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AN EMPIRICAL STUDY OF PROBLEM-SOLVING TECHNOLOGIES AND CONFLICT-HANDLING BEHAVIOR MODES

City University of New York PH.D. 1980

AN EMPIRICAL STUDY OF PROBLEM-SOLVING TECHNOLOGIES AND CONFLICT-HANDLING BEHAVIOR MODES

by

MICHAEL N. CHANIN

A dissertation submitted to the Graduate Faculty in Business in partial fulfillment of the requirements for the degree of

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The City University of New York
1980

This manuscript has been read and accepted by the Graduate Faculty in Business in satisfaction of the dissertation requirements for the degree of Doctor of Philosophy.

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Abstract

AN EMPIRICAL STUDY OF PROBLEM-SOLVING TECHNOLOGIES AND CONFLICT-HANDLING BEHAVIOR MODES

by

Michael N. Chanin

Advisor: Professor Harris J. Shapiro

The constantly growing need for improving strategic and operational planning and the absence of integrated studies dealing with problem-solving technologies and conflict-handling modes provides the foundation of this study. Examination of the literature in problem-solving and conflict areas has indicated the need for new theoretical constructs. This paper introduces and discusses such new theoretical constructs as CMC (Conflict Management Continuum), CMS (Conflict Management Space), DMIS (Dialectical Materialism Inquiry System) and based on it a new conceptual model of strategic problem-solving and planning, and DPST (Dialectical Problem-Solving Technology). Relationships between three problem-solving technologies: DPST, Devil's Advocate Problem-Solving Technology (DAPST) and Low Structure Problem-Solving Technology (LSPST), five conflict-handling behavior modes (competing, collaborating, compromising, avoiding and accommodating) and performance variables (profit, ROI, ranking) are hypothesized and investigated. A series of Pearson Correlation, one-way ANOVA and pair wise t-tests indicate that subjects are able to differentiate, with a high level of statistical significance, between conflict-handling behavior

modes and that there is a constant pattern of preferences for particular conflict-handling behavior modes. The hypothesized relationships between problem-solving technologies and conflict modes were found in the predicted direction only for the competing and compromising modes. In terms of performance the DPST groups were found to be significantly superior to LSPST groups with some advantage of DAPST over LSPST and no differences between DPST and DAPST groups. No support was found for the dialectical attitudinal hypotheses. Methodological and theoretical issues of conflict-oriented problem-solving are examined and future research directions are outlined.

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To my wife, Luba, and my daughter, Ilene, I dedicate this work.

Michael N. Chanin

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Chapter I

INTRODUCTION

In a recently published article entitled "Is Problem-Solving America's Lost Art?" Malcom W. Browne wrote:

> "Are we Americans really becoming a nation of ignoramuses, and if so, is there anything we can do about it? Scientists, teachers and America's managers are complaining that on the whole our people no longer seem to solve problems very well. The complaints cite precipituous declines in school and college tests scores, the statistical increase in functional illiteracy and the growing difficulty of filling jobs requiring problem-solving abilities...if slide continues our country could eventually find itself a member of the deprived 'Third World', without engineers or the other problem-solvers who created American civilization." (New York Times, July 29, 1980, B-1)

This citation epitomizes the realization of the critical need for new ways and techniques of problem-solving in the constantly and increasingly changing environment of modern business and government management. For a long time attempts were made to improve the quality of decision-making by developing new techniques or formats of problem-solving, which in this paper we call problem-solving technologies. A substantial body of literature and research on problem-solving technologies has been generated in the last 20 years (Bouchard and Haire, 1970, Carr, et. al., 1977; Delbecq, 1967; Delbecq, et. al., 1975; Dunnette, et. al., 1963; Green, 1975; Hall, et. al., 1963; Herbert and Yost, 1979; Nemiroff, et. al., 1976; Van de Ven and Delbecq, 1971, 1974). Examination of the traditional problem-solving technologies indicates that the majority of these technologies reflect the "consensus" or equilibrium" period in the development of organizational theory. Only recently a few problem-solving technologies have made

explicit use of the conflict concept in their constructs (Mason, 1969, Mitroff, et. al., 1977; Emshoff and Mitroff, 1979). However no attempts were made to incorporate conflict behavior modes into empirical studies on problem-solving technologies.

Conflict processes and conflict as an area of scientific investigation have prevailed in the practice of various schools and thoughts of management. Extensive writings and research have been conducted in the area of conflict, conflict management and conflict-handling behavior modes (Blake and Mouton, 1961; Blake, et. al. 1964; Deutsch, 1969; Lawrence and Lorsch, 1967; Pondy, 1966, 1967; Rizzo, et. al., 1970; Ryan, 1977; Sheriff, et. al., 1961; Thomas, 1979, 1976; Thomas and Kilmann, 1978, etc.). The perception of conflict has shifted from viewing conflict as an undesirable inherently destructive and unacceptable factor in "harmonious", "consensus" and "equilibrium" organizational theories (Argyris, 1964; Davis, 1951; Katz and Kahn, 1967; Likert, 1961; March and Simon, 1958; Weber, 1947; etc.) to recognizing conflict not only as an ever-existing phenomenon in all social organizations (Cyert and March, 1963; J. D. Thompson, 1967; V. Thompson, 1961, etc.) but also recognizing its dialectical nature and effectiveness in strategic planning (Chanin and Shapiro, 1979; Mason, 1969; Mitroff, et. al., 1977).

In recent years a five category scheme for classifying conflict-handling behavior modes has acquired prominence in research on conflict. Originally introduced by Blake and Mouton (1964) and later reinterpreted by Thomas (1976), the

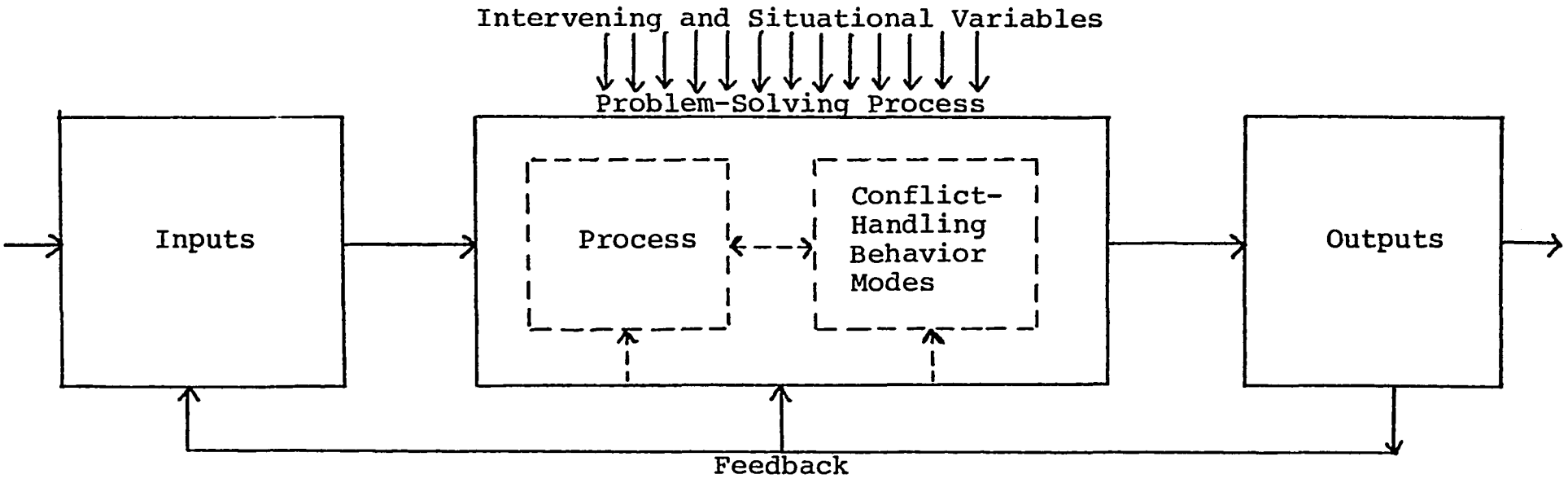
scheme consists of five modes: competing, collaborating, compromising, avoiding and accommodating. Relationships between these five conflict-handling modes and some social and organizational variables were investigated by Blake and Mouton (1964), Lawrence and Lorsch (1967), Thomas (1971), Ryan and Clemence (1973), etc.

The effectiveness of problem-solving for strategic and operational planning can be considerably improved by integrating existing information in both problem-solving and conflict management. Nevertheless, the knowledge and research in the area of problem-solving and conflict-handling behavior has been developed and continues to be developed along separate lines. Figure 1 presents an input-output model of conflict-oriented problem-solving. Using this model we will discuss the directions of the previous and present research.

The input-output model of problem-solving consists of three blocks: inputs, outputs, and problem-solving process. All three blocks are connected by feedback. The input block consists of such variables as personality factors, knowledge and skills of problem-solvers, their beliefs, values, motives, needs, etc. The output block consists of results of problem-solving process: quality, quantity, originality and implementability of decisions; satisfaction of the problem-solvers, changes in human resources, etc. The main block in our model is the problem-solving process block. Known in the literature as the "black box" or Jenkin's box, this block deals with transformation of inputs into outputs. The problem-solving process may be affected by such intervening and situational

Figure 1

The Input-Output Model of Conflict-Oriented Problem-Solving



Inputs

1. Personality
2. Knowledge & Skills
3. Motives
4. Beliefs and Values
5. Needs
6. Group Composition and size
7. Commitment
8. Information
9. Level of Conflict Along Conflict Management Continuum

Intervening and Situational Variables

1. Task Roles
2. Group Norms and Roles
3. Organizational Climate
4. Leadership Styles
5. Rules and Regulations existing in an Organization
6. Formal position and interdependencies of conflicting parties

Outputs

1. Performance
   a. Decision Quality
   b. Decision Quantity
   c. Decision Originality
   d. Decision implementability
2. Opportunity Cost
3. Satisfaction
4. Changes in Human Resources

variables as task roles, group norms and roles, organizational climate, rules and regulations existing in organizations, etc. The problem-solving process block includes two subsystems: the problem-solving process itself and conflict-handling behavior modes.

Our examination of empirical studies dealing with problem-solving technologies shows that no recognition is given to the conflict-behavior-modes subsystem. For example in brainstorming and Delphi expressions of conflict are suppressed through elimination of criticism in the former and through absence of social interaction in the latter. Nominal group technique as well as Dialectical Inquiry System recognizing the existence of conflict and its impact on problem-solving does not incorporate into the research design the modes of conflict-handling behavior. Therefore the empirical studies dealing with problem-solving technologies, using input-process-outputs sequence, usually try to find impact of different problem-solving processes on the outputs given a constant set of inputs: or using a constant problem-solving process to examine the impact of changing input on the output.

The empirical studies on conflict behavior, on the other hand, using the input-conflict-handling behavior-modes sequence, usually try to investigate the influence of "different inputs" or intervening and situational variables on behavior modes. The question which is usually asked is: What input or situational variables lead to specific conflict-handling behavior modes? The mode in the majority of empirical studies on conflict is viewed as an output variable. Thus, both the

research on problem-solving and conflict behavior utilizes only parts of our input-output model of conflict-oriented problem-solving (See Figure 1). Therefore, there exists a need for closing this gap by investigating the interacting modalities of problem-solving technologies and conflict-handling behavior modes which are two integral parts of the problem-solving process. The sequence in this case becomes: input-process-conflict modes-output. Basically we can formulate the design of this research as follows: Given a constant set of inputs and intervening variables controlled through random processes, investigate the impact of different problem-solving technologies on conflict-handling behavior modes and through a combination of both the impact on the outputs of problem-solving.

This investigation may help us to find answers to the following interesting questions of strategic and operational decision making:

1. Does a specific problem technology lead to a particular conflict-handling behavior mode?
2. Does a longitudinal application of a specific problem-solving technology lead to a change in the type of conflict-handling behavior mode, utilized by the decision makers?
3. Is the quality of strategic and operational planning and consequent performance primarily a function of a specific problem-solving technology, or conflict-handling behavior mode, or a combination of both?

The intention of this study is to contribute to the

existing theoretical and empirical knowledge in the area of strategic and operational problem-solving. The objectives of this study in terms of theoretical contribution is the following:

First, to examine the present state-of-the-art of problem-solving technologies and conflict handling behavior modes.

Second, to interpret and possibly extend the concept of conflict and conflict management from the position of dialectical materialism.

Third, to introduce and discuss a new inquiry system - Dialectical Materialism Inquiry System (DMIS) - and based on it a new conceptual model of problem-solving and stretegic planning.

Fourth, to develop a decision-process type high structure problem-solving technology based on DMIS, i.e. DPST (Dialectical Problem Solving Technology).

In the area of empirical contribution the objectives of this study are as follows:

First, to examine interacting modalities and quality of different problem-solving technologies and conflict-handling behavior modes.

Second, to test a simplified version of the DMIS model in strategic and operational decision-making for ill-defined, ill-structured and uncertain problems.

Third, to investigate dialectical changes in behavioral attitudes and group performance and interacting modalities of problem-solving technologies and conflict-handling behavior modes.

Thus, the purpose of this research is twofold:

1. To contribute to existing conceptual knowledge and,

2. To contribute to the existing empirical knowledge.

Because one of the major goals of this work is to develop a theoretical foundation an in-depth examination of existing state-of-the-art research on conflict and problem-solving will be undertaken in the next four chapters. In the beginning of Chapter II we will examine the prevailing views and approaches to conflict and conflict management. Then conflict-handling behavior modes will be discussed and results of empirical studies will be presented. Finally, we will introduce a dialectical extension and reinterpretation of conflict and conflict management. Chapter III is devoted to discussions and research analysis of "harmonious" problem-solving technologies (Brainstorming, NGT, and Delphi). Chapter IV analyzes the theoretical foundations and research of such conflict-oriented problem-solving technologies as DIS and Devil's Advocate Approach.

In Chapter V we first introduce a new inquiry system - Dialectical Materialism Inquiry System (DMIS) and its theoretical foundation - the Dialectical Materialism Laws. Then a Conceptual Model for problem-solving will be presented and discussed. Chapter VI classifies and operationalizes the conflict-oriented problem-solving technologies and presents the research hypotheses. Chapter VII deals with such issues of research methodology as research design, subjects, description of the simulation, independent and dependent variables.

This chapter also discusses the "Mode" instrument, preliminary data analysis and findings of the pilot study.

Chapter VIII is devoted to the analysis of the findings in the present study. In the beginning, an analysis of demographic data and analysis of reliability and structural validity of "Mode" scale is undertaken. Then the testing of various hypotheses will be presented. Finally miscellaneous findings and observations will be reported.

In Chapter IX we will present the summary of the findings the managerial implications and applications and finally the directions of future research.

Chapter II

CONFLICT AND CONFLICT MANAGEMENT: A THEORETICAL REVIEW AND EXTENTIONS

In recent years the volume of writings and research on conflict has substantially increased. As a result of increased interest a more realistic and balanced view of conflict is emerging. Traditionally conflict was viewed as an undesirable and destructive force which requires suppression and stringent controls. However, the modern view of conflict accepts it as a natural and ever-present organizational phenomenon, which may have destructive or constructive potential depending on its management.

The increasing economic, technological, social and political changes create many sources of conflict in organizations. Many managers, accepting inevitability and functionality of conflict, find themselves spending more and more time managing conflict. Thomas and Schmidt (1976) found that middle level managers spend over 25% of their time in dealing with conflict between themselves and superiors, peers, or subordinates. They also found that at the lower levels (e.g. first-line supervisors) the managers spent even more time on conflict management.

Two Approaches to Conflict

Conflict and conflict processes prevail not only in every day life of different groups and organizations but also in the structure and development of organizational theory. However, conflict has been and still remains the subject of substantial controversy in the practice and theory of management. This controversy is embodied in the two principal

approaches towards conflict: the traditional school of thought also known as the "consensus" or "harmony" school of organizational theory and the behavioral or "conflict" school of organizational theory. Recognizing that conflict exists, both schools differ in the way they view it.

