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# GROUP PLANNING AND PROBLEM-SOLVING METHODS IN ENGINEERING MANAGEMENT

Edited by  
SHIRLEY A. OLSEN  
Ohio State University



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## CONTRIBUTORS

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Dr. Charles Burnette

*Charles Burnette & Associates  
234 South Third Street  
Philadelphia, Pennsylvania*

Dr. André Delbecq

*Graduate School of Business  
University of Santa Clara  
Santa Clara, California*

Mr. Paul Fitzgerald

*Consulting International Associates  
1108 Main Street  
Wakefield, Rhode Island*

Ms. Sandra Gill

*868 College Avenue  
Santa Clara, California*

Dr. Donald P. Grant

*Architecture Department  
California Polytechnic State University  
San Luis Obispo, California*

Dr. Julius Kane

*P. O. Box 100  
Bellingham, Washington*

Dr. Harold Linstone

*Director, Futures Research Institute  
Portland State University  
Portland, Oregon*

Ms. Shirley A. Olsen

*Associate Professor  
Department of Industrial Design  
The Ohio State University  
Columbus, Ohio*

Mr. George M. Prince

*Synectics, Inc.  
26 Church Street  
Cambridge, Massachusetts*

Dr. Tudor Rickards

*The INCA Research Programme  
Manchester Business School  
Manchester, England*

Dr. Thomas J. Snodgrass

*Department of Engineering  
University of Wisconsin  
Madison, Wisconsin*

Dr. John N. Warfield

*P. O. Box 6189  
Charlottesville, Virginia*

Dr. Bernadine Young

*Division of Academic Scheduling  
University of Massachusetts  
Amherst, Massachusetts*

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## SERIES PREFACE

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Industry observers agree that most construction practitioners do not fully exploit the state of the art. We concur in this general observation. Further, we have acted by directing this series of works on Construction Management and Engineering to the continuing education and reference needs of today's practitioners.

Our design is inspired by the burgeoning technologies of systems engineering, modern management, information systems, and industrial engineering. We believe that the latest developments in these areas will serve to close the state of the art gap if they are astutely considered by management and knowledgeably applied in operations with personnel, equipment, and materials.

When considering the pressures and constraints of the world economic environment, we recognize an increasing trend toward large-scale operations and greater complexity in the construction product. To improve productivity and maintain acceptable performance standards, today's construction practitioner must broaden his concept of innovation and seek to achieve excellence through knowledgeable utilization of the resources. Therefore our focus is on skills and disciplines that support productivity, quality, and optimization in all aspects of the total facility acquisition process and at all levels of the management hierarchy.

We distinctly believe our perspective to be aligned with current trends and changes that portend the future of the construction industry. The books in this series should serve particularly well as textbooks at the graduate and senior undergraduate levels in a university construction curriculum or continuing education program.

JOHN F. PEEL BRAHTZ

*La Jolla, California  
February 1977*



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# PREFACE

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This book is about methods and strategies that may be useful in team planning and problem-solving. It is directed to students, educators, and practicing professionals involved in policy making, planning, and problem-solving who see the need for a more cooperative attitude and participatory approach to designing. Such an approach incorporates the knowledge, values, and experiences of those parties affected by the outcome of a problem solution and those responsible for its implementation. This is an emergent attitude that has grown out of a dissatisfaction with mechanistic models and purely quantitative methods, which have been unsuccessful in dealing with social issues, product systems, communications, and environments having far-reaching effects on large segments of society.

In order to solve these types of problems, which are complex and probabilistic, methods are needed that provide for the following:

1. The collection and interpretation of qualitative data.
2. Flexibility over time in the processing of data and its subsequent impact on the outcome.
3. The incorporation of opinions and values held by team participants.
4. The processing and storing of large quantities of qualitative and quantitative data impinging on the problem area.
5. Effective idea generation and idea structuring for creative problem-solving.
6. A structure to deal with interpersonal obstacles to communication.
7. The systematization, substantiation, and documentation of decisions.

Many useful methods having these characteristics are already being used and have been described in the literature of such disciplines as architecture, education, engineering, environmental design, management

science, policy science, the social and behavioral sciences, and urban planning. There is, however, no single publication that brings these methods together for comparison, nor is there an existing framework that may be used in the selection and implementation of a method or combination of methods.

The objective of this book is to bring together in one volume a collection of methods that may be useful in team planning and problem-solving and to provide a guide for the selection and implementation of one or more of these methods.

The book is structured in the following manner.

