Effectiveness

	Idea quantity	Idea quality	Participation	Efficiency	Accomplishment	Satisfaction	Composite	Plan quality	Use NGT again
Idea quantity									
Idea quality	.6487								
Participation	.2872	.4549							
Efficiency	.7285	.5302	.3214						
Accomplishment	.4451	.5889	.2924	.3910					
Satisfaction	.8084	.8283	.6577	.7876	.7033	(.798)[a]			
Composite	.9368	.7883	.5220	.8005	.6211	.9633	(.918)[b]		
Plan quality	.5283	.4306	.2855	.5374	.3256	.5540	.5699		
Use NGT again	.5192	.5489	.4670	.7202	.4218	.7132	.6608	.4054	

[a]Cronbach's Alpha, measure of internal consistency reliability, is .798 (Bohrnstedt, 1969).

[b]Cronbach's Alpha is .918.

university, and private employment), or prior involvement in state or national planning efforts.

2. The fourth control measure was designed to compare the pre-workshop responses against the post-workshop responses in order to evaluate the difference between two means in a paired sample. This comparison involved calculating the difference between the responses for each participant on each matched pre-workshop and post-workshop question. That set of differences was then treated as a single sample. For those without prior NGT exposure, this sample mean was expected to be significantly greater than 0. For the participants who had been exposed to NGT prior to the workshop, the sample mean should not be significantly different from 0. This finding would indicate that attitudes had changed significantly in the first case and had not changed significantly in the second one.

The specific questions involved were those addressing the number of unique ideas generated, participation level, efficiency, and anticipated quality of the solar plan. The pre-workshop questions were as follows:

1. How many <u>unique ideas</u> do you anticipate that the workshop format (which has just been explained) will generate compared to the number generated in group discussion situations you have experienced prior to this workshop?

2. How much participation (each group member entering his ideas into the discussion) do you anticipate that this format will foster compared to that of group discussion situations you have experienced prior to this workshop?
3. How efficient (amount of information generated for the time and effort expended) do you anticipate that this format will be in selecting goals, identifying problems, and generating ideas compared to that of alternative planning methods you have used or seen used before this workshop?
4. How would you expect the quality of the Oklahoma Solar Energy Plan (developed using the format just explained) to compare with the quality of the same plan if it were developed using alternative planning methods with which you are familiar?

The corresponding post-workshop questions were presented in the discussion of unidimensional measures of effectiveness.

Prior to the workshop, each participant received a packet of information which included:

1. A brief description of the mechanics of the NGT format (Appendix VI).
2. A summary of the solar plan proposal (Appendix I).
3. Solar plan objectives and issues.
4. Outline of work accomplished to date.
5. Workshop purpose, objectives, schedule, and sample questions.

6. List of workshop participants and group assignments.

During the opening session of the workshop, before the participants were divided into their working groups, the NGT format was explained orally (Appendix VII). After this step, the participants were asked to complete the pre-workshop questionnaire. Forty-five completed pre-workshop questionnaires and 43 post-workshop questionnaires were collected. Of these questionnaires, 42 could be matched by name and/or demographic categories. (The administration of the pre-workshop questionnaire was separated from the administration of the post-workshop questionnaire by approximately eight hours.)

Tests

The statistical test used to evaluate all the measures in this study, with the exception of the comments of the participants, was the Student's *t* statistic. This test is an appropriate test in situations where the research involves analysis of means and relatively small samples. The testing of almost all of the measures involved the comparison of the sample mean to an assumed mean that would have existed for interacting group respondents. In any case where the NGT sample mean was not significantly different from the assumed mean, the inference was that the participants perceived no significant difference between the NGT format and traditional interacting group formats on that specific

measure. The measure of perceived satisfaction involved the only instance in this study where the sample mean of this experiment was compared to the mean found in another study; i.e., Van de Ven, 1974.

All statistical tests were conducted using a .95 level of confidence to determine the significance of the results obtained.

All quantitative analyses were accomplished by using the Statistical Applications System (SAS) package on the University of Oklahoma IBM 370/158 computer (Barr, Goodnight, Sall, & Helwig, 1976).

Experiment Limitations

Research in the field of social sciences has many limitations. Especially in field experiments, the researcher must be aware of the assumptions he must make to proceed with the proposed study. Obviously, in a field test, it is difficult to identify and isolate all factors that influence the outcome of the test(s). Additionally, the research may be subjected to any of the following biasing influences (Helmstader, 1970):

Factor	Definition
1. History	Events other than the experimental treatment (X) which occurred between premeasurement and postmeasurement.
2. Maturation	Changes in the subject group

with the passage of time which are not associated with the experimental treatment (X).

3. Testing — Changes in the performance of the subjects because previous measurement of their performance made them aware they were part of an experiment (that is, measures often alter what is being measured).

4. Instrumentation — Changes in the measures of participants' performance that are the result of changes in the measurement instruments or conditions under which the measuring is done (for example, wear on machinery, boredom, fatigue on the part of observers).

5. Selection — When participants are assigned to experimental and control groups on any basis other than random assignment. Any other selection method will result in differences between groups which will result in differences between groups which are

unrelated to the effects of the experimental treatment (X).

6. Mortality — If some participants drop out of the experiment before it is completed, the experimental and control groups may not be comparable.

7. Interaction effects — Any of the above factors may interact with the experimental treatment, resulting in confounding effects on the results. For example, the types of individuals withdrawing from a study (mortality) may differ for the experimental group and the control group.

The assessment of this experiment depends in large part upon the measurement of the opinions and attitudes of individuals. The assumption is made that the study population possessed definitive attitudes and could express those attitudes on response scales which could serve as measurable surrogates for the attitudes themselves. Obviously, attitudes are not measurable or additive in the same sense that the length measurements might be on physical objects. The awareness must exist that the statistical tests utilized are acting upon these numbers as if they were cardinal, not ordinal. Although controversy over the use of parametric versus non-parametric

statistics exists in behavioral research disciplines, there is substantial evidence that supports the use of parametric statistics in cases where scores are assigned to items of behavior; e.g., attitude scales and performance measurements (Kirk, 1972). It is also assumed that measuring instruments, the researcher, the respondent, and the environment are objective and unobtrusive. The respondents are presumed to have adequate knowledge and capacity to respond. The assumption was made that each participant had experienced a sufficient number of workshops or conferences prior to this meeting that they might be able to make a reasoned comparison between their previous experiences and this workshop. The final major assumption is that the selection of the workshop participants did not bias the results significantly in any direction.

This study used a combination of measurements to reinforce the results obtained. It utilized a one group pre-test/post-test design and a one group post-test only design for differing measures (Kerlinger, 1973). This study did not employ comparison groups using the Delphi Technique or the interacting group format.

With these considerations in mind, the results of this study should be evaluated in light of their support or lack of support for previous studies and the major trend(s) which might be indicated by the combination of the various measures.

This study evaluated the application of NGT in a planning workshop for the development of the Oklahoma Solar Energy Plan. The workshop was designed to test the NGT process as a potential device to provide representative and reliable input into state-level energy planning. The experiment was not designed to provide conclusive evidence of NGT's superiority or inferiority relative to other planning methods, although participants were asked to provide subjective comparisons between NGT and other group process or planning methods. The experiment was limited by financial, time, and resource constraints of the Solar Plan Project. The value of the experiment conducted is to be found in its level of application, the magnitude and complexity of the problem addressed, and the perceived success or failure of the NGT as a planning input device in this milieu.

CHAPTER V

RESEARCH RESULTS

The quantitative and qualitative research results generally support the empirical findings of experimental studies such as Van de Ven (1974) and the subjective findings of field studies such as Voelker (1977). The analysis of these results of the present study has also disclosed important new information related to the impact of prior exposure to NGT upon participant perceptions in the workshop experiment. The application of NGT in the specific context of Solar Energy Planning in Oklahoma was apparently successful, but several factors were identified which could have potentially negative impact on the effectiveness of NGT. These factors are discussed in this chapter and recommendations for modification and further research are in Chapter VI.

NGT Effectiveness

The results obtained from the following measures of the effectiveness of NGT were analyzed by using the Student's *t* value. The range of significant values was computed. (See Table 8 for a summary of results.)

Unidimensional Measures

1. The hypothesis that NGT would foster a significantly greater level of participation on the part of each group

Table 8

Results of Measures of NGT Effectiveness

Measures	Sample Mean	Range of Significance ($p > .95$)
Unidimensional		
1. Participation	4.023	4.369 to 3.677
2. Efficiency	3.907	4.213 to 3.601
3. Idea quality	3.907	4.138 to 3.676
4. Sense of accomplishment	3.465	3.745 to 3.185
5. Idea quantity	3.837	4.113 to 3.561
Composite		
6. Satisfaction	19.140	20.219 to 18.060
7. Effectiveness composite	30.651	32.468 to 28.834
Global		
8. Use NGT again	2.535	2.751 to 2.319
9. Anticipated plan quality	3.415	3.669 to 3.161
10. Conferences with unstructured group discussions	3.525	3.754 to 3.296
11. Commissions/boards with citizens	3.667	3.896 to 3.438
12. Commissions/boards with planners	3.342	3.620 to 3.064
13. Delphi Technique	3.136	3.480 to 2.793

member than would traditional interacting group formats (as perceived by workshop participants) was confirmed. On a sample size of 43 responses on the post-workshop questionnaire, a mean of 4.023 was obtained. The t test range of significance was 4.369 to 3.677, a range that leads to the conclusion the responses were significantly greater than the 3.0 mean which would have been expected if the findings showed no difference between participation levels in NGT groups and interacting groups.

2. The hypothesis that NGT was more efficient in time and effort expended than interacting groups was confirmed. As in the measure on participation, the sample size was 43. The sample mean was 3.907 with a t test range of significance of 4.213 to 3.601. This finding supports the conclusion that the responses were significantly more positive than the 3.0 mean which would have been expected if the participants perceived no difference in efficiency between NGT and interacting groups.