The traditional approach to conflict is represented by writers from classical organizational theory (Davis, 1951; Fayol, 1925; Gulick and Urwick, 1937; Mooney, 1947; Taylor, 1947; Weber, 1947) and the Human Relations school (Argyris, 1964; Bennis, 1966, Likert, 1961; McGregor, 1960). Some of the early writings in modern organizational theory (Barnard, 1938; Katz and Kahn, 1967; March and Simon, 1958; Simon, 1957) also supported the traditional view. These researchers perceived organizations metaphysically - as static and closed systems, composed by rational individuals with need for harmony and tranquility as a necessary condition for organizational survival. Conflict is viewed as undesirable, detrimental and internally destructive process in organizations. The conflict concept was identified with such terms as destruction, violence and irrationality. Thus, conflict was viewed as harmful and was to be avoided through adequate job descriptions, detailed specifications of relationships between different positions, careful personnel selection and training. The traditional approach to organizational conflict was paralleled by a similar position on intra-individual conflict. It was assumed that individuals are motivated by desire for tension reduction. Therefore therapeutic or organizational intervention suggested such steps which would reduce the

tension and its product - anxiety - within the individual and eliminate the source of conflict in organizations.

The behavioral approach to conflict is represented by such organizational theoreticians as Boulding (1962), Cyert and March (1963), J. D. Thompson (1967), and V. Thompson (1961). These scholars viewed organizations as dynamic, interacting and open systems, where individuals were conceptualized as satisficing beings with limited rationality. The behavioral approach supporters argue that conflict is a natural phenomenon in groups and organizations. Therefore it should be accepted as inevitable, necessary and even desirable under specific organizational and environmental conditions. Zalesnik (1970) stated that conflict is endemic, inevitable, and necessary to organizational life. The potential outcomes of conflict may vary from positive, innovative, and constructive to negative, destructive and inflammatory. The behavioral approach is also paralleled by changing views on intra-individual conflict. It assumes that moderate levels of anxiety and tension caused by intra- or inter-individual conflict can facilitate individual performance and ability to adjust to uncertainties of the changing environment.

Examination of modern management practices shows that traditional philosophy is still the most prevalent in organizations. Managerial rewards in most organizations, are partially based on the ability to maintain peace, harmony and tranquility in their units or with customers, while disequilibrium, confrontation and dissatisfactions are negatively valued. However, following the theoretical changes a new understanding

of constructive potentials of conflict begun to evolve in the practice of management. Two interesting examples of constructive conflict applications were discussed by Shapiro (1976). In the first case, a solution was found to the seemingly unsolvable financial problems of New York City through conflicts between the Mayor and City Controller, the Mayor and the Governor, the Mayor in conjunction with the Governor and the President among other conflicting relationships. In the second case a small manufacturing company through constructive conflict management was able to turnaround and drastically improve its performance.

Conflict Defined

The two different approaches to the conflict concept are also reflected in the multitude of conflict definitions. In the behavioral sciences the concept "conflict" has no single and clear meaning. In a paper dealing with the state of conceptual disarray in the literature on conflict Fink (1968) stated that "...existing diversity of empirical and theoretical approaches to the study of social conflict has produced a conceptual and terminological confusion, which impedes both comparison between distinct classes of conflict phenomenon and the process of theoretical integration" (p. 416). This statement was later supported by O'Connell(1971) which indicated that definitions of conflict have been either ignored or stated in exceedingly vague terms.

Conflict definitions presented by writers from the traditional school can be summarized into the following different groups:

1. Conflicts take the form of acts

   Coser (1956) viewed conflict as "antagonistic struggles" (p. 135); Deutsch (1969) stated that a "conflict exists whenever incompatible activities occur" (p. 7); according to Litterer (1966) conflicts are acts to reduce deprivation.

2. Conflicts take the form of behaviors

   Walton (1966) considers conflict as an "opposition process in any of several forms - competition, status, rivalry, bargaining, sabotage, verbal abuse, etc." (p. 411).

3. Conflicts take the form of omissions

   Beales and Siegel (1966) regard conflicts as "breaches in normally expected behavior" (p. 21); according to March and Simon (1958) conflict is a breakdown in one standard mechanism of decision-making; Schmidt and Kochan (1972) perceive conflict as overt inter-party acts or omissions to "block" other parties.

4. Conflict as internal states of suspended action

   Boulding (1962) treats conflict as an internal state of functional paralysis. Brown (1965) defines conflict as an internal state of decisional pressures toward incompatible acts; and finally, Marek (1966) notes that conflict is "a threat" to cooperation (p. 64).

The major representatives of the behavioral approach interpreted conflict as dysfunctional inter-party interactions (J. D. Thompson, 1967) or as implicitly dysfunctional activities affecting organizational effectiveness (V. Thompson, 1961).

According to Pondy (1967) the term conflict has been used in the literature to describe antecedent conditions of conflict behavior; effective states of individuals involved; cognitive states of individuals involved, and actual conflict-full behavior.

A negative connotation of conflict was given by Likert and Likert (1976), who define conflict as "the active striving for one's own preferred outcome which, if attained, precludes the attainment by others of their own preferred outcome, thereby producing hostility" (p. 7).

Recently, Thomas (1976), following Pondy, adopted a more general definition of conflict between social units, which he calls "dyadic conflict". He considers dyadic conflict "as a process which includes the perceptions, emotions, behaviors and outcomes of the two parties...conflict is a process which begins when one party perceives that the other has frustrated, or is about to frustrate, some concern of his" (p. 891).

Summarizing the above cited definitions of conflict we may conclude with a citation from Schmidt and Kochan (1972) which stated that "the mainstream of organizational literature is generally ambiguous in delineating the concept of conflict" (p. 359). Therefore, later we will present a new dialectical definition of conflict.

Conflict Resolution and Conflict Management

Our examination of the literature on conflict shows that both the researchers and practitioners treat "conflict management" and "conflict resolution" as synonymous concepts.

Misunderstanding the nature of conflict many researchers and managers believe that conflict should be resolved once it occurs. Hawes and Smith (1973) indicate that:

> "Normative theories of conflict assume that the only good conflict is a resolved conflict. The rationale is that people are happier, healthier, and more productive when they are cooperating and getting along with one another...A central thesis throughout these discussions is that the effects of conflict is destructive and the best means for bringing it to a speedy end should be sought." (p. 245).

Filley (1975) connotates conflict resolution as termination of manifest conflict between individuals or groups. The conflict resolution concept is also used by the researchers who adhere to the systems approach. From this point of view, social systems are compared to an organization and conflict to a disease. For example Parsons (1951) treats conflict as a form of sickness in the social body. The systems theorists typically view conflict as a disruption of homeostasis. According to Hawes and Smith (1973) conflict resolution presumes that cooperation is the normal state of a system:

> "Equilibrium and stability of systems are thought of as conflict-free states in which all components are coordinated and acting in harmony. Conflict occurs as a temporary disruption of the system. The disruption has a beginning, in all likelihood, a cause, and is terminated allowing a return to a state which although possibly altered by the conflict, will remain stable until the next episode of disruption." (p. 425).

Thus the underlying perspective of conflict resolution is that conflict by its nature is destructive and it should be viewed as a temporary disruption of the normal state of cooperation. The underlying implications of conflict resolution

is that conflict is solved for good and will not occur in the future. Later in this chapter we show from the dialectical explanation of conflict, why the very concept of "conflict resolution" is a misconception.

With the recognition that conflict can be functional and dysfunctional in organizations the emphasis has slowly shifted from the elimination of conflict through conflict resolution to utilization of constructive advantages of conflict through conflict management. The purpose of conflict management has been variously stated as keeping conflicts productive and useful (Thomas, 1976). Fisher (1980) indicated that "conflict management refers solely to the interaction sequences developed by a group to deal with social conflict and, consistently used by the group when social conflict occurs" (p. 237). The general implications of conflict management are that conflict is an ongoing process and that it will definitely occur again, although probably in slightly modified form.

Conflict-Handling Behavior Modes

Description of the Modes

In the mid 1960s several variations of a five category scheme classifying conflict-handling behavior received widespread acceptance by researchers. In the Managerial Grid, Blake and Mouton (1964) proposed five conflict-handling behavior modes: Confrontation, Smoothing, Bargaining, Forcing and Withdrawal. The authors suggest that an individual's orientation (task or people) determines which mode will be utilized to handle conflict. Different levels of task orientation and people orientation give rise to the five conflict handling

modes. Blake and Mouton also suggest that individuals usually choose that mode with which they are most comfortable. The confrontation mode was seen by the authors as the most effective mode because of its correspondence to the "9,9" management style which is high on both the task and personnel dimensions.

Lawrence and Lorsch (1967) extending the work of Blake and Mouton suggested that success in dealing with inter-departmental conflicts depends upon (among other things) the use of a proper, specifically problem-solving, conflict-handling mode.

It is necessary to stress that various words have been used by different researchers to describe conflict-handling behavior modes. March and Simon (1958) discussed Problem-solving, Persuasion, Bargaining, and Politics. Boulding (1962) used such terms as Conquest (Forcing), Compromise, Avoidance, Award (similar to smoothing), and Reconciliation (Problem-Solving).

Recently Thomas (1976) interpreted Blake and Mouton's (1964) original classification scheme by using the following five modes of conflict-handling behavior: Competing, Collaborating, Compromising, Avoiding, and Accomodating. The advantage of the revised scheme is that it is based upon two separate dimensions: Cooperation - individual attempts to satisfy concerns of other persons, and Assertiveness - individual attempts to satisfy one's own concern. The five modes of conflict-handling behavior are defined as follows:

a. Competing is identified with forcing (Lawrence and

Lorsch, 1967) and "power-oriented" behavior (Filley, 1975). This mode represents a desire to achieve a favorable result at the expense of the other in a win-lose situation.

b. Collaborating is identified with problem-solving or confrontation. It represents an individual's desire to find an integrative approach which will satisfy both parties. Behaviorally, it involves confrontation and clarification in the existing differences and finding a mutually beneficial outcome. Under this mode individuals usually consider a complete set of possibilities with identification of all aspects. It is also known as the win-win approach to conflict.

c. Compromising is identified with sharing and bargaining. It represents a behavioral mode which seeks moderate but incomplete satisfaction, because each party should forgo something, finding a middle ground.

d. Avoiding. Behaviorally this mode describes an individual who avoids unpleasantness, ignoring the problem or relying upon fate. This individual usually tries to postpone the solution to the problem by withdrawing from the scene of conflict. Sometimes this mode takes on a form of suppression when the person withholds his differences from others.

e. Accommodating known as smoothing. This conflict-handling mode concentrates on appeasement; when an individual tries to satisfy the concerns of other individuals without paying attention to his own.

Most of the studies on organizational conflict have treated conflict as a unidimensional variable with "cooperation" and "competition" as its polar points. The unidimensional

approach to conflict was supposed to simplify the understanding of conflict but in reality it made it difficult to find a meaningful explanation for individual behavior in a conflict situation. In addition the simple cooperative-competitive dimension does not reflect the complexity of individual perceptions on conflict behavior.

Thomas (1976) and Ruble and Thomas (1976) discussed a two-dimensional model which is isomorphic to the Blake and Mouton (1964) model. This model includes two analytically independent dimensions of conflict behavior:

1. Assertiveness - individual's attempt to satisfy his own needs.
2. Cooperativeness - individual's attempt to satisfy concerns or needs of other person.

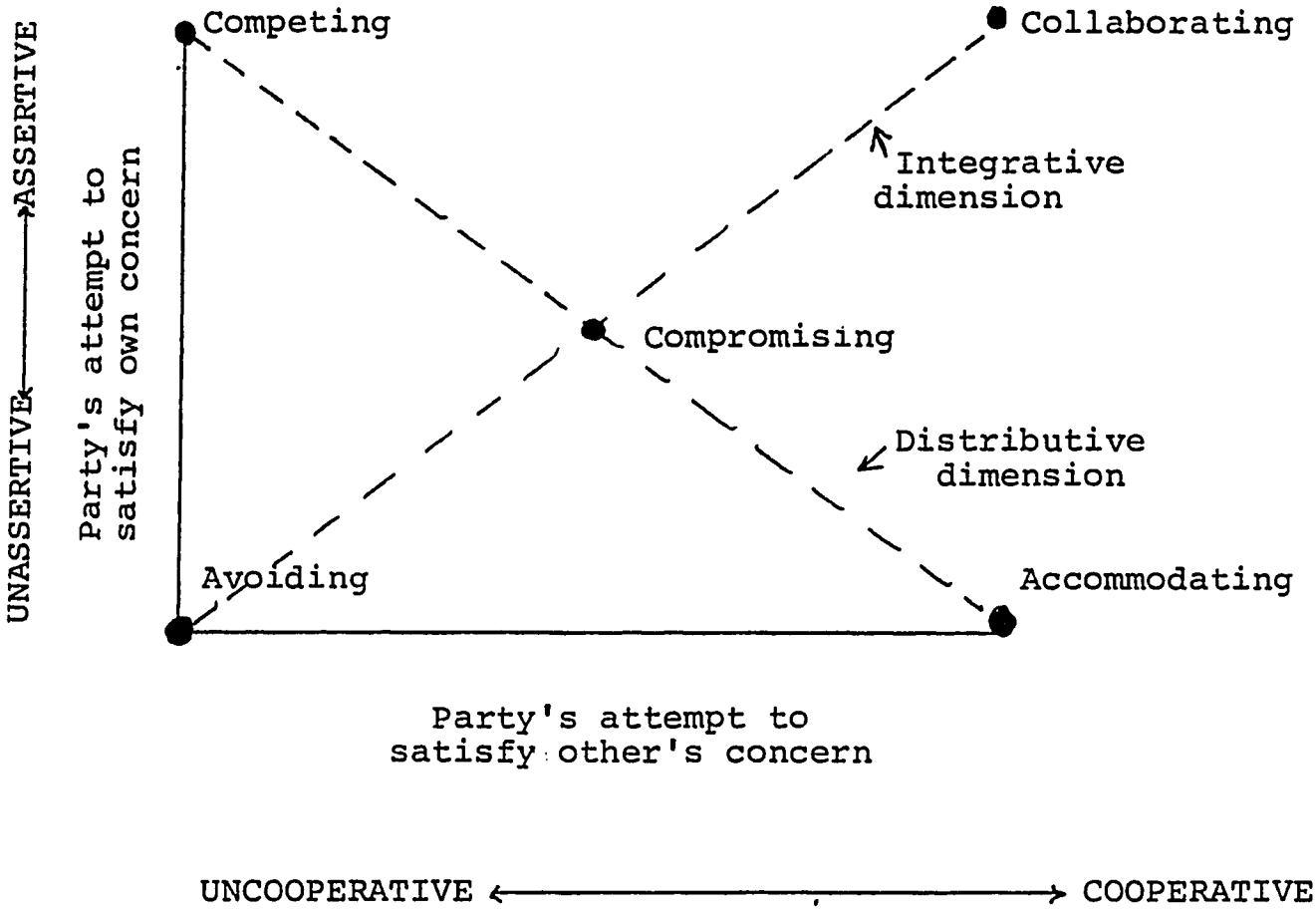
Figure 2 illustrates the five conflict-handling behavior modes and dimensions of conflict behavior.

Using these two dimensions of assertiveness and cooperativeness we may identify the five conflict-handling behavior modes as follows:

a. Competing is assertive and uncooperative;
b. Collaborating is assertive and cooperative;
c. Compromising is intermediate in both assertiveness and cooperation;
d. Avoiding is unassertive and uncooperative;
e. Accommodating is unassertive and cooperative.

FIGURE 2

Five Conflict-Handling Modes, Plotted According to Party's Attempt to Satisfy Own and Other's Concerns



In addition, Kilmann and Thomas (1975) noted that these five modes can be interpreted in terms of integrative and distributive functions, described by Walton and McKensie (1965) These two dimensions are shown by oblique arrows in Figure . The integrative dimension approximates the behavior of an individual with respect to the total satisfaction of all sides in a conflict situation. This implies that the size of the "pie" which is not established (variable), depends on finding alternative solutions to satisfy concerns and needs of all parties involved in a conflict situation.

The distributive dimension shows the portion of satisfaction which goes to each individual involved in the conflict situation. This implies that the size of the "pie" is fixed and the problem is how to divide the pie among conflicting individuals. The competing mode represents the "taking" function and accommodating represents the "giving" function of the individual involved in a conflict situation

According to Kilmann and Thomas (1975) the indices of the above discussed conflict behavior dimensions are calculated as follows:

1. Assertiveness = (Competing + Collaborating) - (Avoiding + Accommodating).
2. Cooperativeness = (Collaborating + Accommodating) - (Competing + Avoiding).
3. The Distributive Index = Competing - Accommodating.
4. The Integrative Index = Collaborating - Avoiding.