An overview of the history of policy making, planning, and problem-solving is provided to indicate the context in which the new methods have evolved.

Principles pertaining to group dynamics, social technology, group processes, human communication, and group problem-solving have been collected to guide the policy maker, planner, or problem-solver in the selection and implementation of a method or methods.

Each method is described in depth by one or more persons, each of whom has expertise in the subject through involvement in its development and/or its application. This provides the reader with first-hand knowledge, experiences, and indications of future development.

An abstract of each method is presented for quick reference and to facilitate cross-comparisons.

In summary, I believe that this book provides a comprehensive overview of current group process methods that should be useful to the newcomer or student wanting an introduction to new approaches to group problem-solving. The principles outlined at the beginning of the book provide a theoretical base to guide the user in selecting the most appropriate method, and the detailed accounts provide the necessary information for putting the method into practice.

SHIRLEY A. OLSEN

*Columbus, Ohio  
January 1982*

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# GROUP PLANNING AND PROBLEM-SOLVING METHODS IN ENGINEERING MANAGEMENT

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# CONTENTS

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CHAPTER 1	Background and State of the Art	1
	<i>Shirley A. Olsen</i>	
CHAPTER 2	Framework for Selection and Implementation	23
	<i>Shirley A. Olsen</i>	
CHAPTER 3	Brainstorming	77
	<i>Tudor Rickards</i>	
CHAPTER 4	Delphi Method	103
	<i>Bernadine Young and Harold A. Linstone</i>	
CHAPTER 5	Interpretive Structural Modeling (ISM)	155
	<i>John N. Warfield</i>	
CHAPTER 6	Issue-Based Information System (IBIS)	203
	<i>Donald P. Grant</i>	
CHAPTER 7	Kane Simulation (KSIM)	247
	<i>Julius Kane and Paul Fitzgerald</i>	
CHAPTER 8	Nominal Group Technique (NGT)	271
	<i>Sandra L. Gill and André L. Delbecq</i>	
CHAPTER 9	Program Planning Method (PPM)	289
	<i>Sandra L. Gill and André L. Delbecq</i>	

CHAPTER 10	A Role-Oriented Approach to Problem-Solving <i>Charles H. Burnette</i>	303
CHAPTER 11	Synectics <i>George M. Prince</i>	317
CHAPTER 12	Value Engineering <i>Thomas J. Snodgrass and Sandra L. Gill</i>	365
Appendix	Method Abstracts	395
	Brainstorming	395
	Delphi Method	401
	Interpretive Structural Modeling (ISM)	408
	Issue-Based Information System (IBIS)	412
	Kane Simulation (KSIM)	417
	Nominal Group Technique (NGT)	420
	Program Planning Method (PPM)	424
	A Role-Oriented Approach to Problem-Solving	428
	Synectics	432
	Value Engineering	438
Author Index		442
Subject Index		447

## CHAPTER 1

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# BACKGROUND AND STATE OF THE ART

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SHIRLEY A. OLSEN

As problems are realized to be more complex and difficult, as problem situations are seen to require knowledge and information from many disciplines, and as teams of people from diverse backgrounds, values, and perspectives are brought together to assist in obtaining creative solutions to problems, it becomes increasingly clear that new ways to structure and facilitate such group efforts are needed.\*

In response to this statement of need and others like it, this book has been written. It is a collection of methods that have been found useful by groups involved in policy making, planning, and problem-solving. The methods have been brought together in one volume to fulfill the need for methods that facilitate the design process requiring team effort and the need for a more participatory, democratic approach to the activity of designing. Design, as it is used here, is broadly defined as an activity directed toward the development of a policy, plan, or product, that, if implemented, will result in a desirable situation in which there are little or no unforeseen or undesired side effects and aftereffects.<sup>1</sup> Design is seen as being synonymous with policy making, planning, and problem-solving.

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In order to begin our discussion of the group methods and the scope of this inquiry it is appropriate that we first review the circumstances warranting a team or group approach.

First of all, given a complex problem, there usually are no experts knowledgeable about the total problem area. The problem is most often a unique one for which there are no precedents. Also, the problem area spans many disciplines and professions. The collective members of a group or team are able to bring to the problem a larger quantity of data than would an individual. Through interaction one member of the group can build on another member's input, resulting in the production of a larger number of ideas and alternative solutions. Also, the collective members of a group have a variety of approaches to solving a problem. In problem-solving situations in which the team consists of such participants as policy makers, planners, problem-solvers, implementors, consumers or users, and those affected by the outcome, there is usually a greater understanding of the solution and the means for implementation, which reduces the chances of communication failures. The likelihood of solution acceptance is also greater, resulting in more effective implementation and maintenance.