3. The hypothesis that NGT would generate higher quality ideas than would interacting groups was confirmed. The sample of 43 responses had a mean of 3.907 with a t test range of significance of 4.138 to 3.676. In this measure of idea quality it was assumed that the mean response of interacting group members would be the "average" response (3.0 mean). This finding showed that the responses were significantly different from 3.0 in the positive direction,

indicating that participants felt that NGT generated significantly higher quality ideas than those produced by interacting groups.

4. The hypothesis that NGT group members would indicate a higher sense of accomplishment than they would have felt in an interacting group format was confirmed. The sample of 43 responses generated a mean of 3.465. The t test range of significance was 3.745 to 3.185. As was the case in evaluating the responses on idea quality, the assumption was made that the mean response of interacting group participants would be "some" (3.0 mean). The results showed that the responses were significantly greater than 3.0, indicating that participants felt a significantly stronger sense of accomplishment as a result of the NGT format than would have been experienced in interacting groups.

5. The hypothesis that participants would perceive that the quantity of ideas generated by NGT would be significantly greater than the quantity generated in an interacting group format was confirmed. The sample size was again 43. The sample mean was 3.837 with a range of significance of 4.113 to 3.561. Since the range did not include the 3.0 expected interacting group mean, this finding indicated that the workshop participants believed that NGT generated significantly more ideas than would the traditional interacting groups.

Composite Measures

1. The hypothesis that the perceived level of satisfaction would be higher for the participants in this workshop than that which would have been found in an interacting group format was confirmed. If there had been no perceived difference, one would have expected to see a mean of 15.0 (five specific measure scores of 3.0). Instead, the mean was calculated to be 19.140 with a t test range of significance of 20.219 to 18.060 on a sample of 43 responses. This finding indicates that the participants were significantly more satisfied with NGT than they would have been with interacting groups. The hypothesis that there would be no significant difference between the sample mean obtained in this study and the mean found by Van de Ven (1974) on similar measures (participation, time well spent, idea quality, idea quantity, and effectiveness) was denied. The significant range of the difference of means between the two samples (this study and Van de Ven's study) was found to be -1.96 ± 1.674 (-3.634 to -.286). Because this range does not include 0, then the difference in the two means is significantly different from 0. This finding implies that the means of the two studies are drawn from different populations and are significantly different from each other. While this finding was not expected, it is of relatively minor importance because the unidimensional measures which comprised the two composite measures of

satisfaction were not exactly the same. In addition, the results of both measures of satisfaction were in the predicted directions and significantly more positive than those from interacting groups. The conclusions concerning satisfaction were the same in both studies.

2. The hypothesis that the perceived level of effectiveness evaluated on a composite measure of unidimensional measures would be higher for participants in this workshop than the level found in a workshop utilizing the interacting group process was confirmed. If there had been no perceived difference, a mean of 24.0 would have been expected (eight unidimensional measures of 3.0). The mean was computed to be 30.651 with a range of significance of 32.468 to 28.834 on a sample of 43. This confirmed the hypothesized relationship.

Global Measures

1. The hypothesis that the participants in this workshop would perceive that NGT was an effective mechanism for solar planning in Oklahoma was confirmed. The mean response to the question on whether the participant would use NGT again in a similar situation was 2.535 with a range of 2.751 to 2.319 on a sample of 43. The neutral response on this measure was 2.0 ("Don't know"). The responses to this question were considered to be the "proof-of-the-pudding" indication of whether NGT had been effective. The participants could indicate a response of "Yes", "No", or "Don't

know". A strong positive response on this measure would seem to indicate a high degree of success for the NGT process. The mean response to the question on anticipated quality of the Solar Plan was 3.415 on a sample size of 41. The significant range was 3.669 to 3.161, a range which indicated that the participants felt that the quality of the plan would be significantly higher due to NGT than it would have been if traditional planning methods had been used (response mean 3.0).

2. The hypothesis on the comparison of NGT to four other planning mechanisms was confirmed. The participants rated NGT as significantly more effective (as a tool to generate planning input) than conferences with small unstructured group discussion sessions. The sample mean was 3.525 with a range of significance of 3.754 to 3.296 which did not include the neutral mean value of 3.0. The participants also rated NGT as significantly better than commissions or boards composed of business or government officials with citizen participation. The sample mean was 3.667 with a range of significance of 3.896 to 3.438 which failed to include the neutral mean of 3.0. NGT was rated as significantly more effective than commissions or boards of business or government officials with professional planners as members (no citizen participation). In this case, the sample mean was 3.342 with a range of significance of 3.620 to 3.064 which did not include the neutral mean of 3.0.

As predicted in the hypothesis, NGT was not seen by the participants as significantly more effective than the Delphi Technique. The sample mean was 3.136 with a range of significance of 3.480 to 2.793 which did include the neutral mean of 3.0. This finding is in agreement with the Van de Ven study (1974).

3. There was a total of 67 comments made on the post-workshop questionnaire in response to the question concerning the most positive aspect of the workshop. Of this total, 35 (52.2%) were related to some aspect of participation; 22 (32.8%) were directed toward the equality and balance of participation in the NGT format; 10 (14.9%) singled out the capability of NGT to facilitate shared expertise and to permit each individual's input to be significant; and 3 (4.5%) chose the ability of NGT to minimize the influence of dominant individuals. The second major group of comments was directed toward satisfaction. This group contained 10 comments (14.9%) including remarks concerning satisfaction, sense of accomplishment, task closure, or pooling of judgment. The third major group (nine responses--13.4%) dealt with the quantity, quality and variety of ideas generated by the workshop. The final four groups addressed task-focus, efficiency, group leaders, and pre-planning. There were six comments (9.0%) directed towards NGT's ability to retain a strong task-focus, balancing the problem solving orientation against the social orientation of the group.

Four (6.0%) were made selecting the efficiency of the NGT process as the most positive aspect of the workshop. Two responses (3.0%) were given concerning the group leaders, and one (1.5%) was made designating pre-planning as a most positive aspect.

In summary, the various facets of the participation capacity of NGT were most impressive to the participants. This position is in agreement with the quantitative results obtained earlier, but it places a much greater degree of emphasis on the importance of participation in relation to other aspects of NGT than had been previously indicated. (See Table 9 for a summary of the comments; Appendix VIII for a complete listing.)

A total of 55 comments was made in response to the question concerning the most negative aspects of the workshop. The largest number of comments (12--21.8%) were directed at perceived problems with time; i.e., too little time, too much time, or inefficient use of time. The second largest number (eight--14.5%) indicated dissatisfaction with the ranking/voting procedure. Most of these comments paralleled the observation made by Voelker (1977) that NGT has difficulty dealing with different levels of specificity among the ideas generated. (See Appendix VIII) The third major category of negative responses (seven--12.7%) were related to the topical questions. This finding confirmed the admonition made by Delbecq et al. (1975) that the

question formulation in the NGT process is a critical step which must be performed carefully in order for an effective discussion to result. The fourth major group of comments (six--10.9%) reflected the belief of some participants that they (or other participants) did not possess an adequate knowledge of the subject area or acquaintance with the objectives of the workshop to address effectively the subject. This finding confirmed the observations made by previous researchers (Medin, 1975; Voelker, 1977) that some type of educational or instructional process should precede the NGT discussion if the participants are unfamiliar with the technical aspects or background of the subject. The final six groups contained negative reactions that related to the NGT discussion characteristics (five--9.1%), the NGT structure (five--9.1%), inappropriate application of NGT (three--5.5%), the group output (three--5.5%), participant problems (three-5.5%), and pre-planning deficiencies (three--5.5%).

In summary, the three areas of time, the idea ranking procedure, and the topical questions were the primary irritants for the participants. In all likelihood, the time problems were attributable to requirement for a one-day workshop--a factor that was dictated by the project funds available. The ranking procedure difficulties stemmed from two areas: (a) participants were unhappy about comparing ideas at different levels of specificity or abstraction; and (b) some of them disliked being asked to make priority

Table 9

Participant Comments

Aspect		Number	Percent
	Positive Comments		
1.	Participation	35	52.2
	Equality	(22)	(32.8)
	Shared expertise	(10)	(14.9)
	Minimize dominance	(3)	(4.5)
2.	Satisfaction	10	14.9
3.	Idea quantity, quality	9	13.4
4.	Task-focus	6	9.0
5.	Efficiency	4	6.0
6.	Group leaders	2	3.0
7.	Pre-planning	1	1.5
	Total	67	100.0
	Negative Comments		
1.	Time	12	21.8
2.	Ranking procedure	8	14.5
3.	Topical questions	7	12.7
4.	Perspective	6	10.9
5.	Discussion	5	9.1

Table 9--Continued

Aspect	Number	Percent
Negative Comments--Continued		
6. NGT structure	5	9.1
7. Application of NGT	3	5.5
8. Group output	3	5.5
9. Participants	3	5.5
10. Pre-planning	3	5.5
Total	55	100.1[a]

[a]Due to rounding.

rankings on a difficult, complex issue. The topical questions had been anticipated as an area of difficulty. Although the questions had been reviewed by knowledgeable parties, the questions apparently failed to be satisfactory to some participants. This problem could have been due to the wording and structure of the questions or to the difficult nature of the question topics. Together, these three groups of comments (time problems, ranking procedure, and topical questions) accounted for 49.1% of the negative comments.