Research Results

Examination of the literature and empirical research allows us to distinguish three groups of studies:

First, studies in which attempts are made to find the most prevalent (frequently used) modes of conflict-handling behavior and establish whether utilization of a specific mode leads to the desired outcome and higher individual or group performance.

Second, studies which investigate the impact of various input variables (personality, individual needs, beliefs, etc.) on conflict behavior, and

Third, studies in which two-dimensional models of conflict-

handling behavior derived from the five conflict modes are used to find a meaningful explanation of interpersonal conflict-behavior.

Blake and Mouton (1964) identified confrontation or problem-solving as the most prevalent mode of conflict-handling behavior. They suggested that groups using the problem-solving mode will enjoy effective interpersonal relations and that forcing may be helpful as a backup alternative when confrontation is not effective.

Lawrence and Lorsch (1967) in a study of six organizations found that problem-solving is the most prevalent mode and proportional to organizational performance. The authors have found that the highest utilization of problem-solving was in the two high performing organizations, a smaller level of problem-solving in the next two medium performance organizations and the lowest level in the low performing organizations. They also related presence of forcing and absence of smoothing, as backup modes to the effectiveness of organizational performance

A considerable part of existing empirical studies on conflict discuss conflict behavior in a dyadic setup; supervisor and subordinate conflict relationship. Burke (1970), uses dyadic conflict in investigation of different conflict-handling behavior modes, using Lawrence and Lorsch measures (1967). He found that the most prevalent mode as it was perceived by managers has been (1) confrontation, followed by (2) smoothing; (3) forcing; (4) compromising; and (5) withdrawal. However when supervisors and subordinates were asked to relate the five modes to the constructive use of conflict the pattern

of modes changed. The more constructive perception of conflict had this sequence: (1) confronting; (2) smoothing; (3) compromising; (4) forcing, and (5) withdrawal; and least constructive perceptions were identified with (1) confrontation; (2) forcing; (3) withdrawal; (4) smoothing; and (5) compromising. Burke (1970) also compared five conflict-handling behavior modes by using Pearson correlations with Adequacy of Planning Measures. He reported that confrontation was positively related to six out of seven dependent variables, forcing and withdrawal negatively were related, smoothing and compromising were basically unrelated. Thomas (1971) looking into interdepartmental relations also found that managers' satisfaction with indepartmental negotiations was positively correlated with collaborative and accommodative behavior of managers in other departments, and negatively correlated to competition and avoidance. Similar results were obtained in a study by Ryan and Clemence (1973). They asked the employees to rate their organizations on conflict-handling behavior and 24 other variables dealing with organizational effectiveness. Factor analysis shows that the problem-solving mode is correlated positively with each of the organizational effectiveness variables and negatively with each organizational ineffectiveness variables with 21 out of 24 correlations being statistically significant.

Jamieson and Thomas (1974) have studied the power and conflict parameters in a teacher-student conflict classroom relationship. The result shows a consistency of conflict-handling behaviors as perceived by the students across the

three educational levels - high school, undergraduate and graduate. In terms of prevalence ranking the students indicated the following sequence: (1) avoiding; (2) compromising; (3) accommodating; (4) collaborating, and (5) competing. The only exception was for undergraduate students who ranked collaborating third and accommodating fourth.

Lirtzman (1977) employed an augmented Blake and Mouton (1964) instrument (persuasion and formalization conflict modes were added to problem-solving, compromising, forcing, smoothing, and avoiding) to test the following hypothesis:

1. That organization members perceive dissimilarity among the conflict handling modes;
2. That there is no substantial difference in perception of conflict modes across different types of organization setting;
3. That problem-solving is the most preferable mode of conflict-handling behavior, and
4. That employees attribute problem-solving as the conflict behavior mode preferred by management.

Two hundred and one employees from three organizations (a business school, an industrial plant and a social service agency) provided the information to test the above-stated hypothesis. The findings of the study indicate that Hypothesis 1 was supported only partially. Substantial dissimilarities were found in perception of forcing, avoiding, smoothing and formalization with no differences between problem-solving, bargaining and persuasion. Hypothesis 2 was mainly supported with only the perception of formalization and bargaining

showing some variation in different organizational settings. The support for the problem-solving mode was found only in the social service agency, whereas it appears to have low preference in industrial and business school samples (Hypothesis 3), thus contradicting the previous findings. Some greater support was given to Hypothesis 4, indicating that employees perceive their managers as having the highest preference for the problem-solving mode.

The Lirtzman (1977) study provided support for the Lawrence and Lorsch (1967) paradigm suggesting that the proper model of conflict behavior is a function of various structural and environmental variables affecting organizations. Thomas (1976) indicated that conflict behavior depends to some degree on such intervening variables as organizational climate, existing rules and regulations, group norms, etc. However, only a few studies investigated the relationship between various input and situational variables and conflict-handling behavior modes. Therefore a detailed analysis of these studies is necessary.

Blake, Mouton and Shepard (1964) introduced two intervening variables: the belief of parties involved in the conflict situation and the importance placed on the conflict outcome. The authors suggested that given the parties belief that agreement is possible and importance of conflict outcome is high - problem-solving will be used. However, if importance of the conflict outcome is low under the same conditions the alternative choice is smoothing. In the case when belief in achieving an agreement is low and stakes are high - competition

is a probable choice, and if stakes are low - withdrawal is the alternative choice.

Renwick (1975) studied the impact of conflict (input variables) on conflict behavior. The subjects in this study were 72 employees from two manufacturing companies with a diverse representation of departments and positions. The findings of this study indicate that conflict-handling behavior modes are influenced by topic and source of conflict. When topic of conflict is "Salaries, promotions, and performance appraisal" the employees were more likely to use confrontation followed by compromising and smoothing. For the topic "Personal habits and mannerisms" the most likely choice is compromising followed by smoothing and confrontation. Finally when the topic is "Physical working conditions and organizational policies and procedures" the most likely sequence is compromising, confrontation and forcing. Examination of the sources of conflict shows that "Differences in knowledge or factual material" are most likely to be handled by confrontation, forcing and compromising. Such topics as "Personality differences" and "Differences in attitudes or opinions" will most likely lead to application of compromising and smoothing modes of conflict behavior. Analysis of correlation coefficients between five modes and three topics as well as between five mode and three sources of conflict offers additional interesting findings. A stable positive relationship was found between compromising and smoothing which are likely to be used together, whereas the use of confrontation seemed to preclude employee's withdrawal from the conflict situation (a stable negative relationship).

Renwick (1975) explains the combined utilization of smoothing and compromising as a two-step approach to conflict management, where one method serves as a primary strategy and the other is used as a backup mode. Positive correlations were observed between the use of a specific conflict mode across topics and sources of conflict suggesting that individuals have preferences for a particular conflict-handling mode to deal with a variety of reasons, causing conflict.

In a later study Renwick (1977) examined the effects of sex differences on the perception and management of superior-subordinate conflict. A sample of 95 managers (55 males and 40 females) described how they dealt with differences and disagreements involving their immediate supervisors and how they responded to such conflict. No differences were found between the likelihood with which males and females subordinates would use various modes to deal with the conflict. The results also indicate that sex of the supervisor is not related to female subordinates' perceptions of conflict management. In addition females strongly perceived that they dealt constructively with the conflict as opposed to males who did not. Renwick (1977) also reports that none of the five conflict-handling behavior modes were related to supervisor's evaluation of the subordinates' performance or job efforts.

Ryan (1977) investigated the relationships between seven supervisor-rated conflict behaviors (problem-solving, bargaining, forcing, smoothing, avoiding, accommodating, adherence to rules, and adherence to chain of command), three situational variables (non-routinization, personal influence and dogmatism) and

subordinate's perception of conflict (role or overt). The hypothesized relationships were examined in three different organizations: a social service agency, an industrial plant and a university. The hypothesized relationships between conflict behavior modes and supervisory non-routinization, supervisory influence and subordinate dogmatism as well as hypothesized nagative relationships between conflict behavior modes and supervisory adherence to chain of command and subordinate personal influence were supported. However findings of the study contradicted expected nagative relationships for supervisory smoothing and anticipated positive relationships for supervisory bargaining, forcing, and dogmatism. The author also questioned the widely cited roles of Blake and Mouton (1964) and Lawrence and Lorsch (1967) conflict-handling behavior modes in reducing subordinate conflict.

Recently London and Howat (1978) analyzed the relationship between employee commitment and conflict behavior. The study utilized data collected from 49 supervisor-subordinate dyads in 49 parks and recreation districts throughout the State of Illinois. The ranking of conflict-handling behavior modes in terms of prevalence in application showed no difference between supervisor, subordinates or the total sample. The conflict behavior modes could be ranked as follows: (1) confronting; (2) compromising; (3) smoothing; (4) forcing, and (5) withdrawing. The only exception to this sequence was found in the subordinate sample, where withdrawing was ranked fourth, and forcing - fifth. Positive relationship predicted for compromising and commitment was supported only for subordinates

($r=.25$, $p<.05$). A negative relationship between forcing and commitment of supervisors was only supported for organization ($r=-.31$, $p<.05$) and profession ($r=-.25$, $p<.05$). Strong positive correlations were expected between confrontation and commitment. However the results for subordinates did not show strong or consistently positive correlations between confronting and commitment to organization ($r=.25$, $p<.05$) and between confronting and commitment to profession ($r=-.42$, $p<.05$). A negative correlation was found between confronting and supervisors' commitment to profession ($r=.25$, $p<.05$) and to community ($r=-.32$, $p<.05$). Statistically significant difference was found only between two modes of conflict: subordinates were more likely to withdraw from a conflict than supervisors at $p<.05$, and supervisors were more likely to use forcing than subordinates at $p<.01$. Three types of comments (commitment to (1) organization; (2) profession, and (3) community) were correlated with conflict-handling behavior for supervisors (community, $r=-.33$, $p<.01$). A low positive relationship, hypothesized for smoothing and commitment was not supported.

The above discussed studies are summarized in Table 1 . In order to facilitate the comparison of preference for different conflict-handling behavior modes we have ranked each mode from one to five using the mean and standard deviation of this mode. Table 1 also contains information about the level of statisfical significance, at which a particular mode differs from other modes in the same row.

An examination of the mode ranks in Table 1 shows that considerable variation exists across different studies, input

TABLE 1

Preference Ranks for Conflict-Handling Behavior Modes

Author	Instrument	Subjects	Independent Variable	Dependent Variable: Competing	Collaborating	Compromising	Avoiding	Accommodating
Lawrence and Lorsch (1967)	Lawrence and Lorsch (1967)	Managers in six organizations	n/a	3	1**	n/a	n/a	2
Burke (1970)	Lawrence and Lorsch (1967)	74 managers in a large corporation	Subordinates perception about conflict with superiors:					
			1. Overall	3	1	4	5	2
			2. Always constructive use	4	1	3	5	2
			3. Sometimes constructive use	2	1	5	3	4
Jamieson and Thomas (1974)	Kilmann and Thomas (1974)	200 students from high school (N=102), undergraduate (57) & grad. students (N=41)	Students perceptions about conflict with teachers:					
			1. Total Sample	5	4	2	1	3
			2. High School	5	4	2	1	3
			3. Undergraduate	5	3	2	1	4
			4. Graduate	5	4	2	1	3
Renwick (1975)	Blake and Mouton (1964)	72 employees from different departments and positions from two companies	Topics of Conflict					
			a. Salaries, promotions and performance appraisal.	4**	1	2	5**	3
			b. Personal habits and mannerisms	5	3	1**	4	2
			c. Physical working conditions and organizational policy and procedures	3	2	1	5**	4

TABLE 1 (Cont.)

Author	Instrument	Subjects	Independent Variable	Dependent Variable: Competing	Collaborating	Compromising	Avoiding	Accommodating
			Sources of Conflict					
			a. Differences in knowledge or factual material	2	1**	3	5**	4
			b. Personality differences	5	4	1**	3**	2**
			c. Differences in attitudes and opinions	5	3	1**	4*	4**
Renwick (1977)	Blake and Mouton (1964)	95 managers (55 males & 40 females) from a nationwide insurance company.	Application of conflict mode between:					
			1. Male subordinates & male supervisors used by					
			a. subordinates	4	2	1	5	3
			b. supervisors	2	1	3	5	4
			2. Female subordinates and male supervisors and used by:					
			a. subordinates	4	2	1	5	3
			b. supervisors	2	4	1	5	3
			3. Female subordinates and female supervisors and used by:					
			a. subordinates	4	2	1	5	3
			b. supervisors	4	3	1	5	2

TABLE 1 (Cont.)

Author	Instrument	Subjects	Independent Variable	Dependent Variable: Competing	Collaborating	Compromising	Avoiding	Accommoding
London and Howat (1978)	Blake and Mouton (1964	49 supervisor-subordinate dyads from park and recreation districts	Total sample:	4	1	2	5	3
			Supervisors:	4	1	2	5	3
			Subordinates:	5	1	2	4	3

n/a - information is not available

* - statistically significant at $P < .05$ two-tail test

** - statistically significant at $P < .01$ two-tail test

and situational variables and conflict-handling behavior modes. However, several preliminary conclusions can be drawn:

First, it appears that the most preferable mode of conflict behavior is compromising, followed by collaborating. Thus the exclusive emphasis on early studies (Blake and Mouton, 1964, Lawrence and Lorsch, 1967, and Burke,[1] 1970) on problem-solving as the most preferred mode is not supported by the later studies (Renwick, 1975, 1977, Lirtzman, 1977).

Second, accommodating and competing can be perceived as the next two most preferred modes of conflict behavior with accommodating being more attractive to students in the Jamieson and Thomas study (1974) and to subjects in the London and Howat study(1978).

Third, avoiding is viewed almost exclusively as the least preferred and desired mode of conflict in all studies.

However, the existing knowledge would be of little help to us in predicting individual behavior in conflict situations or predicting a possible outcome of this behavior resulting from different inputs or different situational and intervening variables into the conflict process. As a result of this, recently some researchers are trying to use a two dimensional approach to explain human behavior in conflict situations. Research by Renwick (1975, 1977) suggests that conflict-handling behavior modes are likely to be used in a two-step procedure or are likely to be applied as mode dyads. Reality shows that human behavior cannot be simply explained by a single conflict

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[1] The paper by Burke (1970) contains the information on relative ranking of preferences for particular conflict behavior mode.

mode. Nevertheless the research in this area is still in an infantile stage.

In an exploratory study Kilmann and Thomas (1975) tested the meaningfulness of conflict behavior dimensions: assertiveness, cooperativeness, integration and distribution, which were described early in this chapter. The authors used Pearson correlations to examine the relationships between Jungian personality dimensions (Jung, 1923) as measured by Myers-Briggs Type Indicatory (Myers, 1962). Jungian personality dimensions include four types: sensation-intuition, thinking-feeling, judging-perceiving, and introversion-extraversion. The findings of this study indicate that only two Jungian personality types were significantly correlated with some conflict dimensions. The thinking-feeling type was found to be negatively correlated to assettiveness ($r=-.27$, $p<.01$) and to distribution ($r=-.38$, $p<.001$) and positively correlated to cooperativeness ($r=-.25$, $p<.05$), indicating for example that a thinking-feeling person is more likely to cooperate than to compete. The introversion-extraversion type positively correlated only to assertiveness ($r=.28$, $p<.01$) and to integration ($r=.29$, $p<.01$).

The results of this study provided some insights into Jungian personality effect on composite conflict behavior. However there is an obvious need for continuing research into the relationship between composite conflict behavior dimensions and such conflict output variables as performance, satisfaction, etc.

Conflict and Conflict Management: A Dialectical Extension and Reinterpretation

One of the major reasons explaining the existing diversity

of views, definitions and interpretations of conflict stems from misunderstanding the nature of conflict, specifically its dialectual nature. The misleading views on conflict by scholars from Classical Organization Theory and Human Relations schools are undergoing change. Though conflict still has a negative connotation and is looked upon as an evil, more and more practicing managers recognize the ever-present reality and constructive value of conflict. Kelly (1970) notes that though "most knowing managers have not adopted a different posture to conflict management; most have mastered the new argot that includes such choice phrases as 'structure me a meeting', 'let us go for a confrontation', 'they are definitely going to escalate this one', 'let us introduce a little uncertainty into the situation' and so on." (p. 104).