Many designers working in teams have found the experience to be a negative one and not very fruitful in terms of outcome and meeting individual needs. There are probably a number of reasons for this. First, there may have been a lack of knowledge about group processes in general. Second, there may have been little or no knowledge about those methods that foster creative group problem-solving. Most likely the format of the meetings was that of the conventional interactive committee meeting or routine meeting. Such meetings are appropriate for coordination and information exchange.<sup>2</sup> They are not appropriate for creative group problem-solving involving idea generation, idea structuring, and/or idea evaluation. Some of the problems that might arise from using the conventional interactive meeting format are group pressure, domination by one individual, a conflicting secondary goal such as "winning the argument," and disagreement, which results in hard feelings,<sup>3</sup> all of which interfere with the task at hand.

The methods presented in this book are the result of an inventory of methods already being used by task-oriented groups in a number of disciplines, these being architecture, business administration, engineering, environmental design, marketing, military science, and urban planning. They were selected on the basis of certain characteristics that they have in common. These appear in the list of criteria in the following section, Scope of Inquiry.

## SCOPE OF INQUIRY

The focus of this inquiry is on methods that may be used by task-oriented groups or teams in creative problem-solving situations. The types of problems that benefit most by the application of such methods may be classified as complex-probabilistic<sup>4</sup> or, as Rittel and Webber have termed them, “wicked” problems.<sup>5</sup> Such problems may be viewed from several perspectives, which must be reconciled. Depending on the point of view and the interests of those involved in solving the problem and those affected by the problem solution, a number of strategies and solutions exist; sometimes these are seen as being diametrically opposed. One of the difficulties in dealing with a complex probabilistic problem lies in the definition of its boundaries. Often these problems are enmeshed within other problems in such a way that in order to solve the original problem several others must be solved as well. Often, too, it is difficult to know at what level to attack the problem. One strategy may be to attack it at the local level, whereas another may be to attack it at the national or international level. Complex problems are also characterized by large amounts of qualitative and quantitative data and a large number of dependent variables affecting each other simultaneously. This makes it very difficult to keep track of the “total picture” or the effect of one or several changes on one component or subsystem of the total problem system. Also, after the problem solution has become operational the effect of some modification or malfunction within the system is often unpredictable. As mentioned earlier, these complex probabilistic problems affect a large segment of the population, and thus within the participatory democratic group required to solve such problems there are vested interests and differences in values and world views. And finally, it should be mentioned that once the solution is implemented, it is difficult to “take it back” or alter it as a whole. Some examples of these types of problems are transportation systems, mass communications involving social issues, international sign systems, housing for the elderly, community revitalization and renewal, prefabricated housing components such as kitchens and bathrooms, mass-produced housing, and the planning and design of new cities.

Those methods found useful in solving these types of problems and presented in this book have a majority of the following criteria in common. These criteria are based upon the needs of conventional interactive groups or committees plus the needs of task-oriented groups involved in solving complex problems. The methods presented provide for most or all of the following:



1. Establishment of an agenda.
2. Goal definition.
3. Role definition.
4. Rotating leadership.
5. Isolation of issues.
6. Distinction between facts and opinions.
7. Definition of terms.
8. Specification of level of approach to the problem.
9. Recording of ideas in order to keep track of progress.
10. A structure for interaction.
11. Fulfillment of personal needs.<sup>6</sup>
12. Separation of the information processing subtasks—idea generation, idea structuring, and idea evaluation.<sup>7</sup>
13. Separation of problem definition from generation of solution strategies.<sup>8</sup>
14. Collection, interpretation, and storage of quantitative and qualitative data.
15. Recognition and incorporation of opinions and values held by team members.
16. Multilogue (multiperson simultaneous dialogue).<sup>9</sup>
17. Provision for use of holistic languages, for example, simulation, maps, graphs, diagrams, and iconic models (two and three dimensional).
18. Provision for both individual effort and group effort depending on the nature of the subtask and the desired outcome.
19. A relaxed nonstressful environment.<sup>10</sup>
20. Ego-supportive interaction in which there is an open give and take situation among participants.<sup>11</sup>
21. Absence of penalties attached to an espoused idea or position.<sup>12</sup>
22. Mechanisms that support changes in attitude, rethinking, and mediation.

## DEFINITIONS

The following terms are considered to be key words in this introduction and are subject to varied interpretations. Therefore, in order to clarify this discussion, they will be defined.