Summary

The results reported thus far have generally supported the hypotheses established in Chapter IV. On the five unidimensional measures of effectiveness, NGT was found to be significantly more effective than traditional, interacting groups given the limitations and assumptions made in the workshop experiment. Similar results were obtained on the composite and global measures of effectiveness which included two combined measures, two individual measures, and four direct comparison measures. It was found that a significant difference existed on the combined measure of satisfaction between the sample mean and the mean found by the Van de Ven study (1974). Because the measure was not replicated exactly, no definitive conclusion could be drawn from this difference. It was also found that the workshop participants in this study perceived no significant difference in effectiveness between NGT and the Delphi Technique. This

relationship had been predicted. While noting the exceptions identified above, the research results have confirmed the expectations and predictions made by the researcher.

Research Results on Control Measures

There were three measures of control utilized in this study. First, research results were analyzed to determine if participant responses would vary in relation to whether they were acquainted with the NGT process prior to this workshop experiment. Second, the results were studied to establish whether the responses varied in relation to the participants' occupational categories. The occupational categories were government, university, and private. Third, a determination was made to see if responses varied according to whether the participant had been involved in state or national planning before the workshop. The responses to all unidimensional, composite, and global measures of effectiveness were analyzed across these controls. In addition, the pre-workshop responses were compared to the post-workshop responses across these controls. (See Table 10 for a summary of results.)

1. The hypothesis stating that no significant response variation would occur in relation to prior exposure to NGT was denied on seven measures (efficiency, idea quality, idea quantity, satisfaction, effectiveness, plan quality, and NGT versus conferences). On the unidimensional measure of efficiency, the mean for those with prior exposure to

NGT was 3.077 while the mean for those without prior exposure was 4.267. The t test on the difference of the means revealed a range of significance of -.628 to -1.752. Since this range does not include 0, the means can be considered to be significantly different from each other. On the unidimensional measure of idea quality, the mean for those with prior exposure was 3.385 and the mean for those without was 4.133. The range of significance was -.297 to -1.199, a range which led to the finding that these means were also significantly different from each other. On the unidimensional measure of idea quantity, the mean for those with prior exposure was 3.231 and the mean for those without was 4.100. The range of significance was -.325 to -1.413 which indicates that these means were significantly different. On the composite measure of satisfaction, the mean for those with prior exposure to NGT was 16.462 and the mean for those without prior exposure was 20.300. The range of significance was -1.788 to -5.888 which meant that the means were significantly different. On the composite measure of effectiveness, the mean for those with prior exposure was 26.154 and the mean for those without was 32.600. The range of significance was -2.995 to -9.897 which indicated that the means were significantly different. On the global measure of anticipated plan quality, the mean for those with prior exposure was 3.000 and the mean for those without was 3.586. The range of significance was -.052 to -1.120 which indicated

that the two means were significantly different. When asked to compare NGT with conferences using unstructured group discussions, those participants with prior exposure to NGT had a mean response of 3.167. Those participants without prior exposure had a mean of 3.679. The range of significance was -.034 to -.990 which meant that the means were significantly different. In addition, the ranges of significance on the measures of participation and desire to use the NGT again were close to indicating a significant difference between the sample means in either case. It should be noted that on each measure (with the exception of commissions or boards with citizen participation) those participants who had not been exposed to NGT prior to the workshop had higher mean responses than those individuals who had been exposed to NGT before attending the workshop. Prior exposure to NGT had a strong influence on the perceptions of participants in this workshop experiment in relation to the effectiveness of NGT.

2. The hypothesis that there would be no significant variation in responses due to occupational category was confirmed with one exception. That exception was on the measure comparing NGT to conferences with unstructured group discussions. In comparing the responses of participants from university occupations to those with occupations in private industry, a significant difference was found between their means. The mean for the university

participants was 3.267 and the mean for privately employed participants was 3.867. The range of significance was -.138 to -1.620. All other means between government and university participants, between government and privately employed participants, and between university and privately employed participants were tested and found to not be significantly different.

3. The hypothesis that there would be no significant variation in responses owing to prior involvement in state or national planning efforts was confirmed. The testing of responses means across all specific and general measures of effectiveness failed to reveal any case where the means were significantly different.

4. The hypothesis that there would be a significant change in the responses of participants who had not been exposed to NGT before the workshop between the pre-workshop questionnaire and the post-workshop questionnaire was denied. The second half of that hypothesis stating that there would be no significant change between the pre-workshop responses and the post-workshop responses for those who had prior exposure to NGT was confirmed. In testing the difference of means for both groups on the pre-test, post-test measures of idea quantity, participation, efficiency, and anticipated plan quality, no significant difference of means was discovered. In addition, no significant difference of means was found when the pre-workshop responses were matched

with the post-workshop responses, the difference calculated, and a *t* test performed comparing the means of those with prior exposure against those without.

Summary

The statistical test used to analyze the research results of this experiment was the Student's *t* test. This test was appropriate from the standpoint of the small sample size and the one-group, post-test experimental design utilized on most measures in the study. As predicted, the sample mean responses were found to be significantly larger than the assumed neutral means on all unidimensional, composite, and global measures of effectiveness except for the predicted comparison between NGT and the Delphi Technique. Contrary to predictions, significant differences were found on several measures between the response means for those who had been exposed to NGT prior to the workshop as compared to those who had not been exposed. As expected, occupational category and prior involvement with state or national planning had no significant impact upon the responses of the participants. Contrary to predictions, there was no significant change in the perceptions of participants without prior exposure to NGT between their responses on the pre-workshop questionnaire and the post-workshop questionnaire. The prediction that no significant change would occur in the responses of those participants who had prior exposure to NGT between the pre-workshop and post-workshop questionnaires was confirmed.

Table 10

Response Variation on Control Measures[a]

Control Measures	N	Participation	Efficiency	Idea quality	Accomplishment	Idea quantity	Satisfaction	Composite measure	Plan quality	Use NGT again
Prior exposure to NGT:										
Yes (mean)	13	3.538	3.077	3.385	3.231	3.231	16.462	26.154	3.000	2.231
No (mean)	30	4.233	4.267*	4.133*	3.567	4.100*	20.300*	32.600*	3.586*	2.667
2. Occupational category:										
Government-University										
(mean)	12	4.250	3.750	3.833	3.417	3.667	18.917	29.917	3.364	2.417
(mean)	15	4.000	3.933	3.867	3.333	3.800	18.933	30.333	3.429	2.533
Government-Private										
(mean)	12	4.250	3.750	3.833	3.417	3.667	18.917	29.917	3.364	2.417
(mean)	16	3.875	4.000	4.000	3.625	4.000	19.500	31.500	3.438	2.625

Table 10--Continued

Control Measures	N	Participation	Efficiency	Idea quality	Accomplishment	Idea quantity	Satisfaction	Composite measure	Plan quality	Use NGT again
University-Private										
(mean)	15	4.000	3.933	3.867	3.333	3.800	18.933	30.333	3.429	2.533
(mean)	16	3.875	4.000	4.000	3.625	4.000	19.500	31.500	3.438	2.625
3. Prior planning experience:										
Yes (mean)	22	4.045	3.818	3.955	3.591	3.818	19.227	30.682	3.381	2.500
No (mean)	21	4.000	4.000	3.857	3.333	3.857	19.048	30.619	3.450	2.571

[a]See Appendix IX for more detailed version of this table.

*Indicates a significant difference in means at $p > .95$ using the t test.

Table 10--Continued

Control Measures	N	Conferences-Unstructured	Commissions with Citizens	Commissions with Planners	N	Delphi Technique	Pre-Test/Post Test N	Quantity	Partici-pation	Effi-ciency	Plan quality
1. Prior exposure to NGT:											
Yes (mean)	12	3.167	3.750	3.167	(8)	3.000	12	-.083	-.250	.167	0.000
No (mean)	28	3.679*	3.625	3.423	(14)	3.214	30	.300	.067	.367	.036
2. Occupational Category:											
Government-University											
(mean)	10	3.400	3.250	3.500	(5)	3.000	11	.000	-.091	.091	-.222
(mean)	15	3.267	3.846	3.357	(11)	3.273	15	.133	-.333	.400	.071

Table 10--Continued

Control Measures	N	Conferences-Unstructured	Commissions with Citizens	Commissions with Planners	(N)	Delphi Technique	N	Pre-Test/Post Test: Quantity	Participation	Efficiency	Plan quality
Government-Private											
(mean)	10	3.400	3.250	3.500	(5)	3.000	11	.000	-.091	.091	-.222
(mean)	15	3.867	3.733	3.214	(6)	3.000	16	.375	.313	.375	.125
University-Private											
(mean)	15	3.267	3.846	3.357	(11)	3.273	15	.133	-.333	.400	.071
(mean)	15	3.867*	3.733	3.214	(6)	3.000	16	.375	.313	.375	.125
3. Prior planning experience:											
Yes (mean)	20	3.500	3.579	3.450	(15)	3.133	21	.095	-.095	.238	-.105
No (mean)	20	3.550	3.765	3.222	(7)	3.143	21	.286	.048	.381	.150

*Indicates a significant difference in means at $p > .95$ using the t test.

CHAPTER VI

CONCLUSIONS, RECOMMENDATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

The purpose of this applied research experiment was to make a formal empirical evaluation of the effectiveness of NGT when applied to a complex problem in a field situation. The problem addressed was the development of a Solar Energy Plan for Oklahoma. The study was designed and directed towards answering the following questions:

1. Would the participants in this study perceive NGT to be an effective mechanism to provide informational input into the process of solving a complex problem such as developing a Solar Energy Plan for Oklahoma?

2. Would the perceptions of the participants, as reflected in their responses to evaluative questions, vary significantly in relation to prior exposure to the NGT process, occupational background, or prior involvement in state or national planning efforts?

Conclusions

1. a. NGT appears to represent an effective mechanism to provide representative, reliable input into the process of solving complex problems such as developing a Solar Energy Plan for Oklahoma.

   b. NGT appears to be more effective than the traditional

interacting group process in providing informational input into the process of solving complex problems such as developing a Solar Energy Plan for Oklahoma.