Lourenco and Glindewell (1975) used a dialectical (Hegelian dialectics) form of analysis to explain the conflict between a local television station and its company headquarters. The conflict was resolved through a synthesis that involved a constructive change in the base of power.

Robbins (1974), who in our opinion advanced the most progressive views on conflict stated that:

> "The early evidence suggests that the 1970s may be remembered in the annals of management history as the decade that conflict management came to the forefront as a major interest of both practicing managers and academic researchers." (p. 67)

Robbins (1974) defines conflict as any kind of opposition or antagonistic interaction between two or more parties. He conceptualizes conflict as existing along a continuous range.

At one extreme there is no conflict; at the other extreme is conflict's highest state, which he describes as an act of destroying or annihilating the opposing party. Robbins (1974) has advanced the idea of interactionist conflict philosophy, which:

> "1. recognizes the absolute necessity of functional conflict;
> 2. explicitly encourages functional opposition;
> 3. defines conflict management to include stimulation as well as resolution technique.
> 4. considers the management of conflict as a major responsibility of all managers." (p. 12).

Despite the progressiveness of Robbins (1974) views he does not provide a comprehensive explanation of the sources of conflict and its dialectical nature. In the next sections we will discuss the dialectical materialism law of interpretation of opposites, develop a conflict management continium and conflict management problem space and also redefine conflict and conflict resolution.

The Law of Interpretation of Opposites: A Theoretical Foundation of Conflict

The Law of Interpretation of Opposites (also known as the Law of Unity and Conflict of Opposites) explains the cause and the moving forces of the process of change and development. This law basically states that everything that surrounds us in nature is made up from conflicting and interacting opposites. Examination of the characteristics and interaction of things or events, their modes of action and counteraction, the processes into which they enter, show that all these characteristics, events, relationships and interactions exist in fundamental opposites. In general, in each sphere of inquiry that we may

contemplate, fundamental opposites are found in every area of nature, society or organizations. For instance, in mathematics there is plus and minus, addition and subtraction, differential and integral; in chemistry - the combination and disassociation of atoms; in organic life - build-up and breakdown of organic compounds; there exist positive and negative electric charges, attractive and repulsive forces acting between two bodies. In social sciences the fundamental opposites can be illustrated by the conflict between different groups - labor and management, minorities and majorities, liberals and conservatives.

Among additional examples of fundamental opposites we often use in business and management are profit and loss, long-range and short-range objectives, and satisfaction and dissatisfaction of employees.

These fundamental oppositions express themselves in contradiction and conflict of opposed tendencies, which despite phases of temporary equilibrium (unity of opposites) lead to continuous change and development. The particular nature of each process is determined by its own contradictions. In any thing or in any event there are many parallel and interacting contradictions. However the shape or result of the event will be determined by the principle contradictions.

The unity of opposites which are mutually dependent, inseparably connected as parts or aspects of a single whole, is temporary, transitory, conditional and relative. The unity of opposites is a contradiction that may be described by a particular relation of superiority - inferiority, i.e., by domination of one side over the other and in some cases by

equality of opposites. For example, solid, liquid and gaseous states of bodies correspond to different domination-relationships in the unity of attraction and repulsion properties of the molecules of bodies. Similarly, in the contradiction of capitalistic society, private ownership plays a dominant role in relation to its opposite (labor) and in the contradiction of socialist society the Communist Party and the administrative-managerial bureaucracy plays a dominant role in relation to its opposite - the workers and farmers. In a particular organization management may be a prevalent force over the opposite element - labor; in another case, the production and marketing departments may be in conflict and one dominates the other.

The classical example of a fully dialectical process is the class struggle in a societal change. The essential interests of exploiting and exploited classes are defined as opposing and contradicting. During most of human history the exploiting class was the dominant side. However, during periods of revolution or major social changes the roles of the two classes switch. The dominated class becomes dominating. In the process of social formation the old classes disappear and they are subsumed by a new social structure which creates new classes or groups. Similar processes can be found on a smaller scale in organizational settings. When a company undergoes major structural and leadership changes the old coalitions and groups disappeared and new contradicting groups or coalitions with opposing views are created.

Dominant relationships by their very nature are unstable

and susceptible to change, though the period of change may be quite long. It is the working out (through specific forms and processes) of existing contradictions and dominance relationships between dynamically interdependent and mutually influenced conflicting opposites with new dominance relationship that provides the cause and moving force of the permanent process of change.

Recapping this section we may state that a fundamental assumption of the dialectical Law of Interpretation of Opposites is that there are inherent contradictions and oppositions in all things and that consequences of interaction of these opposites lead to the process of continuing change and development. Thus the continued existence of contradictions between opposites provides the source of conflict.

Conflict Management Continuum

The dialectical origin of conflict indicates that conflict in itself undergoes a maturation process, determined by a particular nature, strength and interaction of contradicting opposites. Therefore we may conceptualize conflict as a multi-stage entity with the five following levels of strength:

1. Dissonance[1] - is a state of conflict when there is a lack of agreement, incongruity or discrepancy between opposites in a particular entity.
2. Divergence is a state of conflict when opposites are drawing apart and there exists a difference between them in form, character or opinion.

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[1] Our definitions are based on definitions given by Webster's Third New International Dictionary, ed. Phillip Babcock Gove Ph.D., G. & C. Merriam Company, Springfield, Mass. (1971).

3. Disagreement is an act or an instance of disagreeing, or a state of being in a disparity.
4. Confrontation is an act of meeting opposition and hostility.
5. Antagonism is an act of the highest expression of hostility open agression and enmity through mainly destructive activities.

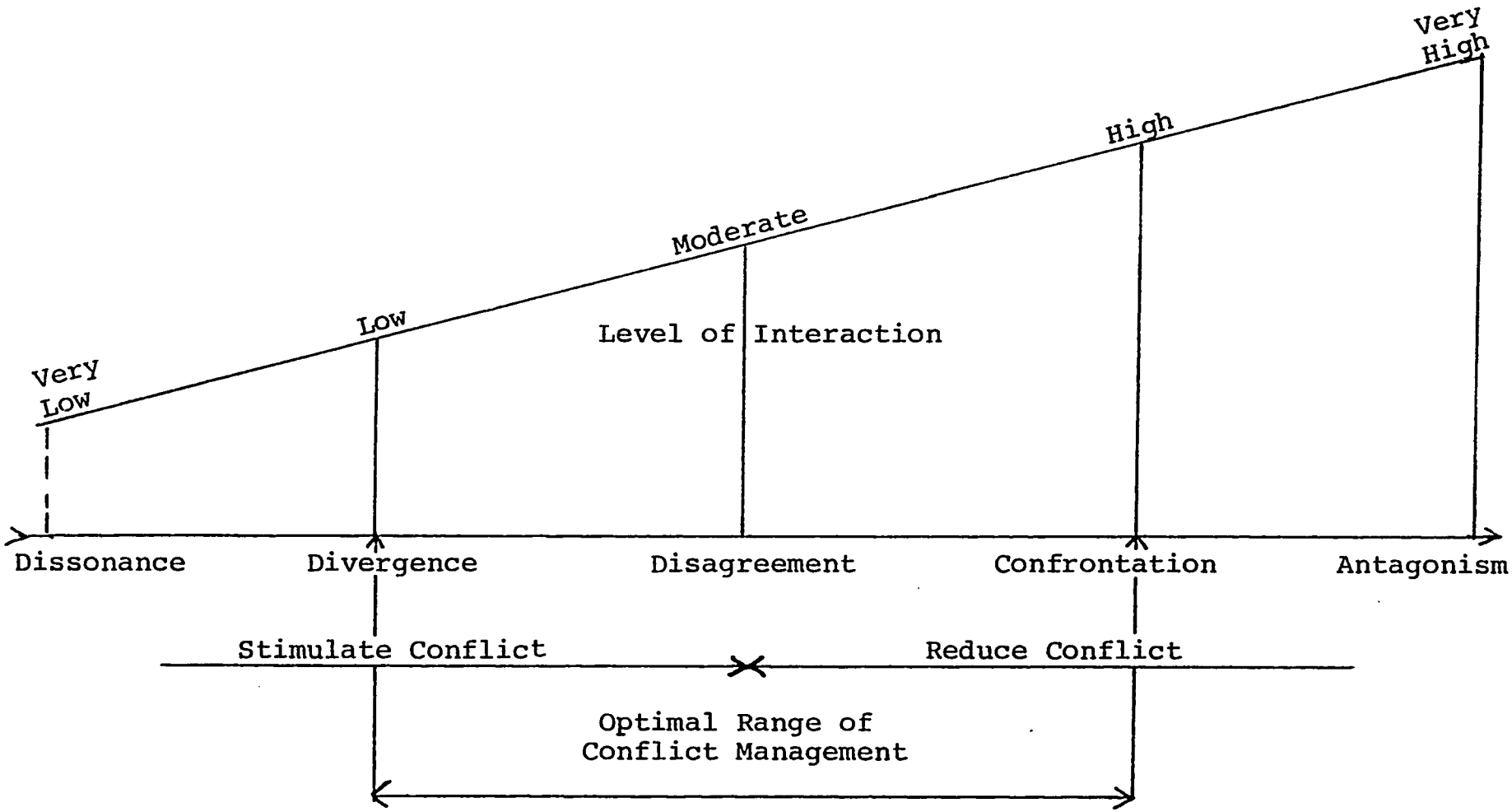
Every conflict episode or situation (but not the conflict itself) has a beginning and an end. The beginning of conflict usually starts with dissonance and progression to antagonism if no conflict management is undertaken. The Conflict Management Continuum includes all levels of conflict states and actions that may develop between individuals, groups, organizations or societies as well as within the last two.

Figure 3 illustrates the Conflict Management Continuum.

As seen from Figure 3 each stage of conflict has a corresponding level of interaction between contradicting opposites. Dissonance and Divergence are defined as "states" and therefore the level of interaction is quite low. The highest level of interaction of course exists at the antagonism stage. It is presumed that the optimal range of conflict management should be between divergence and confrontation, because stimulating conflict from divergence to disagreement can be most productive in utilizing constructive and functional nature of conflict. On the other hand the reduction of conflict level from confrontation to disagreement will reduce the disfunctional and destructive potential of conflict. In addition the expenses needed to deal with the conflict in this region should not be

FIGURE 3

Conflict Management Continuum



excessive. It is also stipulated that there is no need in stimulating conflict between Dissonance and Divergence because in this part of the continuum conflict undergoes a maturation process with contradicting opposites gaining strength and establishing the dominance relationship. If any success is expected radical measures are needed to deal with conflict reduction in the areas between confrontation and antagonism. The most likely outcome of conflict at this stage is a cardinal restructuring of the whole system and its components, possible elimination or exit of one of the opposing sides and enormous losses of human resources and capital.

Thus, the Conflict Management Continuum can be a useful tool to diagnose the level of conflict and its constructive and destructive impact on organizational performance should be developed.

Conflict Management Space

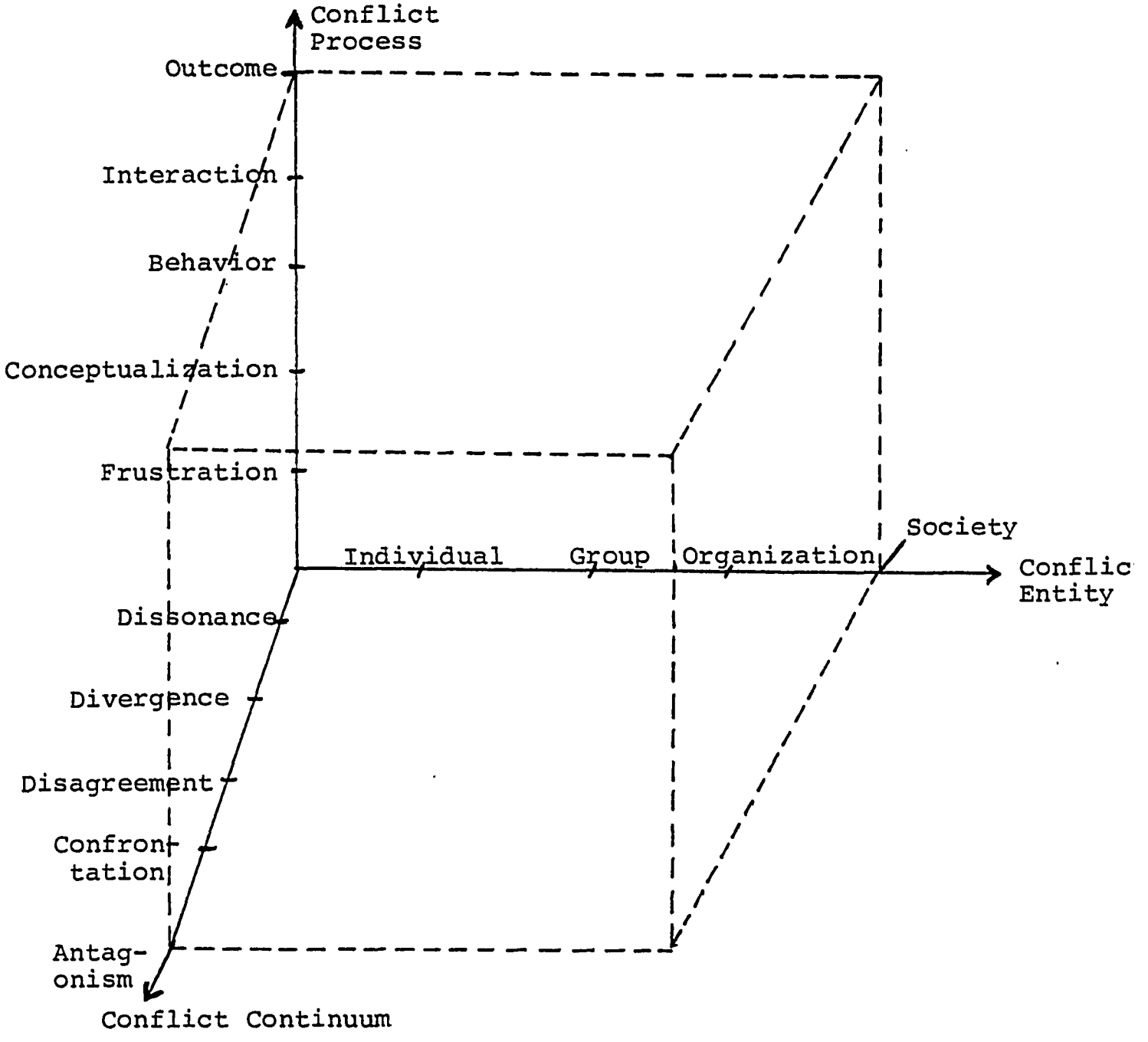
The Conflict Management Continuum (CMC) explains the multilevel nature of the conflict phenomenon only along a single dimension. CMC does not provide us with answers to such questions as:

(1) who or what is the entity in which conflict exists?
or (2) what are the perceptual changes that parallel the development of conflict?

Therefore there is a need for an integrative and holistic understanding of conflict. This may be achieved through a three-dimensional Conflict Management Space (CMS), the concept of which is introduced below. The three vectors of CMS are the conflict continuum, the conflict entity, and the conflict process (Figure 4). We have already discussed the five

FIGURE 4

Conflict Management Space



levels of conflict in CMC: dissonance, divergence, disagreement, confrontation and antagonism. Therefore, let us discuss next the conflict entity vector. There are four basic conflict entities. The first is the individual entity - which is a single human being. The type of conflict which is attributed to an individual is intraindividual. The second conflict entity is the group (primary group) which can be defined as a set of individuals interacting and possessing a common set of group norms in the process of their work or other activities. The type of conflict attributed to the group is known as interpersonal or intragroup. The third conflict entity is the organization. The organization can be defined as a social unit composed of two or more primary groups with a legitimate status, formal structures and control systems. The type of conflict attributed to the organization is interorganizational or intraorganizational. Society is the last entity on the conflict entity vector. Society can be defined as a complex set of individuals, primary groups and organizations integrated by substantial cultural, economic, territorial and behavioral norms. The conflict attributed to society is known as intra-societal conflict between substantial groups or interests, based on economic status, race or particular interests. Inter-society conflict deals with geopolitical conflicts.

The third vector on CMS is the conflict process[1] dealing with individual perceptions about conflict.

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[1] Our explanation of the steps of the conflict process is drawn from Thomas, K. W. "Conflict and Conflict Management" in Marvin D. Dunnette (ed.), Handbook of Industrial and Organizational Psychology, Chicago, Rand McNally, 1976.

> "The conflict process is the sequence of events within a conflict episode...It includes the inner experience of conflict parties - for example, their perceptions and attributions, strategizings, frustrations, angers - as well as their externally visible behaviors." (Thomas, 1979).

Pondy (1967), Walton (1966) and Thomas (1976) note that conflict tends to occur in cycles. Pondy refers to a particular conflict cycle as an episode. Within a conflict relationship, each episode is partially influenced by the results of previous episodes and in its turn lays down the foundation for conflict episodes in the future. What really fascinates us is Pondy's advanced thinking. Probably without having knowledge of Dialectical Materialism he is closer than anybody to a dialectical interpretation of conflict. Pondy's concept of the conflict cycle is very similar to the spiral (cycles on a higher level) theory of development in dialectical materialism. The episode interpretation of conflict is an example of applying the dialectical law of Negation of Negation[1] in the area of conflict.

The conflict process vector includes five steps: Frustration, Conceptualization, Behavior, Interaction, and Outcome (Figure 5).

Thomas (1976) notes that conflicts appear to stem from one party's perception that the other party frustrates the satisfaction of one's concerns (needs, desires, objectives, etc.)

Conceptualization is viewed as a party's conceptualization

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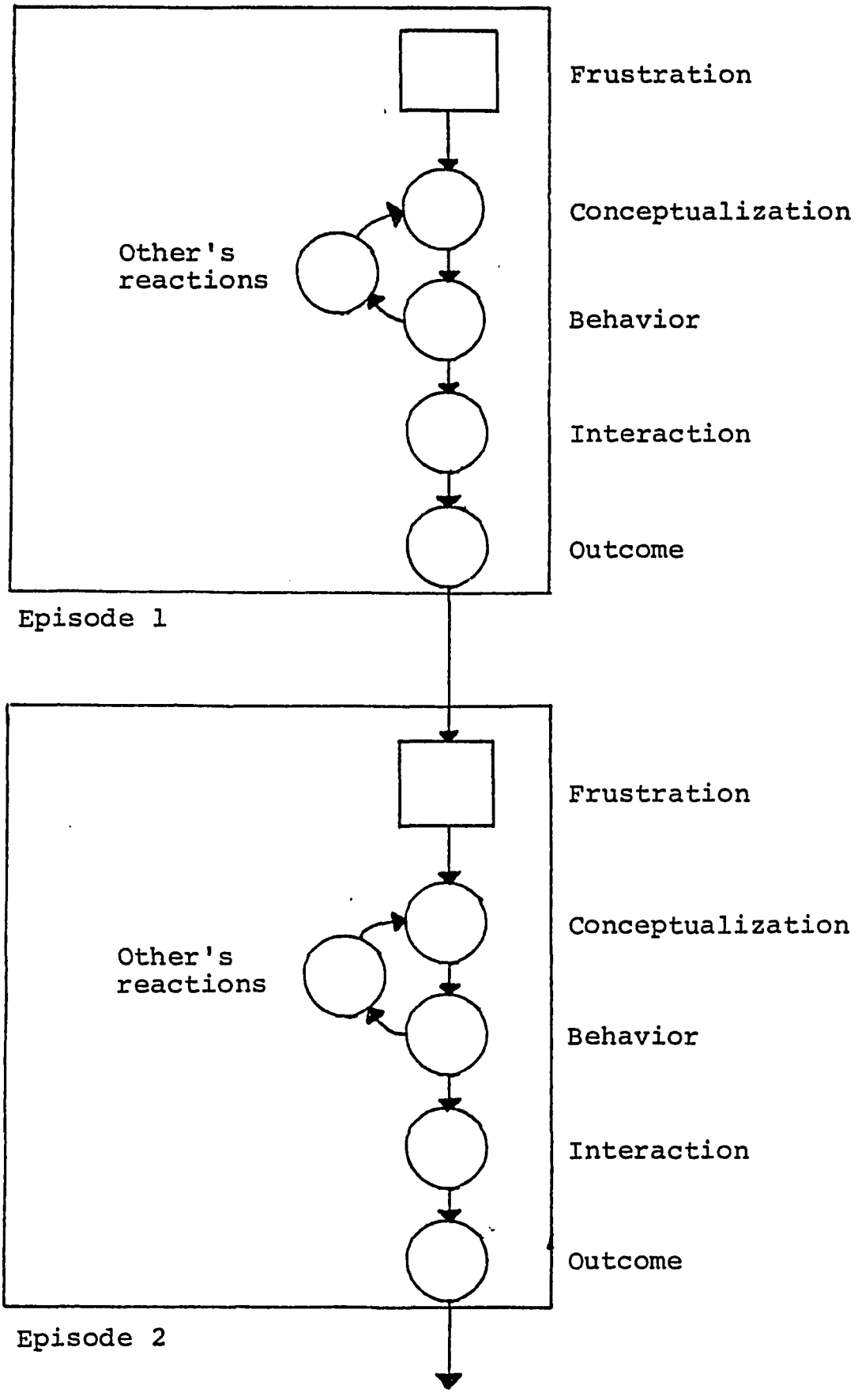
[1] An elaborate discussion of dialectical materialism laws will be undertaken in the next chapter.

FIGURE 5

Process Model of Conflict Episodes



of the situation which includes defining the issue, awareness of alternatives and their outcomes.

The third event after frustration and conceptualization is a party's conflict behavior which includes three components of behavior: orientation, strategic objectives and tactics and the determinants of each.

The fourth step involves interaction which means behavior in response to frustration. At this step the party's behavior is viewed as initiating a sequence of behaviors from the conflicting parties.

The final step in the conflict process is the outcome of the conflict episode. When active interaction between parties involved in a conflict ceases some kind of outcome has occured. This conflict outcome is known in the literature as the "confict aftermath", which involves more than a resolution of the conflict episode. As Thomas (1976) notes:

> "There are residual emotions - frustration from the new agreement, and hostility or mistrust stemming from the other party's behavior during negotiations. There may also be stereotypes, perceptions of incompatibility, long-term goals concerning the other, and so on." (p. 909)

As seen from Figure 5 the outcome of the conflict episode 1 becomes input to conflict episode 2, thus supporting the dialectical approach to conflict.

Thus, the Conflict Management Space with its three vectors (Conflict Continuum, Conflict Entity and Conflict Process) may provide a useful tool for conflict management in organizations:

First it offers an integrated, conceptual view of conflict,

Second, it may help administrators to diagnose the existing stages of conflict in organizations and groups, and

Third, it may be instrumental in developing and implementing strategies for reducing or stimulating conflict as the need arises.

Conflict Redefined

Presentation of the dialectical law of interpretation of opposites as the origin of conflict and the analysis of the conflict literature undertaken in this chapter allows us to redefine some of the definitions of conflict.

First, we would like to present a new definition of conflict:

> Conflict is a natural phenomenon involving individual perceptions of a dialectical process between two or more interacting parties with incompatible goals, ideas, values, behaviors and so on.

The key concepts in this definition are:

1. Natural phenomenon - indicating that conflict is an objective and ever-present concept.
2. Conflict may only exist through individual perceptions; without perceptions there is no conflict.
3. For conflict to take place two or more interacting parties are needed.

In this chapter we also critically examined the "Conflict Resolution" concept. The implications of this concept as used by many authors (Burke, 1970; London and Howat, 1978; Robbins, 1974; etc.) are that conflict can be solved completely, and that there is a beginning and an end to conflict. Therefore

Robbins (1974) has "no conflict" as one of the extreme points on his conflict continuum. Nevertheless many researchers (Lirtzman, 1977; Pondy, 1969; Ryan, 1977) have used conflict reduction instead of conflict resolution probably intuitively understanding the incorrectness of the conflict resolution concept. Therefore we would like to suggest that the "Conflict Resolution" concept be applied only to a specific conflict episode or situation. However, in general, the more appropriate term should be Conflict Reduction.

Finally we would like to define conflict management as a purposeful activity by managers, administrators and executives in determining the optimal range of conflict, implementing various activities and policies directed to increase organizational effectiveness through stimulation or reduction of conflict.

Chapter III

"HARMONIOUS" PROBLEM-SOLVING TECHNOLOGIES

General Background

Increased complexity of modern organizations and rapid changes in economic, social and political environments have created conditions for which the concepts of decision-making and problem-solving become critical. With the increased level of openness business and administrative organizations have grown in size and scale of activities. These developments have led to the creation of more complex forms of organizational structure reflecting the need for new problem-solving technologies. In addition, organizations continue to broaden their boundaries and domain in terms of new materials, technology, markets and geographic location. Governments are also taking on larger programs which require adequate problem-solving technologies.

It is obvious that as the accumulation and specialization of knowledge increases and the larger the organizations become, successful solutions will involve multi-disciplinary and multi-representative group problem-solving processes. This at least partially explains the consistent proliferation of numerous committees, subcommittees and increased frequency and duration of meetings in complex organizations. The pervasive concern of contemporary managers and administrators is to find elaborate and effective methods for making group decisions involving not only their own staff with different backgrounds, interests and perspectives but also attracting various outside interest groups, such as customers, suppliers, experts, community

representatives, and federal and local regulatory agencies. It is evident that traditional problem-solving has become increasingly obsolete in dealing with diversity of interests and with the dramatic flux of social and economic conflicts. Therefore, new approaches are needed for problem-solving, shifting the emphasis from numerical optimization to incorporating social and behavioral parameters that have larger subjective dimensions.

Advocates of the "Decision Theory School" (Stogdill, 1974) stress that the most important functions of managers and executives are problem-solving and decision-making. Problem-solving and decision-making are an integral part of every type of managerial activity (planning, organizing, controlling, administering, etc.) and of every managerial function (production, marketing, finance, personnel etc.). Particularly management researchers focus their attention on ill-structured or "non-programmed" decisions, which Simon (1960) calls "Heuristic" and Thompson (1967) "Judgemental" decisions or problems.

Problems are said to be unstructured when they are ill-defined, ill-confined, unfocused, unique and complex; problems for which there exist no predetermined or explicit set of ordered responses. Conversly, structured problems are well-defined repetitive, well-confined, and programmable in terms of standardized solutions. All levels of management deal with ill-structured problems, which vary with the level of organizational hierarchy. On the lower levels managers are faced with ill-structured operational problems, i.e., high level of absenteeism, production stoppage due to a major failure of

electric equipment, etc. On the higher levels the management deals with ill-structured strategic problems that are consequently important in terms of actions taken, their precedence, and commitment of resources, i.e., penetration into new markets, diversification, extensive capital investments, etc.

Before discussing specific problem-solving technologies we have to develop working definitions and concepts, that will be utilized in this research.

The relationship between decision-making and problem-solving is not a source of universal agreement among management researchers and practitioners. Some of them view the two terms as almost equivalent, others draw rather clear distinctions. Viewing decision-making as a wider concept we agree with the position taken by Fisher (1980) who includes in decision-making some problems while excluding others. The problems excluded from decision-making are the problems that possess only one "best" or "correct" solution determined by external and objective means. Such problems may be represented by a mathematical problem which has one right solution or by a logic puzzle governed by invariable rules of induction and deduction. Problem-solving that is included in decision-making deals with problems that have no solution subject to external validation at least at the moment when decisions are made. The solution to these problems comes only through group acceptance and readiness to carry out the solution. Therefore, the validation of the solution comes only through group consensus and commitment to implement the solution.

Our definitions of the working concepts utilized in this

research are primarily based on those by Bartee (1973). He defines a problem as an unsatisfied need to change a perceived present situation to a perceived desired situation. A solution to a problem is realized when the present and desired situations are perceived to be the same. Perception here means the individual's view of the world. Problem-solving, according to the author, is the activity associated with the change of a problem state to a solution state. Three ways of problem-solving may be distinguished: first, when the perceived present situation is transformed into the perceived desired situation; second, when the perceived desired situation can be transformed into the perceived present situation; and third, a solution is found by a combination of the first two ways.

Problem-solving is conducted through a problem-solving technology. Problem-solving-technology or problem-solving technique or format, is defined here as a formal structure (procedure) for arriving at decisions given some objective. The concept of decision-making refers to a set of activities usually executed by a small group and directed toward determining an appropriate course of action from a set of alternative activities.

Bartee (1973) utilizes the following three dimensions to describe the problem-solving space: Problem taxonomy, problem-solving modes, and problem-solving process.[1] The problem taxonomy includes conceptual, empirical, behavioral and societal problems. Among problem-solving modes he distinguishes among

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[1] For a detailed discussion of these concepts see Bartee (1973, pp. 440-44).

individual, group, organizational, and societal modes. The last dimension - the problem-solving process - consists of genesis, diagnosis, analysis, and synthesis. To complement Bartee's description of problem-solving space we would like to introduce problem-solving technology as a new dimension. Problem-solving technologies may be divided into low, medium, and high structure problem-solving technologies. Another useful concept is conflict. Using this concept we may classify problem-solving technologies into two groups: (1) "Harmonious" problem-solving technologies and (2) Conflict-oriented problem-solving technologies. The first group of problem-solving technologies reflects the "consensus" or "equilibrium" period in the development of organizational theory. At the present time we may distinguish three major technologies belonging to this group: brainstorming,[2] nominal group technique, and delphi technique. The conflict-based problem-solving technologies include those utilized in this research — Dialectical problem-solving technology and Devil's advocate problem-solving technology.

In this work we are primarily interested in problem-solving technologies which are different from bargaining or negotiation type of decision-making. Delbecq, et. al. (1975) define bargaining or negotiation as a situation "in which opposing factions differing in norms, values, or vested interests stand in opposition to each other concerning either ends, means, or both". However, there is a more substantive

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[2] Brainstorming includes both individual brainstorming and group brainstorming.

difference between problem-solving and bargaining. The bargaining type of decision-making occurs when there exists a fixed "pie" or gain available to the opposing parties and their relative shares are not yet decided. In this case, each party tries to change the perceptions of the counterparts to accept their desired situation. In problem-solving the joint gain or pie is not fixed; it varies with the ability of the participants to find new mechanisms and ways to increase the size of the pie. Under problem-solving the total payoffs generally and payoffs of each side specifically are a function of interactive processes in a group.

Brainstorming

Brainstorming, sometimes also referred to as creative problem-solving was developed by Osborne (1957). In the late 1950s and early 1960s brainstorming acquired a widespread popularity. This technique was utilized in a number of large companies, in some units of the U.S. Army, Air Force and Navy and in various federal and state agencies. During this period brainstorming was also actively popularized and researched in a number of colleges and universities.

The purpose of brainstorming is to free individuals participating in group problem-solving from inhibition, self-criticism, and criticism by others in order that they may produce as many creative ideas as possible in response to a specific problem. The implicit assumption of such a procedure is that within a group the probability of finding an effective solution to a problem or viable position on a controversial issue is substantially increased.

The cornerstones of the brainstorming process are four basic rules, designed to suppress or at least to delay to the end of the process any criticism or disagreement between the members of the group:

1. Criticism is Ruled Out. This means that all critical judgements or opinions about the quality of ideas or proposals are suppressed or held until all members have expressed their ideas.
2. "Free-wheeling" is Welcomed. The wilder the idea the better.
3. Quantity is Wanted. The larger the number of ideas the more likely the group will come up with an effective decision.
4. Combinations and Improvements are Sought. This rule indicates that participants in addition to their own ideas should suggest how ideas of other members of the team can be improved or combined to produce an effective solution to a problem.

Complimentary to these rules, brainstorming also involves collaboration and facilitation in attacking the problem. According to Osborne (1957) the value of brainstorming lies in stimulating the flow of ideas. In the brainstorming technique an individual apparently is able to utilize his intuitive abilities more fully than otherwise. The suppression of criticism probably also increases the number of ideas without paying too much attention to their quality.