If the assumptions are accepted that the participants were capable of making valid comparisons between their previous experiences and NGT; that those previous experiences were primarily face-to-face, interacting group discussions; and that the evaluation questions used in this study made a valid assessment of the participants' opinions, then Conclusion 1b was strongly supported by the results obtained. If those assumptions are not universally acceptable, the value of the study is not lessened significantly because Conclusion 1a still stands well supported by the results. If one completely discards the assumption that the "neutral" response on the evaluation questionnaires represented the response expected for a perception of no difference between NGT and interacting groups, the results on five unidimensional measures, two composite measures, and five global measures of effectiveness remain positive and significantly above the mid-range or average response value. In addition, participant responses to the open-ended questions identified the most positive aspects of NGT to be participation, satisfaction with the process, idea quantity, quality and variety, and task-focus. These aspects were the discussion components that NGT was specifically designed to enhance.

Only one of the major categories of negative comments

pertained to a design characteristic of NGT. That characteristic was NGT's inability to handle widely varying levels of specificity among ideas generated. The remaining aspects of the process identified as most negative were not directed at inherent characteristics of the NGT process; they seemed to be the result of problems with preparation for the workshop, the training of group leaders, project time and resource limitations, and the formulation of topical questions by the project team.

The foregoing conclusions and the research results upon which they are based generally support the research studies cited. With two exceptions, they are in agreement with the Van de Ven study (1974) on measures of satisfaction with the group process, quality of ideas, participation equality, task-focus, and decision quality or overall effectiveness of the process. The exceptions are that this study obtained a significantly different mean on the composite measure of effectiveness than the Van de Ven study and obtained a strong positive correlation between measures of satisfaction and idea quantity where Van de Ven found a weak negative correlation. Both exceptions are suspect since the measures were not replicated exactly.

The results of the present study on decision quality were also in basic agreement with the results found by Gustafson et al. (1973) and Yost and Herbert (Note 3). In all three of these studies, the decision quality or

overall effectiveness of NGT was judged to be significantly better than that of interacting groups.

On the measure of idea quantity, this study was in agreement with the Rotter and Portugal study (1969) and the Van de Ven study (1974). In these studies, NGT was found to generate a significantly greater number of ideas than the number generated by the interacting group process. From the standpoint of idea quantity, the present study is not in agreement with the Green study (1975) which found no significant difference between NGT groups and interacting groups. As was noted in Chapter III, there are methodological problems with the Green study which make comparisons to this study suspect.

The results of this study empirically support the subjective opinions of NGT success reported by Grabbe (Note 1) in Hawaii, Metz (Note 2) in Middletown, Ohio, Medin (1975) in Fond du Lac, Wisconsin, and Voelker (1977) at Oak Ridge National Laboratories. This study also encountered the same problems of inadequate participant preparation (or technical knowledge of the subject) and widely varying levels of specificity among ideas presented, as reported by Grabbe (Note 1), Metz (Note 2), and Voelker (1977).

2. Perceptions of the effectiveness of NGT by participants who had been exposed to NGT before this workshop were significantly lower than the perceptions of those who had not been exposed to NGT.

This conclusion was based on the significant difference in the means of the two groups (one with and one without prior exposure) found on measures of efficiency, idea quality, idea quantity, satisfaction, composite measure of effectiveness, anticipated plan quality, and the comparison of NGT to conferences with small unstructured group discussions. In addition, the difference closely approached significance on the measures of participation and desire to use NGT again. Because the measures in this experiment were only designed to discover whether such a difference existed, no evidence was collected to explain why such differences occurred. One explanation for such differences may be that once a person is exposed to NGT, he or she approaches the next encounter(s) with a more critical frame of mind, judging those successive encounters against previous NGT discussions and not against the interacting group format. In addition, once a person is exposed to NGT, future encounters with the process do not represent the dramatic change in group discussion format that occurs in the first exposure. There also may be some explanation to be found in that once a person is exposed to NGT, he or she will be more sensitive to the limitations of NGT during later encounters with the process. Based upon the results of this study, prior exposure to NGT had a definite negative impact upon the perceptions of effectiveness indicated by the participants.

3. a. Differing occupational backgrounds (government, university, or private) had no significant influence on the perceptions of the participants in this study.

   b. Prior involvement in state or national planning efforts had no significant influence on the perceptions of participants in this study.

In comparing the difference of means for each of the four comparisons involved in Conclusions 3a and 3b, only one instance was discovered where the difference was significant. That instance was the comparison of the means for the university related participants and the privately employed participants on the measure of NGT versus conferences with small unstructured group discussions. On all other unidimensional measures, combined composite measures, and individual global measures of effectiveness, no significant difference of means was identified. The same findings occurred in evaluating the means for the measures comparing NGT to other planning methods and in comparing the pre-workshop responses to the post-workshop responses. The evidence seems to indicate that occupational and prior planning experience characteristics have no significant impact upon the perceptions of participants in relation to the effectiveness of NGT. Conclusions 3a and 3b support the discussions in Delbecq et al. (1975) that NGT could be used effectively in a wide variety of situations where participants have a great diversity of educational, occupational,

and experiential backgrounds.

4. The participants in the workshop perceived NGT to be significantly more effective to generate input into the planning process than would conferences with small unstructured group discussions, commissions or boards with citizen participation, and commissions or boards with planners as members. It was not perceived as significantly more effective than the Delphi Technique.

These conclusions are based on the responses obtained on the post-workshop questionnaire. In three of the four comparisons NGT was rated as significantly more effective than the planning processes specified; but when compared to the Delphi Technique, NGT was not perceived as significantly more effective. This finding is in agreement with the findings of Van de Ven (1974). Before this study, the first three of the four comparisons had apparently not been addressed formally in the literature on NGT. These comparisons had been inferred by studies such as Delbecq et al. (1975), Metz (Note 2), and Medin (1975).

Recommendations

1. Group leaders must be well trained in the mechanics and presentation of NGT if the NGT process is to be effective.

Of all the operational difficulties encountered in this workshop experiment, the training of the group leaders appeared to be the most serious. Based upon the comments

made in the post-workshop questionnaire and to the researcher, the unfamiliarity of the leaders with the NGT process caused time to be wasted in discussion sessions, caused occasional breakdowns in the process structure during discussions, and caused confusion during the ranking/voting procedure for many groups. The Solar Energy Plan Project Team had made the decision to select group leaders on the basis of high status and well known reputations in their respective fields. This selection was done because the team felt that the group leaders should be able to command the respect of the participants in their respective groups. The group leaders in this study were given explanatory material on how to conduct NGT discussions; they also participated in a three hour training session one week prior to the workshop. It was apparent at the close of the workshop that the trade-off between high status group leaders with very limited preparatory time and lower status group leaders with more preparatory training had not been favorable. Many of the operational problems mentioned in the negative comments could have been mitigated by utilizing better trained group leaders. This observation should by no means be construed to cast criticism at the group leaders themselves. These people were busy individuals and had graciously consented to perform as group leaders without additional compensation.

2. In complex problem situations where some participants may lack an adequate level of technical competence in

the specified subject area, some type of education process should be utilized before the NGT conference begins.

On the basis of comments made to the project team during and after the workshop, the researcher is in agreement with the recommendations made by Grabbe (Note 1), Metz (Note 2), and Voelker (1977) that participants should possess an adequate level of technical competence or background knowledge in the subject area for the NGT process to be successful. This recommendation is especially true when the subject under consideration is complex, multi-faceted, and/or highly technical. In the workshop experiment, several comments were made by group leaders and participants that some participants did not possess a sufficient understanding of solar energy to contribute effectively to the group discussion. While accepting a certain level of bias in such comments, the statements probably have some merit. The effectiveness of the workshop may have been improved had some action been taken to educate all participants on the present "state of the art" for solar energy. This educational process could have possibly allowed them to make better judgments on the implications of solar energy development and their particular areas of expertise.

3. In complex problem situations where several levels of factor or idea specificity may be involved, the NGT process should be applied in iterations.

This experiment encountered the same type problems with differing levels of factor specificity as the nuclear power plant siting study of Voelker (1977). The researcher in this study is in full agreement with Voelker that an effective modification to the NGT process in complex problem solving environments is to organize the process around multiple iterations of NGT. Under this arrangement, NGT group(s) would meet initially to identify a broad list of factors, ideas, or problems relevant to the question being considered. Staff personnel supervising the project would analyze this list and reorganize the factors, ideas, or problems into common levels of specificity. The NGT group(s) would then reconvene to consider the reorganized list and to expand the factors identified within each specificity level. The process could be repeated as many times as necessary to achieve the project objectives. This process is essentially the same as the process recommended by Voelker in relation to building complex decision models with several hierarchial levels of factors. The process is also similar to that followed by the city of Fond du Lac, Wisconsin (Medin, 1975) in narrowing an initial list of 428 problems identified by the citizens of that city to a list of thirteen top priority problems that city officials could concentrate on solving.

4. In environments where the primary objective is to gather broad representative input (i.e., citizens'

viewpoints), NGT could be applied via multiple workshops in many locations.

In situations like those described in Fond du Lac, Wisconsin (Medin, 1975) and Middletown, Ohio (Metz, Note 2), representative, reliable citizen input could be gathered by first thoroughly publicizing the issue in question and the information pertinent to that issue, then holding NGT workshops throughout the area involved. These workshops could be held in an open format as they were in the Middletown case or in a closed format. In the open format, the place and time of the NGT meeting would be publicized and people would be assigned to groups of eight to ten members as they arrived at the meeting. Each group would be led by a group leader/recorder trained in the use of NGT. In the closed format, NGT sessions would be conducted for specific groups and organizations such as unions, civic organizations, trade associations, and community organizations. In this instance, the staff personnel supervising the project would either furnish trained NGT leaders or perform the training of members of these organizations to lead NGT sessions. This multiple NGT workshop concept could easily be combined with the use of several iterations of the process to provide a high level of citizen participation in the identification, priority ranking, and suggestion of solutions for public policy issues at the neighborhood, city, metropolitan, and state levels of government. The process would fit easily

into a program such as the Goals for Dallas Project which began in 1966 and continues to the present (Goals for Dallas, 1977).