The original work of Osborne underwent various modifications. The method most widely used in research has been the

Nominal Group Process. Under the nominal group process the individuals perform their task in the presence of each other but write their ideas and proposals independently without talking about them. The following three dependent variables (measures) have been used in studies of the brainstorming technique: (1) the average total number of ideas; (2) the average number of unique ideas; and (3) the quality of ideas produced.

Osborne (1957) on the basis of his experiments stated that "the average person can think up twice as many ideas when working with a group than when working alone" (pp. 228-229). However, earlier empirical studies were not supportive of Osborne's ideas. Taylor, Berry and Block (1958) conducted an experiment to determine whether group participation when using the brainstorming technique facilitates or inhibits creative thinking.

Ninety six subjects were divided into two groups: 12 teams of four individuals each and a pool of 48 individuals. Specially designed problems - "Tourist", "Thumbs", and "Education" - were selected and pretested for the experiment. After the groups and the individuals independently wrote the solutions, the 48 individual subjects working independently were randomly assigned to 12 nominal groups of four. In these randomly "pooled" nominal groups the performance of the subjects was not facilitated or inhibited because of the nature of the nominal group process. Analysis of the results showed that for each of the three problems the nominal teams produced twice as many ideas as the real groups. The quality of the ideas

in the nominal groups also was higher than it was in the real teams. Taylor, et. al. (1958) concluded:

> "To the extent that the results can be generalized it must be concluded that group participation, when using brainstorming, inhibits creative thinking." (p. 43)

Dunnette, Campbell, and Jaastad (1963) replicated the Taylor, et. al. (1958) study with industrial employees as subjects by exposing both groups (real and nominal) to both the individual and group brainstorming sessions. The results were similar to those of Taylor, et. al. (1958). Individual brainstorming showed superior results in comparison to group brainstorming both in quality and quantity of ideas.

In a study similar to Taylor, et. al. (1958) Parnes and Meadow (1963) compared nominal groups of subjects who worked under conventional procedures (critical thinking calling for quality solutions as opposed to quantity) with real groups employing deferred judgement. The real groups using deferred judgement significantly out-performed the nominal groups using critical problem-solving in terms of the total number of good ideas. In a second study the subjects in nominal groups were asked to use deferred judgement. However, the findings from this study failed to support Taylor, et. al. (1958) results because no significant difference was found between the two treatments.

In an earlier study Meadow, Parnes and Reese (1959) studied the effects of brainstorming and critical judgement on problem-solving. The findings of this study as well as those of

Bouchard (1969), Weiskopf-Joelson and Eliseo (1961) indicated that results under brainstorming are significantly superior to those under critical judgement.

Rotter and Portugal (1969) in a study similar to Taylor, et. al. (1958) and Dunnette, et. al. (1963) found that individuals working alone produced more unique ideas than individuals working as a group, individuals working for a short period of time alone and then as a group, and individuals working first as a group and then alone. In the last two combined treatments (nominal and interacting processes) the individuals were more productive when they worked alone.

Hall, Mouton and Blake (1963) and Osborne (1957) found that brainstorming groups were superior in comparison to an equal number of brainstorming individuals in terms of the average number of ideas produced. However, these findings were not supported by Bouchard (1969), who found no difference between a combination of group and individual brainstorming and simply individual brainstorming.

Bouchard (1969), Bouchard and Hare (1970), Campbell (1968), Leader (1963), and Vroom, Grant, and Cotton (1969) found that nominal groups were significantly superior to interacting groups in terms of the quality of ideas produced, and the average number of total and unique ideas produced.

The examination of the literature on brainstorming leads to a conclusion that when the group task is to generate ideas or more generally information on a specific problem or issue the interacting process inhibits creative thinking in the groups. However, in making this statement we have to consider

several methodological problems existing in the brainstorming research.

Two major points of criticism were raised in relation to the Taylor, et. al. study (1958):

1. Utilization of students-subjects led to creation of ad hoc teams. It is possible that real functioning groups made up from employees and their co-workers would exhibit better performance in group problem-solving (Hall and Williams, 1966).
2. The design of the study did not test each subject in both individual and group brainstorming. Therefore, the experiment did not provide an opportunity to examine the comparative performance for the same subject in both treatments.

Osborne (1957) suggested that the optimal size of a group is 12 persons, and that at least the group leader should have extensive training in brainstorming. It can also be conjectured that the advantage of nominal groups over interacting groups is attributed to these variables. Both, Taylor, et. al. (1958) and Dunnette, et. al. (1963) used groups with four subjects per group and neither trained subjects in brainstorming.

Brainstorming can be viewed as a low structure problem-solving technology. The brainstorming technique provides individuals with only the principles but not with a step-by-step procedure for group problem-solving. Therefore, instead of an organized problem-solving process these teams tend to shift towards unorganized, spontaneous modes of interaction with dominating individuals in many cases. In addition, the almost

complete elimination of criticism as a form of conflict expression between ideas and views probably affects the brainstorming technique. As a result of these deficiencies brainstorming groups have a focus effect, that is the groups tend to pursue a single train of thought for a long period of time (Dunnette, et. al. 1963, Taylor, et. al., 1958) instead of considering several viable alternatives.

Examination of the literature on brainstorming shows no example of field studies involving managers or executives as problem-solvers and business cases or problems as media for experimentation. In addition the extrapolation of the results from laboratory experiments always leaves many questions unanswered when it concerns real business organizations.

The Dunnette, et. al. findings (1963) suggested that an optional sequence for combining individual and group work would be group problem-solving followed by individual problem-solving. An empirical test of this idea was conducted by Brilhart and Jochem (1964) who compared three different problem-solving procedures. Each of these procedures employed three steps: (a) analysis of the problem; (b) brainstorming using Osborne's instructions and (c) setting up of standards and criteria to evaluate ideas. Procedure I consisted of the abc sequence; Procedure II - acb; and, Procedure III - a(bc).[3] Using the total number of ideas as a dependent variable no significant difference was found between patterns I and III. Brilhart and Jochem (1964) came to an interesting conclusion

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[3] Steps b and c were combined into one step - generation of ideas and their evaluation at the same time.

that patterns which separate ideation and evaluation are superior to patterns which combine them.

The declining popularity of brainstorming and the lack of hard empirical evidence of scientific validity shifted the attention of researchers towards new group problem-solving techniques such as the Nominal Group Technique and the Delphi Method.

Before discussing the Nominal Group Technique we have to distinguish between apparently similar concepts: Nominal Group Process and Nominal Group Technique. Nominal Group Process is a process whereby individuals work alone (in the presence or absence of other individuals) and results of their activity are later combined and viewed as if these individuals had worked together. Bouchard and Hare (1970) used the term pooled individual effort to describe this process. Nominal Group Technique, defined in the next section, is a considerably wider concept and includes both nominal and interacting group processes.

Nominal Group Technique

Procedure

Examination of the literature on small group problem-solving indicates the existence of two distinct phases. The fact-finding (ideation) phase and the evaluation (solution-getting) phase. The fact-finding phase involves problem identification and data generation about the existing problem. The evaluation phase involves information synthesis, examination of and choosing among strategic elements of a problem or component elements of alternative solutions (Delbecq, et. al.

1975). It appears that problem-solving processes which distinguish problem identification from problem solution are superior to problem-solving processes which combine them (Dunnette, et. al. 1963; Brilhart and Jochem, 1964; Maier and Hoffman, 1957). It was suggested that there exists a human tendency to solve the problem even before the problem is understood. This tendency, among others, not only inhibits problem-solving but seems to become stronger where there is anxiety over the nature of the decision (Maier and Hoffman, 1960). The research findings suggest that in order to minimize the influence of inhibiting factors it is necessary to treat the two phases of problem-solving as two different activities that require different roles and processes (Bales and Strodtbeck, 1969; Simon and Newell, 1958). It has been found that interacting group processes facilitate individuals to consider various dimensions of a problem and help the integration and evaluation of different solutions.

On the other hand, the nominal group process is more effective for generating information and for fact-finding about the problem variants (Zagona et. al., 1966). The need for a differential approach to the two phases of problem-solving has been incorporated in the Nominal Group Technique (NGT), developed by André D. Delbecq and Andrew H. Van de Ven in 1968. According to the authors NGT was developed from socio-psychological studies of decision conferences, studies of industrial engineering problems of program design in the NASA aerospace field, and social work studies of citizen participation in program planning. The authors state that the optimal

combination of group processes for a problem-solving committee is:

1. "The use of nominal group processes for fact-finding, idea generation, or initial subjective probability estimation in the first phase of committee work.
2. The use of structured feedback and interacting discussion in the second phase; and
3. Nominal group voting for final independent individual judgements in the final phase." (Delbecq and Van de Ven 1971, p. 203)

The Nominal Group Technique incorporates both interacting and nominal processes. However, before outlining the procedural steps of this problem-solving technology we have to elaborate on the concept of interacting process.

Van de Ven (1974) defines interacting problem-solving technology as a conventional discussion group format, which is a generally unstructured, free-flowing meeting, with minimal direction by the leader, presenting to the group only the issues of the problem. Interacting group problem-solving is the traditional and most widely used approach in small group decision-making. The interacting procedure usually involves several steps:

1. Presentation of the problem by the group leader;
2. Unstructured group discussion to generate information and pool different opinions among members of the group,
3. Majority voting procedure, priority or consensus decision.

NGT is a structured problem-solving technology which consists of the four following steps:

1. Silent generation of ideas in writing
2. Round-robin feedback from group members to record each idea in a terse phrase on a flip chart
3. Discussion of each recorded idea for clarification and evaluation
4. Individual voting on priority ideas with the group decision being mathematically derived through rank-ordering or rating.

First, seven to ten individuals sit around a table quietly and independently write their ideas on the problem or task. The individuals use the nominal process without interacting with each other for five to ten minutes.

Second, a recorded round-robin procedure follows in which each member of the group presents one idea at a time to the group without discussion. An average of eighteen to twenty-five ideas are summarized in a concise statement and recorded on a blackboard or a flip chart in full view of all members.

Third, after the ideas are presented and registered, a discussion of the recorded ideas is undertaken for purpose of clarification and evaluation by discussing one idea at a time.

Fourth, after all ideas are discussed the meeting concludes by independent voting on priorities by individuals through a decision rule accepted by the group (i.e. rank-ordering, rating procedure, majority voting, etc.). The group decision is the pooled outcome of individual votes.

The objectives of NGT, according to the authors of this problem-solving technology are as follows:

1. To assure different processes in order to stimulate creativity in each phase of problem-solving.
2. To provide balance and equitable participation among individuals in all groups.
3. To incorporate a mathematical voting technique in the aggregation of group judgement.

Gustafson et. al. (1973) have stressed two major advantages of NGT:

First, it utilizes different group processes for different phases: independent idea generation, structured feedback, and independent mathematical judgement;

Second, it provides equal attention and opportunity for each individual to not only contribute ideas but to incorporate these ideas into the group frame of reference. Independent idea-generation through the nominal process, round-robin recording and sequential discussion, and finally independent voting all increase individual participation.

Among other advantages that we would like to emphasize are the following:

1. NGT offers both social reinforcement and task accomplishment to participants through balancing and maintaining social-emotional group roles and performance of task-instrumental roles.
2. A final outcome of the NGT process is a sense of fulfillment and accomplishment and interest in the future phases of problem-solving.

3. The NGT process produces a high quantity of ideas.

Nevertheless, there are some disadvantages associated with the NGT technology:

1. NGT is not a spontaneous meeting. Extensive pre-planning is required to clarify the information desired from the group and provide the necessary supplies.
2. NGT is usually limited to a single-purpose and single-topic meeting. Therefore, it is practically impossible to make an adjustment or change the theme in the middle of discussions.
3. The structured format of NGT requires conformative behavior from the participants, which is not readily accepted by untrained individuals.

Research Results

In recent years NGT has been applied in health, social service, education, industry, and public administration organizations (Delbecq and Van de Ven, 1971, 1970; Delbecq, et. al., 1975; Van de Ven and Delbecq, 1974, 1972a, 1972b, 1971). Practical application of NGT in various areas of activity has stimulated interest among researchers and academicians. Therefore, an in-depth analysis of the research results in now in order.

Van de Ven and Delbecq (1971) have enumerated a number of studies that supposedly show the superiority of NGT over brainstorming and interacting groups in terms of the average number of unique ideas, and the quality of ideas produced. However, it should be noted that the authors actually refer

not to NGT technology but to "nominal" groups, which are "pooled-individual response groups".

Gustafson, et. al. (1973) compared the effectiveness of independent individuals, interacting individuals, NGT, and Delphi processes on a problem of subjective probability estimation (i.e., What is the probability that it will rain tomorrow?). The researchers found NGT groups outperformed all other groups in terms of lowest percentage of error and variability of estimation. Interacting individuals outperformed independent individuals and Delphi groups, and independent individuals outperformed Delphi groups. These findings led the authors to a conclusion that the type of problem-solving technology moderates decision quality in a subjective probability estimation problem.

Van de Ven and Delbecq (1974) have investigated the quantity of unique ideas and satisfaction with the decision-making performance using sixty seven-member heterogeneous groups (twenty NGT, twenty Delphi and twenty interacting groups). The selected individuals were dormitory students, student-housing administrators, faculty, and academic administrators. The subjects were asked to define the job description of a university dormitory counselor. No difference was found in the quantity of ideas between NGT and Delphi technologies and the NGT groups generated significantly ($p<.01$) more unique ideas than interacting groups. The NGT groups also had a higher satisfaction ($p<.01$) with the decision-making process. There was no difference between the Delphi and interacting groups.

Green (1975) found no significant differences between NGT and interacting groups in the number of items generated and number of unique responses under permissive, democratic and authoritarian leadership styles; thus, contradicting the findings of previous studies. Green indicated that there is a need to study the conditions under which NGT may or may not be superior. He specifically suggested investigation of (1) the participants' knowledge of facts that are the object of the fact-finding task, and (2) the participants' willingness to communicate.

Carr, et. al. (1976) studied NGT, brainstorming, interacting, and pooled-individual groups in three phases of the problem-solving process. The following tasks were employed in each of the three phases:

1. Problem-identification Phase: To identify the problems of academic life that students-subjects encounter at the university.
2. Listing-of-barriers Phase: To name barriers to achieving the goal of completely safe highway travel.
3. Solution-Generation Phase: To list solutions to the problem of books and journals being damaged and stolen from the university library.

The quality of ideas was judged by a special panel of judges. Again the results were not supportive of NGT, which was significantly inferior to pooled-individual efforts in terms of the quantity of ideas. No significant difference was found between NGT and pooled-individual groups in eight out of nine quality criteria. However, in another study

Carr, et. al. (1977) using students as subjects asked them to list the barriers to achieving totally safe highway travel. Each idea was evaluated on clarity, centrality, and frequency. Also a composite quality score was derived by summing the evaluations of the three criteria. Although no significant quality difference was found, in terms of unique ideas the NGT groups were superior ($p<.05$).

Frederick (1976) compared performance, personality characteristics and perceived satisfaction in NGT and interacting groups in the problem analysis stage of the problem-solving process. The 140 subjects-students from Mississippi State University were randomly assigned to 10 NGT and 10 interacting groups. The subjects in both treatments were required to complete a task designed to generate a response indicative of any circumstance or force that prevented a group from attaining a stated goal. Among the interesting findings of this study were the following: (1) No significant difference was found in terms of quantity or quality of responses between NGT and interacting groups; (2) the NGT groups contained a significantly greater number of high satisfaction individuals than did the interacting groups. In addition, the interacting groups contained a greater number of low satisfaction individuals than NGT groups.

Eldridge (1977) looked at the effects of NGT and brainstorming decision-making procedures on group productivity in a complete process, from the formation of the problem to the implementation of the final solution. Forty-nine groups containing four subjects - undergraduate students - followed

three different decision-making procedures (NGT, interacting, and control groups[4]). The results of this study were inconsistent. The NGT and brainstorming groups generated not only more alternatives but better alternatives. However, significant difference was found between NGT, brainstorming and control groups in terms of quality of the final choice, group participation, group commitment or productivity.