5. Mechanically, the NGT process could be improved by having the participants write their ideas on strips of paper, one idea per strip. During the idea presentation phase, the participants would read the idea they had selected and pass the strip of paper to the recorder who would tape it to a flip chart.

This suggestion would eliminate one of the structural problems of NGT; namely that of forcing all participants to wait and remain silent while each group member presents his or her idea and the recorder writes the idea on a flip chart or blackboard. The difficulty arises in maintaining the interest and attention of all group members as this rather slow process proceeds. This problem was discussed by Delbecq et al. (1975) and was also encountered in this study. This modification should cut the time delay in this transposition process. In a situation where the appropriate facilities were available, this process might be further enhanced by having group members electronically transfer their ideas onto a screen(s) in front of the group.

Directions for Future Research

1. The variation in perceptions in relation to differences in prior exposure to NGT should be investigated further.

The present study has only identified that such a variation occurred. The next step is for research experiments to be designed to test for reasons why this variation was found. The answer to this question has important implications for the continued use of NGT. If the perceptions of the effectiveness of NGT diminish after initial exposure to the process, then perhaps the high success ratings achieved by NGT in this study and the other studies discussed in Chapter III were more attributable to the novelty of the process than to actual substantive differences from other group problem solving processes. On the other hand, the explanation may be that participants still perceive NGT to be highly effective but that they become less tolerant of its limitations as they experience continued use of the process. Another possibility is that this finding was peculiar to this workshop experiment and might not be replicated. Whatever the eventual explanation may be, the question obviously requires further research beyond that which presently exists.

2. An empirical field test should be conducted on a level comparable to this workshop experiment in state government planning, incorporating direct comparisons between NGT groups, interacting groups, and Delphi respondents on identical measures.

Because of the limitations of time, money, and resources, this experiment could only evaluate the effectiveness

of NGT in comparison to assumed or hypothetical response means. Therefore, any comparison between the results found in this study and those which might have been found for interacting groups in the same situation are weakened since no evidence is available to support the assumed interacting group responses. The suggested empirical research design should follow that of the Van de Ven study (1974) with appropriate modifications to test the additional findings obtained in this study.

3. An empirical field test should be conducted on a level comparable to this experiment in state government planning, incorporating multiple iterations of the NGT process.

This field test should follow the suggestions made by Voelker (1977) and the researcher in this study in designing and evaluating an experiment utilizing several iterations of NGT. The research could address the solution of a complex problem or the development of a decision model with hierarchial levels of factor specificity. The test should be constructed to evaluate the overall effectiveness of NGT and any variation in perceptions of effectiveness across different characteristics of the participants involved. The research might also be structured to compare different group problem solving methods on identical measures when addressing the same problem.

4. The unexplained low correlations between idea quantity and participation, participation and sense of accomplishment,

sense of accomplishment and efficiency, participation and anticipated plan quality, and anticipated plan quality and sense of accomplishment should be investigated further.

The measures utilized in this study were capable of identifying the above correlations, but they were not capable of providing any evidence as to why such relationships existed. At this point, a question exists as to whether these correlations would be repeated in an experiment similar to this study. If they are replicated, then evidence should be provided to answer the question "why?" such correlations exist since they do not conform to intuitive logic.

5. The application of electronic methods to NGT should be investigated.

The application of present "state of the art" electronics to NGT represents an area of possible refinement which has remained relatively untouched. One of the major drawbacks to NGT is that the group members must meet in a face-to-face environment. Yet to be determined are the possible effects of using NGT in a situation where participants are geographically separated and conduct the NGT session via talkback television, cable television, telephone conference calls, or interactive computer terminals. This process could have vast potential impact both in terms of bringing together experts from many specialty areas and/or

gathering broad samples of citizen input on various public issues. The feasibility of such a process is considerably enhanced by the continuing developments in micro-miniaturization which are occurring in the world of computers and related hardware components.

Summary

This study has answered affirmatively the question of whether the participants would perceive NGT to be an effective mechanism to provide informational input into the process of solving a complex problem such as developing a Solar Energy Plan for Oklahoma. In reaching this conclusion, this study generally supports the findings made by earlier researchers (Chung & Ferris, 1971; Delbecq et al., 1975; Grabbe, Note 1; Gustafson et al., 1973; Knippen & Van Voorhis, 1974; Medin, 1975; Metz, Note 2; Mosley & Green, 1974; Rotter & Portugal, 1969; Van de Ven, 1974; Voelker, 1977; Yost & Herbert, Note 3). One of the major contributions of this study has been the discovery that perceptions of NGT effectiveness by participants with prior exposure to NGT were significantly lower than the perceptions of those without prior exposure to the process.

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APPENDIX I

Summary of

PROPOSAL TO DEVELOP A SOLAR ENERGY PLAN FOR OKLAHOMA

Submitted to

The Energy Research and Development Administration

Washington, D.C.

By

The University of Tulsa

The University of Oklahoma

Oklahoma State University

June, 1977

STATE SOLAR ENERGY PLAN

Introduction

The recognized crisis in the management of our energy resources has created an urgent need for each state to have a centralized coordination of each state's energy and conservation activities. Each state must move rapidly to not only manage effectively its indigenous energy resources to help meet its future energy needs, but to effectively interact with each other to provide a coordinated management of the nation's energy resources.

It is extremely urgent that major activities in alternate energy sources such as solar, be included in state planning now if Oklahoma is to avoid a major decline in revenue along with the depletion of its fossil fuels. Recognizing this, the State Department of Energy plans to develop and implement a state Solar Energy Plan. This effort will be integrated into the Department's overall Energy and Conservation Programs.

The Department will be assisted in developing the Solar Energy Plan by the three major universities in Oklahoma who have many years of experience in Solar Energy Research and Development.

The Plan

The State of Oklahoma is in total agreement with ERDA

in that there is an urgent need for each state to have a viable plan to implement the utilization of solar energy as rapidly as possible. Ultimately, ERDA's aim to have acceptance of solarization and the creation of a viable solar energy industry will come about when a majority of the states actually implement a plan. Oklahoma fully supports this need for effective solar energy technology transfer to the private sector and recognizes that the key to accomplishing this is effective communications. To provide this effective communication, Oklahoma's plan will emphasize the acquisition, assimilation and dissemination of solar oriented data/information.

To provide a more effective Solar Energy Plan we propose to conduct a "Goal Setting/Prioritizing Workshop" aimed at involving as many resource experts in the shortest period of time with a minimum of expense. The approach to the workshop will follow a structured pattern called the "Nominal Group Process" developed by Dr. Andre Delbecq of the University of Wisconsin. The workshop participants will be selected primarily from Oklahoma and will be knowledgeable about the subject areas considered. Tentatively, these subject areas include Planning Methodology, Legal and Public Policy, Consumer/Producer Impacts, Information/ Technology Transfer, Demonstration Program, and R & D Program. The end result will in effect be an assessment of Oklahoma's Solar Energy situation with priorities and approaches to the problems established to develop a viable

state plan.

The workshop outputs will be assimilated and evaluated by the Project Team. The results will then be the basis for the plan development. To accomplish the technology transfer, the plan will call for Oklahoma to establish a unified approach to solar data/information collection and dissemination. The plan will call for a demonstration program to be coordinated with the orderly establishment of a solar-related industry to manufacture and maintain components and systems utilizing direct solar energy. This will be an integrated effort to at least initially help produce standards and evaluation tests, and procedures that will result in acceptable performance criteria and standards. The Plan will call for the State to develop public education and R & D programs through full utilization of Oklahoma resources and capabilities.

The Plan's primary objective will be to implement a Solar Energy Program that will focus on analysis and possible solutions of problems associated with effective use and management of the State's solar resources in terms of environment, people, facilities and the development of immediate, intermediate and long range goals. Ideally the plan will serve as a model that other states could modify and use in terms of their specific needs. In other words, one of the products of developing the Oklahoma Plan will be a generalized approach any state could use simply by inputing