Geren (1978) studied the relative effectiveness of interaction, NGT and modified nominal group process in decision-making replicating research by Delbecq and Van de Ven (1971, 1974). Fifteen groups of seven participants each were randomly selected from five public high schools in Atlanta, Georgia. The independent variables in this study were the three problem-solving technologies, the classification of group participants, and Public High Schools. The study was designed to test the differences between three problem-solving technologies in terms of quantity of information, creativity of ideas, and participant's satisfaction. The reported results show that a modified nominal process generated a significantly greater number of distinct ideas for decision-making than NGT and interacting groups. However, no significant differences were found between the problem-solving technologies and pooled creativity scores, and between technologies and perceived satisfaction scores.

Burton, et. al. (1979) studied interacting and NGT technologies with respect to their ability to minimize

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[4] Control groups were allowed to develop their own methods or ways of solution, with no specific structure imposed.

inhibiting influences of conformity and self-weighting. The prior research suggested that interacting or brainstorming groups are inhibited by pressures of conformity and the self-weighting effect under which individuals tend to participate only to the extent that they perceive themselves equally knowledgeable with other group members (Kelly and Thibaut, 1954; Hoffman, 1965). One hundred participants at a workshop on group decision-making were divided into 10 interacting and 10 NGT groups with five members in a group. All groups were asked to generate a list of ideas and facts relevant to solving an unstructured case. The NGT groups were significantly superior ($p<.05$) on quantity and practicality of ideas generated. No significant difference was found in the number of unique ideas. The study also suggested that the restrictive nature of conformity and self-weighting can be drastically reduced by utilization of NGT.

The studies discussed up to this point used unstructured tasks, i.e. opened-ended problems or cases. At the present time, we know of only two studies dealing with structured task problems. The advantage of structured problems as compared to unstructured is that they alleviate the difficulties with criterion assessment. Nemiroff, Pasmore, and Ford (1976) compared consensus, NGT, and conventional interacting decision-making in established and ad hoc groups in terms of decision quality, member attitudes, and time taken to accomplish the task. The results indicate that decisions of the consensus groups were significantly better ($p<.01$) than the decisions of the NGT groups and interacting groups with no

difference between the last two treatments. Consensus groups also reported significantly ($p<.05$) higher satisfaction with the quantity and quality of their participation than the remaining groups with no difference between nominal and interacting groups. Significantly less time ($p<.01$) was needed to complete the task by the nominal groups than by other groups. Established groups needed more time to finish the task as compared to ad hoc groups. The interacting ad hoc groups needed slightly more time than interacting established groups.

Herbert and Yost (1979) applied a structured problem to investigate NGT and interacting consensus groups in terms of decision quality, utilization of best resources, and improvement in the quality over average member-decision quality. The researchers rejected Van de Ven and Delbecq's notions that nominal groups are useful only in generating ideas and that interacting groups are more effective in evaluating and making decisions. The NGT groups were superior ($p<.005$) on all three above mentioned criteria. These findings contradict the results of the Nemiroff, et. al. study (1976).

Delphi Technique

The Delphi technique was developed at the Rand Corporation by Dalkey and his associates. With the first publications in the early 1960s hundreds of Delphi studies were sponsored by corporate, government, and academic organizations and it became widely popularized not only in the United States, but also in Europe, Japan and the Soviet Union. Basically Delphi is an attempt to elicit expert opinion in a systematic way for

useful results. The usual Delphi process consists of administering specially designed questionnaires in several iterations to individual experts, safeguarding the anonymity of the responses.

Turoff (1970) defines Delphi as a technique which provides for the systematic solicitation and collation of judgements on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses.

Two major ingredients of the Delphi Technique are consensus of participants and heuristic goals. According to Sackman (1975):

> "The consensus intent of Delphi is typically oriented toward controlled and rational exchange of iterated opinion leading toward optimal convergence of opinion achievable within the framework of the technique. The heuristic objective views Delphi as an educational technique to help participants, the director, and users to explore a problem area more thoroughly, leading to greater insight on the target problem" (p. 8).

The Delphi technique may be used for a number of possible objectives:

1. To determine or develop a set of possible alternatives or solutions for a specific problem.
2. To accumulate information that may lead to a consensus among the participants in the process.
3. To integrate expert judgements or opinions on a topic that cuts across various disciplines and areas of knowledge.
4. To investigate or to examine various assumptions or information leading to different judgements.

5. To establish subjective probability values of the occurence of future events.

The development and early studies of Delphi conducted at Rand were oriented towards scientific, defense and technological forecasting (Campbell, 1966; Dalkey, 1968, Dalkey and Helmer, 1963). In later years the Delphi technique was applied in diverse areas including forecasting of such social processes as human attitudes and values (Reisman, 1969) and quality of life (Dalkey, et. al., 1972). The application of the Delphi technique is so diverse that at the present time it may range from forecasting of specified, long-term or short-term events, to accumulation of quantitative estimates (profits, sales, future production, etc.), and even establishing qualitative scales of satisfaction, agreement, preference, etc.

A considerable contribution to the Delphi technique was made by Turoff (1971) who expanded the scope of this method as a general-purpose vehicle for distributed human communication and consensus, and for group problem-solving.

Though there are many variations in the process of administering the Delphi procedure, the basic approach utilized in problem-solving generally involves two iterations of questionnaires and feedback reports.

First, a questionnaire specially designed by a staff member in collaboration with the problem-solvers is distributed by mail to a group of participants in order to obtain information on a problem or issue. The participants independently generate ideas by answering the questionnaire. The return responses are summarized into a feedback report.

Second, the feedback report is mailed back to the participants along with a second questionnaire which is developed for a more indepth inquiry into the ideas generated by the participants in the first questionnaire. Receiving the feedback report and the second questionnaire the participants again independently respond to it. Usually the participants are asked to vote independently on priority ideas which are included in the feedback report and to submit their second responses. The final stage is a summarized report of the study which is usually mailed to the participants. In this report the participants, usually experts, concur in a particular application area, where none existed before. This presumes that participants of a Delphi study are experts in their fields.

The proponents of the Delphi technique believe that this approach has many characteristics which facilitate problem-solving performance:

1. The high-quality ideas produced by Delphi because isolated and independent generation of idea in writing forces the panelists to think in terms of complexities and generalities of the problem.
2. The anonymity and isolation of respondents provides freedom from inhibiting factors, such as conformity or self-weighting.
3. Equality of participants' responses is stimulated through simple pooling of independent ideas and judgements.
4. The Delphi technique provides an opportunity to obtain

information and responses from experts who are geographically isolated or cannot be brought together.

In the opinion of Weaver (1972), who conducted probably the most critical review of Delphi literature, the advantages of this method are primarily low cost, diversified application to almost any area where "experts" can be found, ease of administration, minimal time needed on the part of the director and participants, the simplicity, popularity, and directness of the method.

However, Sackman (1975) stated "those and related advantages are characteristically obtained by unwarranted assumptions in method and approach and by seriously compromising the reliability, validity and integrity of final results" (p. 32). Sackman flatly states that conventional Delphi neglects virtually every major area of professional standards for questionnaire design, administration, application, and validation. Among the major characteristics which inhibit the problem-solving process and performance are:

1. Delphi anonymity reinforces unaccountability in method and findings and inhibits exploratory thinking.
2. There is a lack of social-emotional involvement in interacting processes of problem-solving creating a feeling of separation from the problem-solving effort.
3. The absence of verbal communication on the feedback report leads to interpretation difficulties among the participants.
4. Incompatible ideas on the feedback report are controlled

by a simple pooling and adding the votes of participants, thus creating a halo effect and leading to ambiguous conclusions.

Though popularity of Delphi has been enormous, only a few studies have compared it with other known problem-solving technologies.

Dalkey (1969) compared anonymous Delphi technique with a face-to-face interaction for the almanac-type items. He found a tendency towards a more accurate opinion in the anonymous setting though it was not statistically significant.

Farquhar (1970) used an estimation of software manpower requirements to compare interacting groups and the Delphi method. His findings were consistently in favor of interacting groups, which had substantially better results than the Delphi group of participants.

Campbell in his dissertation (1966), which is frequently cited by supporters of Delphi as definitive evidence of its superiority over other techniques, compared face-to-face confrontation in traditional expert panels with the Delphi approach in terms of forecasting accuracy for sixteen short-term statistical economic indicators. He found that forecasting accuracy in Delphi groups was significantly better than in interaction groups. However, as Sackman (1975) notes, confrontation groups were force-fitted into a Delphi-type format to make quantitative forecasts more directly comparable, which probably undermined the motivation and morale to the point where the meetings became counter-productive and the comparison spurious. In addition, Campbell's control groups were

leaderless; that probably led to unnecessary competition and struggle. Therefore, the Campbell study cannot be viewed as empirically valid in comparing the performance effectiveness of Delphi and interacting groups.

We have already discussed in the previous section the comparison of Delphi technology with NGT and interacting groups. Gustafson, et. al. (1973) study, the Delphi method had the poorest performance as compared to other technologies. In addition, it appeared that feedback was having little positive if not deteriorating effect on the Delphi group estimates. In Van de Ven and Delbecq experiment (1974) the Delphi groups generated significantly more ideas ($p<.01$) than interacting groups with no difference between NGT and Delphi groups. However, in terms of satisfaction no difference was found between interacting and Delphi groups with individuals in NGT groups being considerably satisfied with problem-solving as compared to individuals in Delphi groups.

Ronbaugh (1976) used the Delphi technique and social judgement analysis to test and compare two unstructured interactive methods in controlled experimental settings with regard to their potential to reduce group conflict and to provide for group decisions of high quality. The findings of this study generally supported the research hypothesis that social judgement analysis is a significantly better method of conflict management than the Delphi technique and decisions with the help of the first approach were more acceptable to members than decisions made by individuals in Delphi groups. However,

no difference between the two approaches was found with respect to the quality of the final decision.

Determinants of "Harmonious" Problem-Solving Technologies

In recent years the existing knowledge about decision-making and problem-solving has been accumulating very rapidly. However, this knowledge is far from complete. There still exist many unanswered questions, e.g. why different decisions are made by similar groups in similar situations; why the same group does not come out with stable problem solutions under similar conditions; how and why different problem-solving technologies affect the effectiveness of group decisions; what are the factors or intervening variables that influence the problem-solving process.

Our examination of existing research indicates that empirical evidence is quite supportive of NGT as compared to interacting and Delphi problem-solving technologies. In most of the above analyzed studies the NGT groups outperformed interacting and Delphi groups in terms of quality and quantity of solutions, subjects satisfaction with the problem-solving technology, etc. Nevertheless, in quite a few studies we have found no significant difference between NGT and other problem-solving technologies. Therefore, it is necessary (1) to compare NGT and Delphi problem-solving technologies and (2) to derive and critically review a set of determinants characterizing harmonious problem-solving technologies.

A comparison of NGT and Delphi problem-solving technologies suggests that these two approaches have some similarities.

1. Both technologies rely on independent individual work

in the fact-finding or idea generation phase of the problem-solving process.

2. Pooling of individual judgements takes place in NGT and Delphi technologies. In Delphi this function is performed by the staff conducting the study. In NGT technology the individual judgement is pooled through a round-robin interacting process.
3. Idea evaluation is an integral element in both Delphi and NGT problem-solving technologies. In NGT it is done through a sequential discussion of each registered proposal; in Delphi by independent reading, evaluation, and interpretation of feedback reports, provided to Delphi participants by the staff.
4. In both cases a mathematical voting procedure aggregates individual judgement for the outcome of group problem-solving.

Among the major differences between NGT and Delphi problem-solving technologies we have to distinguish the following:

1. NGT group members become acquainted with each other and therefore feel some degree of accountability as opposed to Delphi participants who operate in complete isolation and therefore often feel nonaccountable for their responses.
2. In NGT the communication occurs directly between the members of each group but in Delphi there is an intermediate communication link - the staff members who compile and administer the questionnaire and feedback reports.

3. In NGT the groups meet face to face and therefore social-emotional involvement exists; in Delphi all participants respond in anonymity and there is no social-emotional involvement.

An extensive survey of research dealing with harmonious group problem-solving technologies allows us to distinguish four groups (individual, group, task, and process) of determinants or factors which affect the effectiveness of group problem-solving.

Individual Determinants

This group of determinants includes personality characteristics of the individual and the amount of training the participants have had. The relationship of personality characteristics and performance in small problem-solving groups can be dealt with in three ways. First, it is presumed that certain personality characteristics or personality syndromes may facilitate effective group performance and the larger the proportion of individuals with this characteristic in the group the more likely the group will be effective (Cattell, Saunders, and Stice, 1953; Fiedler, Meuwese and Oonk, 1961).

Second, certain aspects of personality can create a potential area of trouble in group problem-solving because they may introduce additional, interpersonal obstacles. (Collins and Guetzkow, 1964). One specific personality determinant which appears to be dysfunctional to group effectiveness is self-oriented individual behavior which according to Kenfer and Bass (1963) "turned off" disagreeing partners and

permitted agreeing ones to talk more. This decreases the effectiveness of problem-solving because the number and diversity of original proposals becomes considerably reduced.

Third, there is a definite view that groups composed of individuals with different personality characteristics are complementary to each other and therefore these diversified personality characteristics may facilitate effective group performance (Hoffman and Maier, 1961).

We also have to remember that personality characteristics may interact with both the type of the task and the group problem-solving technology. For example, a shy, submissive, careful, risk-averting and methodical person probably would be very unproductive in a brainstorming group dealing with subjective (human relations) problems as opposed to a highly structured problem-solving technology dealing with objective type of problems.

The need to study personal characteristics is stressed by Cronbach (1957) who stated that:

> "Ultimately we should design treatments, not to fit the average person, but to fit groups of students with particular aptitude patterns. Conversely, we should seek out the aptitudes which correspond to (interact with) modifiable aspects of the treatment." (p. 681)

The evidence accumulated from the empirical studies also indicates that individuals trained in group problem-solving usually perform better than untrained individuals. Hall and Williams (1970) found that groups composed of individuals trained in decision-making processes consistently performed more effectively than untrained groups on measures of decision quality, best utilization of resources and creativity.

It is necessary to note that NGT and Delphi problem-solving technologies have not been studied with reference to personality characteristics or level of individual training in group problem-solving processes. Therefore, future studies on NGT or any other new problem-solving technologies should incorporate into its design the effect of the personality factors and training levels on group problem-solving effectiveness.

Group Determinants

The second group of determinants which may be strong factors in group problem-solving effectiveness includes (1) composition and size of the problem-solving group; (2) role orientation of the participants in group problem-solving, (3) normative behavior, and (4) style of leadership.

A number of studies examined the influence of group composition and size in terms of quantity and quality of decisions, difficulty in reaching group consensus, and patterns of interaction. With respect to group size it was found that as the size of interacting groups exceeds more than seven participants, inhibiting factors limit participation of group members, with some of the members becoming clearly differentiated from others (Delbecq, 1968, Holloman and Hendrich, 1971). NGT groups may include up to nine individuals without the inhibiting or dysfunctional factors of interacting groups (Bouchard and Hare, 1970). Several studies also examined the impact of group composition on problem-solving. Groups may be homogeneous or heterogeneous with respect to personality factors, individual needs, sex, different representation of

social, organizational, political or simply intra-organizational groups and with a different perspective on problems. Research results indicate that heterogeneous groups produced a larger proportion of high-quality, high-acceptance solutions than homogeneous groups (Hoffman and Maier, 1961; Hoffman and Smith, 1960). On the other hand, homogeneity stimulates group effectiveness through reduction of potential interpersonal conflict and dominance of the group by one or two members (Ghiselli and Lodahl, 1958).

Another key determinant is the role orientation of the group members. Role orientation involves (1) task dimension - the interrelationship between group members which stems from the task or work of problem-solving, and (2) social dimension - the relationship and feelings which develop between the group members. The major issue in terms of role orientation is how to find such a combination of task-instrumental and social-emotional behaviors or at least to identify problem-solving technologies stimulating this combination in order to create effective problem-solving groups. Van de Ven (1974) found that participants in interacting groups avoided controversies and heated discussions and they most enjoyed the cohesion, friendliness and agreement among group members. At the same time, the majority of the participants expressed dissatisfaction with the lack of task accomplishment. It is obvious that in interacting groups the orientation towards the social-emotional dimension predominates the task-instrumental dimension. An opposite situation is found in the Delphi technique, where task-orientation is the predominant factor. Without the

face-to-face interaction there is a complete absence of social-emotional behavior and participants concentrate their attention on task related activities. According to Delbecq, et. al. (1975) a balanced and effective combination between task-instrumental and social-emotional behaviors is achieved in the NGT environment. The independent individual work during the nominal phase of NGT stimulates task-oriented behavior and the interacting process during the round-robin procedure stimulates social-emotional behavior. This statement is supported by Van de Ven findings (1974), which show that NGT participants express significantly greater satisfaction with problem-solving technology in comparison to participants in interacting and Delphi groups, with no difference between the last two.