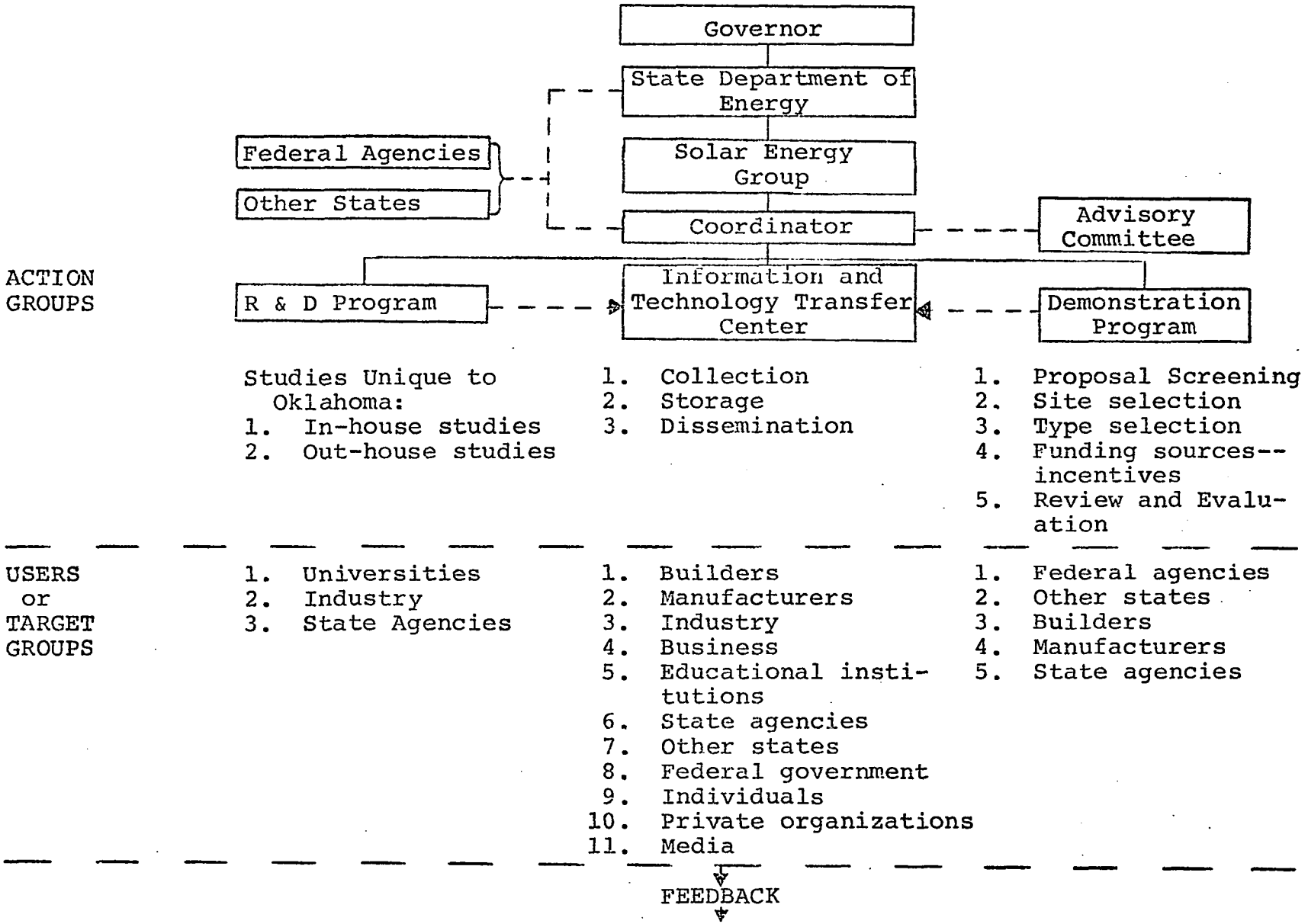


Figure 1. Proposed State of Oklahoma solar energy program.

the constraints and other variables imposed by the particular state.

The proposed structure and responsibilities of the State's Solar Energy Organization are shown in Figure 1.

The Task Force Planning Group includes representatives from Oklahoma's three major universities. Professor Bruce V. Ketcham, State Coordinator for Solar Energy (Director of Solar Projects, Tulsa University), is assisted by Mr. Ralph C. Martin (Director, Program Development, University of Oklahoma), and Dr. Jerald D. Parker (Associate Director, Engineering Energy Laboratory, Oklahoma State University). Professor Ketcham will be responsible for the overall direction of the proposed planning effort. The Planning Group will draw upon the resources from their respective institutions as well as from the State Department of Energy.

The highly important Advisory Group will be formed immediately in order to provide the best possible input to the Planning Group prior to actual development of the Plan. In addition, their counsel will be essential for the implementation of the Plan. The Group will be comprised of representatives from all the user and target groups and will provide many of the workshop participants. They will assist in the form of an overall advisory capacity with special committees formed for each functional activity.

Implementation

Until an actual plan is devised, it is difficult to

address the implementation phase or phases. However, some of the implementation will of necessity take place concurrent with development of the Solar Energy Plan. For example the State Coordinator of Solar Energy has been appointed along with his Task Group. Mechanisms for effective liaison with the Federal Agencies as well as with the various user and target groups will actually be developed as the plan is being developed.

The State Plan will recommend an Implementation Approach. However, it is envisioned that there will be at least two, possibly three approaches but they cannot be speculated upon at this time.

APPENDIX II

WORKSHOP OBJECTIVES

I. Plan Development
   1. Provide information to develop effective plan
   2. Identify specific information sources
   3. Develop definitive planning framework
   4. Approach to developing plan
   5. A detailed structure of the plan
   6. Realistic appraisal of accomplishing project goals (problems; limitations; etc.)

II. Multidisciplinary Group as Workshop Participants
   1. Get as many brains together at one time as possible
   2. Get as broad a group as possible to provide assistance
   3. Involve representatives of state, university, manufacturers, consumers, etc.

III. Subject Areas of Plan
   1. Accumulate list of concerns resulting from application of solar energy
   2. Help define major needs in growth and development of solar energy in Oklahoma
   3. Understanding of Oklahoma's solar energy environment with priorities and needs of the plan.
   4. Identify specific areas the plan should address

IV. Suggest Solutions to Problems Generated by Use of Solar Energy

V. Increase Interest and Involvement in Solar Energy

1. Obtain group of concerned citizens (from workshop, etc.) that will participate in future activities
2. Establish interest in solar energy in state government and the general public
3. Get publicity (visibility)

VI. Identify Technology Transfer Device(s)

APPENDIX III

GROUP I

QUESTION--SESSION 1

Group 1. Identify the goals and objectives of a State Solar Energy Plan and rank them in order of importance (priority) according to short term, intermediate term, and long term categories. The group will receive a summary list of the goals and objectives submitted via the Pre-Workshop Questionnaires.

QUESTION--SESSION 2

Group 1. Identify the MAJOR elements or components that should be included in the structure of the State Solar Energy Plan. (If appropriate, give specific examples, critical incidents, information sources, potential resources, etc.)

QUESTION--SESSION 3

Group 1. Identify the SUB-ELEMENTS or SUB-COMPONENTS within each major category of the structure of the State Solar Energy Plan. Identify those specific areas which should be addressed in the assessment of the Oklahoma energy situation/environment. (If appropriate, give specific examples, critical incidents, information sources, potential resources, etc.)

GROUPS II-VI

(QUESTIONS FOR ALL GROUPS IDENTICAL)

QUESTION--SESSION 1

What goals and objectives should a State Solar Energy Plan address in relation to Topical Subject Area? Specify your responses according to short term, intermediate term, or long term categories. (If appropriate, give specific examples, critical incidents, descriptions of behavior, information sources, existing resources, potential resources, etc.)

QUESTION--SESSION 2

What problems (critical problem dimensions) can you identify in relation to developing and/or implementing a State Solar Energy Plan with regards to Topical Subject Area? Be specific. (If appropriate, give specific examples, critical incidents, descriptions of behavior, information sources, existing resources, potential resources, etc.)

QUESTION--SESSION 3

What solutions (solution components), including implementing devices, would you propose to aid in developing and implementing a State Solar Energy Plan with regards to Topical Subject Area? Be specific. (If appropriate, give specific examples, critical incidents, descriptions of behavior, potential resources, etc.)

APPENDIX IV

PRE-WORKSHOP EVALUATION

1. How many unique ideas do you anticipate that the Workshop Format (which has just been explained) will generate compared to group discussion situations you have experienced prior to this Workshop? (Circle One)

a. many more ideas	b. few more ideas	c. about the same ideas	d. few less ideas	e. many less ideas

2. How much participation (each group member entering their ideas into the discussion) do you anticipate that this format will foster compared to group discussion situations you have experienced prior to this Workshop? (Circle One)

a. much less participation	b. little less participation	c. the same participation	d. little more participation	e. much more participation

3. How efficient (amount of information generated for the time and effort expended) do you anticipate that this format will be in selecting goals, identifying problems, and generating ideas compared to alternative planning methods you have used or seen used before this Workshop? (Circle One).

a. much more efficient	b. little more efficient	c. equally as efficient	d. little less efficient	e. much less efficient

4. How would you expect the quality of the Oklahoma Solar Energy Plan (developed using the format just explained) to compare with the quality of the same plan if it was developed using alternative planning methods with which you are familiar?

a. much lower quality	b. little lower quality	c. the same quality	d. little higher quality	e. much higher quality

5. Have you been directly involved with the development of state or national plans prior to attending this Workshop? (Circle One)

a. Yes b. No

6. You consider yourself to be most closely associated with which of the following groups or institutions? (Circle One)

a. State Government b. Federal Government c. University d. Private Enterprise

e. Other_____ (Please Specify)

7. Do you presently perform most of your work-related activities in Oklahoma? (Circle One)

a. Yes b. No

8. Were you acquainted with this process (The "Nominal Group Technique") before attending this Workshop? (Circle One)

a. Yes b. No

9. Name (Optional)_____

Note: Your name and responses will be kept strictly confidential. Our reason for requesting your name is to allow the comparison of your responses about the Workshop Format at various stages of the planning process.

APPENDIX V

POST-WORKSHOP EVALUATION

PART I

1. In your judgment, what were the most important positive aspects of this specific Workshop format?

2. In your judgment, what were the most important negative aspects of this Workshop format?

3. How many unique ideas did the Workshop format generate compared to group discussion situations you have experienced prior to this Workshop? (Circle One)

   a. many ideas b. few ideas c. about the same ideas d. few less ideas e. many less ideas

4. How would you rate the quality of the ideas selected by your group in this Workshop? (Circle One)

   a. Excellent b. Good c. Average d. Fair e. Poor

5. How much participation (each group member entering his/her ideas into the discussion) did this kind of process foster compared to group discussion situations you have experienced prior to this Workshop? (Circle One)

   a. much less participation b. little less participation c. the same participation d. little more participation e. much more participation

6. How efficient (amount of information generated for the time and effort expended) was this workshop format in selecting goals, identifying problems, and generating ideas compared to alternative planning methods you have used or seen used before this Workshop? (Circle One)

a. much more efficient	b. little more efficient	c. equally as efficient	d. little less efficient	e. much less efficient

7. How would you expect the quality of the Oklahoma Solar Energy Plan (developed using this Workshop format) to compare with the quality of the same plan if it was developed using alternative planning methods with which you are familiar? (Circle One)

a. much lower quality	b. little lower quality	c. the same quality	d. little higher quality	e. much higher quality

8. As a tool to generate input into the planning process, how would you rate this Workshop format compared to the following methods:

   a. Conference with small unstructured group discussion sessions

      1) better 2) the same 3) worse 4) don't know

   b. Commission or board composed of business/government officials with citizen participation

      1) better 2) the same 3) worse 4) don't know

c. Commission or board with business/government officials and professional planners as members (no citizen participation)

1) better 2) the same 3) worse 4) don't know

d. Delphi Technique

1) better 2) the same 3) worse 4) don't know

9. As a participant in this Workshop, how much of a sense of accomplishment do you feel in relation to your efforts today? (Circle One)

a. very much b. much c. some d. very little e. none

10. If you were in charge of a major planning effort at this level, would you use this particular Workshop process? (Circle One)

a. Yes b. Not Sure c. No

11. Name (Optional)_____

Note: If you placed your name on the Pre-Workshop Questionnaire and this Questionnaire, you may disregard questions 12-15. Your name and responses will be kept strictly confidential. We need your name or the responses to questions 12-15 to make a valid evaluation of this Workshop format.

12. Have you been directly involved in the development of state or national plans prior to attending this Workshop? (Circle One)

a. Yes b. No

13. You consider yourself to be most closely associated with which of the following groups or institutions? (Circle One)

a. State Government b. Federal Government c. University d. Private Enterprise

e. Other_____(Please Specify)

14. Do you presently perform most of your work related activities in Oklahoma? (Circle One)

a. Yes b. No

15. Were you acquainted with this process (The "Nominal Group Technique") before attending this Workshop? (Circle One)

a. Yes b. No

PART II

Please write down any comments or suggestions (e.g., information sources, existing/potential resources, reactions, etc.) which would aid in the expeditious development of a high quality, effective Oklahoma Solar Energy Plan.

APPENDIX VI

WORKSHOP FORMAT

I. All participants will be assigned to work groups of 5-9 members. (See Participant List)

II. There will be three work sessions and during each session, each group will consider one major question relating to solar energy. (See Schedule and Sample Questions)

III. The group leader will ask each member to silently write brief responses to the question for 10-15 minutes.

IV. The leader will then proceed sequentially around the table asking each member to read one of his/her responses. The responses will be written on flip-charts in front of the group. The round-robin sequence will continue until all responses have been presented.

V. A discussion period will follow in which each response is examined in sequential order to clarify and to present arguments for or against that particular response.

IV. After the discussion, each group member will individually select the five most important responses and then prioritize their selections. Their votes will then be combined with the votes of the other

group members to arrive at an overall group ranking of the responses.

APPENDIX VII

WORKSHOP SCHEDULE

July 26, 1977

OKLAHOMA STATE CAPITOL BUILDING

I. (8:30-8:55) INTRODUCTION (Senate Chamber)

A. Objectives of Workshop and Plan (Professor Bruce Ketcham)

B. Structure of Workshop (Mr. Blair Stephenson)

II. (8:55-9:00) WORK SESSIONS

A. (8:55-9:00) Move to Group Rooms (Rooms 533A, 533B, 419A, 419B, 419C)

B. (9:00-10:30) First Work Session

C. (10:30-10:50) Break

D. (10:50-12:15) Second Work Session

III. (12:15-1:30) LUNCH (Capitol Cafeteria--Basement)

IV. (1:30-3:00) THIRD WORK SESSION

V. (3:15-4:30) GENERAL SESSION (Senate Chamber)

A. Presentation of Results

1. Group I--Mr. Charles Hill
2. Group II--Dr. Earl Sneed
3. Group III--Dr. John Bills
4. Group IV--Dr. B. G. Schumacher
5. Group V--Mr. Alan Lower
6. Group VI--Dr. Jerald Parker

B. General Discussion (Dr. Parker)

C. Closing Remarks and Workshop Evaluation (Dr. Parker)

VI. (5:30-7:00) INFORMAL DISCUSSIONS (Sheraton Century Center Hotel, Green Country Room)

VII. (7:00-9:30) DINNER MEETING (Sheraton Century Center Hotel, Green Country Room)

A. Comments (Professor Bruce Ketcham)

B. Comments (Dr. Frederick Koomanoff, Dr. Eugene Frankel, Program Manager, ERDA)

C. Summary of Workshop Results and Followup (Mr. Ralph Martin)

APPENDIX VIII

POST-WORKSHOP EVALUATION

Positive Comments

A. Participation (Equal, Balanced, Wide and Representative Input, Maximum Feasible Participation)

1. Participation by everyone--no dominance by anyone, i.e., equal opportunity to express
2. It encouraged, almost required, every participant to come up with ideas, to take part
3. Everyone was able to present all his ideas and to have them discussed
4. The opportunity to have input from each participant plus the evaluation of each input by the entire group
5. Participation on an equal basis by the full group
6. Equalized participation among workshop members
7. Provide an equalization of input by all participants
8. More participation from everyone
9. Giving each individual a chance to express all his views and ideas
10. Chance for participation by each individual
11. Enhanced interaction and participation by all group members
12. Everyone in our committee participated and was successful in expressing his or her ideas. Format was good.

13. It did draw everyone into the discussions
14. All involved had adequate chance for input
15. The format forces a reaction and comment from each participant
16. Everyone must participate
17. Forced participation
18. Forced interaction and direction
19. Insured that each person contributed input to the session
20. Forced participation from all attending
21. Maximum participation by all members
22. It did get everyone involved

B. Participation (Shared Expertise) and Significance of Individual Input

1. Breadth of expertise and experience represented by participants; also the breadth of perspectives
2. Gathering together of expertise
3. Contact among people who are themselves resources
4. Brain-trust; democratic idea sharing without excessive ego interference
5. The variety of interests available to provide input
6. A comparison of the perceptions of diverse interests (by comparing outputs of various sessions)
7. The getting together of men and women of diversified backgrounds for the purpose of addressing a common public concern

8. The opportunity for me (and hopefully, others) to hear views and opinions from a cross-section of interested and knowledgeable people
9. Exposure to the viewpoint of others
10. Small group

C. Participation (Minimize Influence of Dominant Individuals)

1. No one dominated; no parliamentary problems; friendly atmosphere
2. Control, somewhat, dominance by one individual
3. The process should reflect more of a combined concensus of the appropriate people than other methods. This does not say it is of higher quality (The Plan).

D. Satisfaction (Sense of Accomplishment or Task Closure, Pooling of Judgement)

1. Sense that something was accomplished
2. A platform was reached
3. It produced some results
4. Something is being done
5. Statement of operational objectives
6. Positive information available for a program
7. Arriving at voluntary, participatory concensus
8. Interchange ideas
9. It provided a forum for developing some individual thoughts
10. It makes you think

E. Creativity (Quantity, Quality, Variety of Ideas)

1. Development of multiplicity of ideas
2. Generation of a large volume of ideas
3. Development of shopping lists
4. Provided a shopping list to aid in preparation of the Plan
5. The large number of ideas that could be introduced in a short time
6. The range of ideas related to a single question
7. The quality of contributions was high; possibly a reflection of the group, as well as the method
8. Many good ideas surfaced--discussion time was limited but in general it was pretty good
9. Collection of ideas

F. Task-Focus (Problem Solving vs Social Orientation)

1. It provided an orderly way of sifting these ideas, selecting the most promising. A very productive approach.
2. Structured the discussion
3. Maintained structured program and schedule
4. A more structured way of developing ideas
5. Limiting of unimportant discussion (B.S.)
6. The methodology employed

G. Efficiency (Accomplishments in Specific Period of Time)

1. The process was a very efficient procedure to accumulate several ideas from different people

participating in the workshop

2. Got consensus on specific recommendations quickly
3. It promotes a great savings in time
4. It was time saving

H. Group Leader

1. The process is less dependent upon a good leader although we did have a good one (Technology Transfer)
2. Group leader has a definite role in the success of this format

I. Pre-Planning

1. Pre-planning

Negative Comments

A. Time (Too Little, Too Much, Inefficient Use of Time)

1. Attempts too much in too little time
2. Not enough time for idea clarification or to complete ideas expressed
3. Not enough time allowed to thoroughly discuss each idea presented
4. After the initial list of ideas was developed, there should have been a much longer and unstructured time allocated to combining, summarizing, and catagorizing the ideas
5. Not enough time to discuss
6. Did not allow enough time to discuss recommendations
7. Shortage of time to enforce coherence among somewhat similar and related concepts and ideas

8. Too many topical ideas permitted less time for discussion of ideas on their own merits
9. Not enough time for re-cap and reevaluation of the top 5 ideas. It took all our time to achieve them but not enough time to expand them.
10. There was not adequate time for detailed information to be gathered--it all ended up being a bit general in nature.
11. Perhaps all three sessions could have been held during the morning.
12. The sessions (workshop) were too long--90 minutes, three times is a long time to sit and discuss even though the format provides for equal time.

B. Ranking/Voting Procedure

1. Although a list was made of goals, problems, and solutions, there is no real concensus, or minority opinion that can be called. However, if all the groups are looked at, the same kinds of questions occurred in most of them.
2. Frustration over the fact that the recording and voting method did not allow us to consider alternative processes. Individuals tended to contribute steps of a particular planning process or epistemology, instead of alternate ways to plan. Therefore the vote was on items or steps within the planning process which had been recorded and the results

made little sense.

3. The priority list of the long list gave you apples and oranges.
4. Inability to tie together the loose ends, i.e., many disconnected ideas not well integrated.
5. Lists of ideas at different levels of abstraction and much overlap of thought.
6. The voting tended to treat the ideas presented in an artificial manner. The time could have been better spent in consolidating and rephrasing the presented ideas.
7. Doubtful logic in selecting five "most important" problems and solutions
8. Difficult to place many aspects in priority as required

C. Topic Questions

1. Questions were not clear and well defined
2. Depended too much on the phraseology of the questions posed. No one present could clarify them sufficiently. No distinction in questions between qualitative differences of means and ends. Some of us think in processes not nouns.
3. Questions should be stated in more detail
4. The subjects (at least for planning and methodology) were too broad for "delphi"
5. The sensitivity of the process to the question statement

6. No opportunity for the group to first define the question so it was mutually understood with limits involved and so it was agreed to be the most important question relative to the class (group?)
7. Lack of clarity as to whether objectives identified in Session I should form the basis for problems and solutions discussed in Sessions II and III

D. Inadequate Perspective (Preparation, Overview, Information)

1. Inadequate preparation through handout materials; examples of goals, objectives, problems, solutions
2. Needed a little more overview discussion at the beginning:
   --overall approach (the plan)
   --background
   --rationale
3. Too much unknown about workshop needs
4. The process depends on the level of knowledge by participants
5. A person's creative thinking is limited by the familiarity of that subject area to the person
6. Since we looked at each question or topic separately, we did not get the BIG picture, i.e., goals-problems-solutions (our fault)

E. Discussion

1. Definition of ideas and focusing of ideas--there was definite improvement on this at the last session.

2. Does not provide for input of background and reasoning
3. Did not allow for development, refinement, or amplification of ideas. Superficial recommendations were often voted on without modification.
4. Lack of weight given to comments by some method
5. Occasionally, the significance of a point was lost amidst the editing and summarization

F. Structural Complaints

1. Lack of flexibility (however this is solvable)
2. Not being able to participate in all discussion groups
3. Not enough mingling with those from other disciplines, the last group session (mass) could have been used for some kind of final concensus on the few top suggestions or could have had a moderator identify three of the single most important goals, etc.
4. Spontaneity and positive feedback associated with dynamic leadership were missing
5. Discussions could still be dominated by strong individuals

G. Inappropriate Application of NGT

1. This format was not as effective in resolving solar energy issues as it would be resolving range rights between cattlemen and sheepmen after a long

history of range wars. It is a good technique for reconciling ideas but not creating them.

2. We started at the wrong stage of plan development. We were left with the feeling that we had simply re-supplied broad approach ideas such as must surely have already been contemplated. In that sense, there was a feeling of being used in order to report to the granting authority that there was broad citizen input, even though our contribution is likely to have only minimal impact on such a Plan as may be adopted. We needed to start with at least the outline of a tentative plan and spend our time evaluating, refining, and adding to the same.
3. Cost

H. Group Output

1. Duplication could be considered negative
2. Redundant information coming out
3. Most conclusions were too general--however that would be expected from any program having this role.

I. Participant Problems

1. People side tracked the questions
2. Appeared to be some difficulty in groups confining ideas and discussion to their assigned area, however this can be handled editorially by the project group
3. Some participants had a little trouble clarifying

their ideas in a summary way; even shifted from one theme to another in mid-sentence. In some cases, I felt this summary statement roughly approximated what was originally suggested. This was generally the fault of the speaker--not a serious flaw--because in general the ideas were clear and good.

J. Pre-Planning Deficiencies

1. Leaders were not experienced
2. Much time spent in deciding how to do tasks since process is not familiar
3. Lack of variety of backgrounds in the session on R & D

APPENDIX IX

Table 10

Response Variation on Control Measures

Control Measures	N	Partici-pation	N	Effi-ciency	N	Idea quality	N	Accom-plishment	N	Idea quantity	N	Satisfac-tion	N	Composite measure	N	Plan quality	N	Use NGT again
1. Prior exposure to NGT																		
Yes (mean)	13	3.538	13	3.077	13	3.385	13	3.231	13	3.231	13	16.462	13	26.154	12	3.000	13	2.231
No (mean)	30	4.233	30	4.267	30	4.133	30	3.567	30	4.100	30	20.300	30	32.600	29	3.586	30	2.667
Range		.035 to -1.425		-.628 to -1.752*		-.297 to -1.199*		.272 to -.944		-.325 to -1.413*		-1.788 to -5.888*		-2.995 to -9.897*		-.052 to -1.120*		.020 to -.892
2. Occupational category: Government-University																		
(mean)	12	4.250	12	3.750	12	3.833	12	3.417	12	3.667	12	18.917	12	29.917	11	3.364	12	2.417
(mean)	15	4.000	15	3.933	15	3.867	15	3.333	15	3.800	15	18.933	15	30.333	14	3.429	15	2.533
Range		1.068 to -.568		.679 to -1.045		.550 to -.618		.686 to -.519		.563 to -.830		2.662 to -2.695		4.126 to -4.958		.585 to -.715		.494 to -.727

Table 10--Continued

Control Measures	N	Partici-pation	N	Effi-ciency	N	Idea quality	N	Accom-plishment	N	Idea quantity	N	Satisfac-tion	N	Composite measure	N	Plan quality	N	Use NGT again
Government-Private																		
(mean)	12	4.250	12	3.750	12	3.833	12	3.417	12	3.667	12	18.917	12	29.917	11	3.364	12	2.417
(mean)	16	3.875	16	4.000	16	4.000	16	3.625	16	4.000	16	19.500	16	31.500	16	3.438	16	2.625
Range		1.299 to -.549		.539 to -1.039		.480 to -.814		.587 to -1.003		.412 to -1.078		2.414 to -3.581		3.389 to -6.556		.623 to -.771		.340 to -.756
University-Private																		
(mean)	15	4.000	15	3.933	15	3.867	15	3.333	15	3.800	15	18.933	15	30.333	14	3.429	15	2.533
(mean)	16	3.875	16	4.000	16	4.000	16	3.625	16	4.000	16	19.500	16	31.500	16	3.438	16	2.625
Range		1.007 to -.757		.641 to -.775		.408 to -.674		.418 to -1.002		.474 to -.874		2.047 to -3.181		3.221 to -5.561		.581 to -.599		.409 to -.593
3. Prior planning experience:																		
Yes (mean)	22	4.045	22	3.818	22	3.955	22	3.591	22	3.818	22	19.227	22	30.682	21	3.381	22	2.500
No (mean)	21	4.000	21	4.000	21	3.857	21	3.333	21	3.857	21	19.048	21	30.619	20	3.450	21	2.571
Range		.745 to -.655		.436 to -.800		.564 to -.369		.819 to -.303		.521 to -.599		2.366 to -2.008		3.744 to -3.618		.446 to -.584		.366 to -.508

*Indicates a significant difference in means at the 0.95 level using the t test.

Table 10--Continued

Control Measures	N	Conferences-unstructured	N	Commissions with citizens	N	Commissions with planners	N	Delphi technique	Pre-Test/Post Test N	Quantity	N	Partici-pation	N	Effi-ciency	N	Plan quality
1. Prior exposure to NGT:																
Yes (mean)	12	3.167	12	3.750	12	3.167	8	3.000	12	-.083	12	-.250	12	.167	11	0.000
No (mean)	28	3.679	24	3.625	26	3.423	14	3.214	30	.300	30	.067	30	.367	28	.036
Range		-.034 to -.990*		.616 to -.366		.345 to -.858		.513 to -.941		.165 to -.931		.571 to -1.205		.404 to -.804		.665 to -.737
2. Occupational category:																
Government-University																
(mean)	10	3.400	8	3.250	10	3.500	5	3.000	11	.000	11	-.091	11	.091	9	-.222
(mean)	15	3.267	13	3.846	14	3.357	11	3.273	15	.133	15	-.333	15	.400	14	.071
Range		.823 to -.556		.058 to -1.250		.869 to -.583		.714 to -1.260		.610 to -.876		.726 to -1.174		.371 to -.989		1.031 to -.445

Table 10--Continued

Control Measures	N	Conferences-unstructured	N	Commissions with citizens	N	Commissions with planners	N	Delphi Technique	Pre-Test/Post Test N	Quantity	N	Participation	N	Efficiency	N	Plan quality
Government-Private																
(mean)	10	3.400	8	3.250	10	3.500	5	3.000	11	.000	11	-.091	11	.091	9	-.222
(mean)	15	3.867	15	3.733	14	3.214	6	3.000	16	.375	16	.313	16	.375	16	.125
Range		.035 to -.988		.159 to -1.125		.992 to -.420		1.118 to -1.118		.265 to -1.015		.569 to -1.376		.388 to -1.006		.521 to -1.215
University-Private																
(mean)	15	3.267	13	3.846	14	3.357	11	3.273	15	.133	15	-.333	15	.400	14	.071
(mean)	15	3.867	15	3.733	14	3.214	6	3.000	16	.375	16	.313	16	.375	16	.125
Range		-.138 to -1.620*		.562 to -.336		.851 to -.565		1.071 to -.526		.295 to -.779		.401 to -1.692		.712 to -.662		.731 to -.838
3. Prior planning experience:																
Yes (mean)	20	3.500	19	3.579	20	3.450	15	3.133	21	.094	21	-.095	21	.238	19	-.105
No (mean)	20	3.550	17	3.765	18	3.222	7	3.143	21	.286	21	.048	21	.381	20	.150
Range		.414 to -.514		.275 to -.647		.791 to -.331		.748 to -.767		.313 to -.694		.663 to -.948		.404 to -.690		.370 to -.881

*Indicates a significant difference in means at the 0.95 level using the t test.