Together with role orientation, group norms are the two most common standards for group behavior. A number of studies examined the impact of group norms on individual behavior within a problem-solving group. The findings of these studies suggest that there exist group pressures for conformity in conventional discussion groups. These group pressures limit the perceived freedom to openness of individuals in presenting their ideas and inhibit creative decision-making. Because of the nature of the Delphi approach the group norms are minimal. In NGT groups due to the independent phases (nominal and round-robin) the influence of conforming to group norms is considerably reduced (Van de Ven and Delbecq, 1971). The same authors also suggest that individuals are hesitant to identify and discuss their personal social-emotional problems in a group setting

and tend to divert their attention towards organizational, social or other external problems. The implications are that in order for a problem-solving technology to be effective it is necessary to separate personal (internal) and social (external) problems through built-in procedures.

The quality and type of leadership provided in problem-solving groups is obviously just as important as leadership in any other situation. Though the area of leadership is widely researched, we know about only one study (Green, 1975) which used permissive, democratic and authoritarian leadership styles in interacting groups (control) compared to NGT (experimental) groups. With respect to quantity and quality no significant differences were found between the leadership styles as well as between interacting and NGT groups. Only after adjustment for differences in the total number of responses, significant differences were found between interacting groups with permissive leaders and NGT groups in the number of unique responses. Also there was a difference between interacting groups with authoritarian leaders and NGT groups in terms of severity performance criteria.

Task Determinants

It is known that certain types of tasks place different "critical demands" on group members and require specific and necessary behaviors or procedures in order to accomplish those tasks adequately (Leader 1963, Roby and Lanzeta 1958). We may expect that different types of problem-solving tasks will affect the effectiveness of specific problem-solving technologies. However, these speculations are supported with only a few

studies on the relationship between problem-solving and different kinds of tasks and different task structure. Van de Ven (1974) noted that interacting groups developed a negative reaction to the task. This negative relationship manifested itself in considerable difficulties in conducting meetings. Conversely, a majority of leaders in NGT groups reported that their group members became involved and motivated by the task and expressed interest in future phases of the study.

Process Determinants

This group includes the following problem-solving determinants: (1) search behavior of participants, (2) equality of participation, and (3) conflict utilization.

Van de Ven (1974) found a distinct difference in the nature of search behavior in interacting, Delphi, and NGT groups. He found that in interacting groups the participants tended to employ a reactive search process by reacting mainly to the proposals of their teammates instead of generating their own ideas. Reactive search behavior is specifically characterized by short periods of attention on the problem, frequent interuptions, changing focus and drifting comments from participants and large efforts to maintain a good social environment in the group. In addition, because of limited opportunity for individuals to think independently the submitted ideas were general in nature and participants were reluctant to discuss details of the problem

Analyzing NGT and Delphi technologies, Van de Ven (1974) came to a conclusion that there exists a proactive search process

because each participant was required to present in writing his/her ideas and justification of these ideas in a complete form without interruption or critical evaluation from other group participants. The written expression of proposals not only forces the participants to think through the complete problem but also induces a feeling of task commitment and a greater sense of accomplishment (Bouchard, 1969). Therefore, the proactive search behavior which is built into the NGT and Delphi technologies stimulates the problem orientation by requiring participants to record their ideas.

Different problem-solving technologies provided different opportunities for individual participation in the problem-solving process. Chung and Ferris (1971) indicated that to an extent that decision-making is dominated by a few high-status, expressive or strong individuals there will be a perception of less freedom for open discussion and decreased quality of decision-making. Comparing interacting, Delphi, and NGT technologies, Van de Ven (1974) found that in interacting groups a considerable number of participants did not feel free to participate and contribute their ideas. He also found a tendency towards polarization and individualization of issues. On the other hand, the mechanism of NGT considerably reduced the perceived pressure from dominant individuals and therefore the participants were free to express their ideas, ask questions on controversial issues, and generally the problem-solving process provided equal participation for group members. Due to the non-interacting nature of Delphi the participation of individuals was equally distributed.

One of the major determinants of problem-solving is the concept of conflict. As already mentioned the existing disagreement over the nature of conflict and its impact on group effectiveness leads to two major directions in the development and application of problem-solving technologies. One school of thought reflecting the "consensus" or harmonious theories of organizations states that conflict is counterproductive and even destructive to the process of problem-solving. The other school of thought states that conflict is a natural and integral element of human group interacting process and its impact is facilitative and constructive. Most of the studies which illustrate the negative impact of conflict on group effectiveness are based on interacting groups, where conflict is not controlled. In such interacting groups cohesion and interpersonal relationships develop around areas of agreement (Delbecq, et. al., 1975). In order to maintain these social interrelationships the interacting groups put more emphasis on noncontroversial issues, avoiding the discussion of conflicting ideas, position or views. However, when disagreement openly develops the group usually becomes highly polarized on issues. In addition, all remarks and critiques are viewed as personal, therefore we have to agree that in such cases the conflict may be highly destructive and would considerably reduce the effectiveness of problem-solving. But it is necessary to stress that conflict in this situation is uncontrolled.

The second school of thought on conflict as a constructive force in problem-solving is supported by numerous studies. Hoffman, et. al. (1962) found that more creative solutions

,e when conflict is generated by group members who oppose opinion advanced by a person with authority in the group. ʟsecker (1969) discovered, that with an increase of conflict ver issues group members tend to concentrate effort on those issues in order to bring about a solution. Torrence (1957) stated that conflict is very important in achieving consensus among disagreeing group members. Summarizing the results of these studies, we may state that conflict serves as a catalyst in stimulating effective group problem-solving.

Our analysis of brainstorming, NGT and Delphi technologies indicates that all of them represent the "harmonious" or "consensus" viewpoint on conflict. In brainstorming the principles of problem-solving are directed against any expression of conflict among the members of the problem-solving group. The ultimate suppression of conflict is achieved in Delphi because of the absence of social interactions of the problem-solvers. Bedford (1972) found so many shortcomings in conventional Delphi that he dropped the traditional emphasis on consensus and moved to "controlled conflict" between contrasting groups. In NGT groups the expression of conflict is achieved through a structured procedure of "round-robin" presentation and discussion of ideas. Though the "round-robin" procedure is directed towards minimizing and depersonalizing the conflict between members of the group it provides some channeling of conflict by transforming rhetorical, ideological and emotional comments into problem issues. However, NGT remains a "harmonious" problem-solving technology directed towards minimized conflict in the problem-solving process.

Chapter IV

CONFLICT-ORIENTED PROBLEM-SOLVING TECHNOLOGIES

A qualitatively new approach - the dialectical method - to decision-making for strategic and operational planning has gained popularity in recent years. The Hegelian philosophy of dialectics was originally examined and described by Churchman (1971). Following a scheme suggested by Churchman's interpretation of Hagel, Mason (1969) proposed a concept, the Dialectical Inquiry System as a problem-solving approach to organizational planning and strategy. The main objective of this chapter is (1) to examine the philosophical foundations of DIS, and (2) to examine the state of research on DIS.

Dialectical Inquiry System: Theoretical Foundation

The Hegelian dialectical method can be presented by discussing the following major concepts: thesis, antithesis, synthesis, conflict, and Weltanschauung - a way of viewing the entire system or individual's convictions.

The first step in Hegelian design is the development of a thesis. This is done by way of reversing the usual design procedure from data-to-model-to-optimal to optimal-to-model-to-data. The inquirer selects such a Weltanschauung (i.e., 'optimum') which he conjoins only with those elements from the 'data bank' that support his conviction or thesis. The remaining information becomes irrelevant for this thesis. According to Churchman (1971) the inquirer sets about showing that there is a way to look at reality so that the data can be interpreted to support this thesis.

The second step is the development of an antithesis. A

counter-conviction or a different Weltanschauung is conjoined with appropriately selected elements from the same 'data bank' and as a result of this the antithesis is developed. Thesis and antithesis have the same status - thesis could be called antithesis and vice versa. A very important notion is that in Hegelian terms antithesis is the 'deadliest enemy' of the thesis. Thus, there exists an uncompromisable and insolvable conflict between thesis and antithesis, which is the moving force behind the dialectical process.

The third step is synthesis. During this step an observation is made on how opposition (conflict) "arises out of the particular kinds of minds that clash in their convictions" Churchman, 1971 p. 174). The observer, who is opposing the very nature of conflict, as Churchman (1971) notes:

> "...builds a new world view in which the nature of the conflict is understandable, but which shows that at a high level the conflict is merely one aspect of reality and not the critical aspect. The conflict is in fact devoured by the higher level Weltanschauung. Further the very act of creating such a world view in which the observer can observe the conflict also creates a strong conviction about its truth." (p. 174).

The implications of this process are very important and far reaching: conflict and non-unity become the method of conducting inquiry, which leads towards "objectivity".

Applying the Hegelian framework, Mason (1969) has defined a dialectical system as a system which "examines a situation completely and logically from two different points of view" (p. B-408). The two points of view are represented by a plan (thesis) and a counterplan (antithesis). The dialectical process of developing the strategic plan is illustrated in

Figure 6 . First, a feasible and justifiable plan is developed by identifying the underlying "view-of-the-world" assumptions and selecting data from the existing organizational data bank. Second, a counterplan, also feasible and plausible, is developed by identifying a different set of underlying world-view assumptions and selecting corresponding data from the same organizational data bank.

The principal idea of the dialectical method is that management, according to Mason, "learns about the fundamental assumptions of its planning problem and comes to understand them by observing the conflict between the plan and counter-plan and their attendant world views" (Mason, 1969, p. B-408).

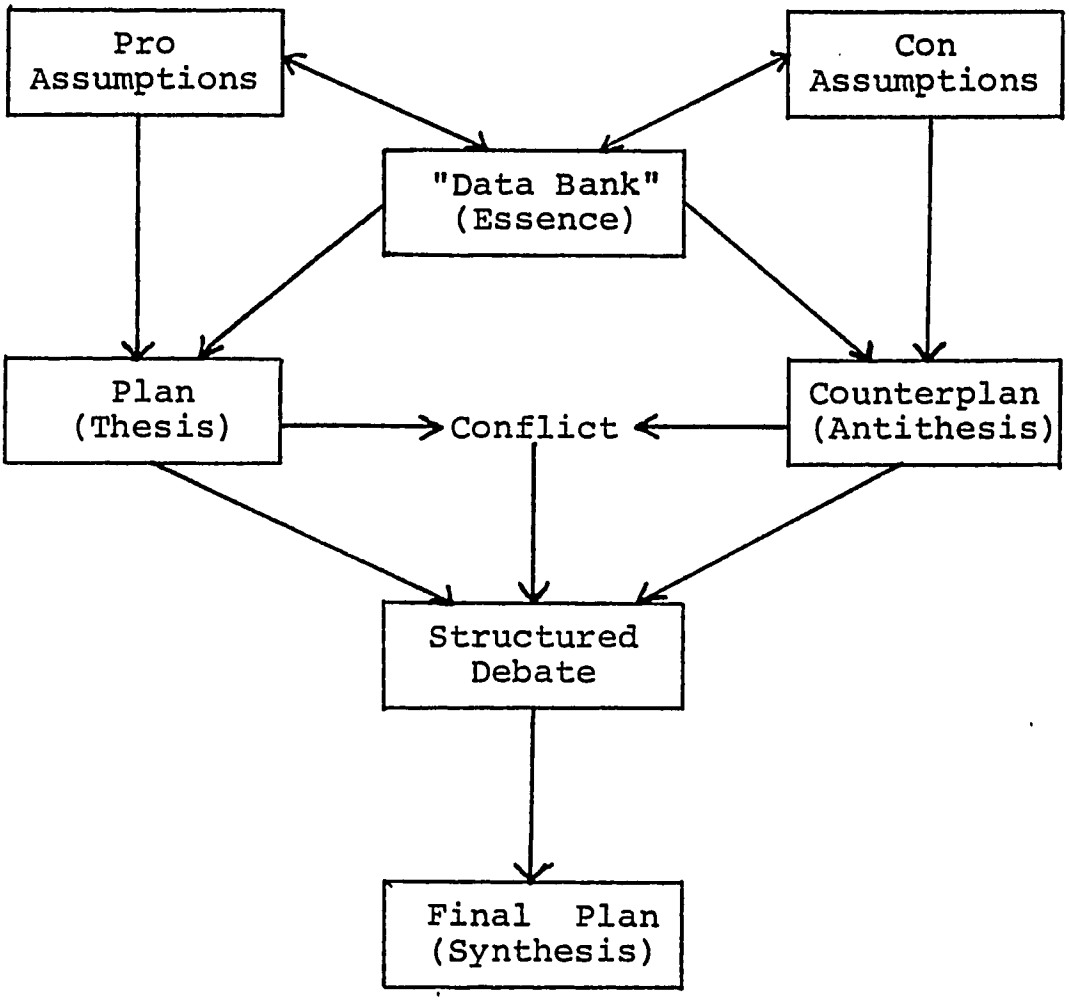
Both the plan and the counterplan demonstrate logical and conclusive proofs that each of them is the best way to achieve an organization's goals and objectives.

Then a "structured debate" is undertaken in which proponents of both sides present and argue the pros and cons of the plan and the counterplan with the forcefulness of Hagel's "deadliest enemies". The debate continues until each element of the organizational data-bank is utilized as supporting or negating evidence.

As a result of this structured debate the implicit assumptions are exposed and a new understanding of the planning problem is developed. The final product of the dialectical process is the new integrated plan and an expanded world view (synthesis), which supports Mason's (1969) major hypothesis that "the managers-recipients of the debate form a new more encompassing conceptualization of the problem - the synthesis" (p. B-411).

Figure 6

The Dialectical Process of Stretegic Planning



Research Results

Unfortunately, the research on DIS still appears to be in an infantile state and therefore the validity of the effectiveness of this method is not established. We know of only four studies applying DIS to strategic planning: Mason (1969) and Mitroff, et al. (1977) have described results of case studies on DIS, Cosier and his associates (1978), and Cosier (1980) have presented findings of a controlled laboratory study on DIS.

Mason (1969) conducted a field/study experiment on DIS application at a company known as RMK Abrasives. This company decided to seek the attainment of two primary goals in the next ten years: (1) to increase after-tax corporate earnings by a minimum of ten percent per year, and (2) to be earning a rate of return on assets of at least eight percent by the end of planning horizon. To achieve these goals the planning department proposed a strategic plan based on ten assumptions. In order to stimulate a dialectical process, a counterplan based on ten different assumptions was formulated. Then a structured debate was initiated at which the top management was presented (in a written and an oral form) with the plan and counterplan advocates. The open discussions of the problem caused the managers to reconsider the company's goals and pertinence of the data bank. From the analysis of post-study interviews and questionnaires, Mason inferred that synthesis did occur. Managers developed not only a new and enriched understanding of the problem, but a new set of planning assumption that was formulated into a new strategic plan.

Mitroff et al. (1979) have applied the dialectical approach in the study on proactive planning at the Bureau of Census, Washington, D.C. In phase 1 of this study 120 subjects - volunteers from all branches and levels of the Bureau - were divided into 16 groups. Each of these groups was instructed to think freely and without the current constraints of internal and external environment and asked to write a scenario of what the Bureau ought to be like in the year 2000. During the next two months some of the participants dropped out and the remaining 80 subjects produced reports on the future of the Bureau. Then, the 80 employees were assigned to four different homogeneous groups according to their scoring on Jungian-based technology test, which measures the individual-personality type. This was followed by a series of lectures with a special emphasis on DIS as the most suited to strategic planning.

In phase 2 the remaining 39 subjects were divided into five groups utilizing Kilmann's (1977) MAPS Design Technology (Multivariate Analyses, Participation and Structure). MAPS organized each group on the basis of employees' preference for planning issues of phase 1 and preference for other employees to work with. Each of the five groups produced a final report. In the final stage one person from each of the five groups was assigned to a team with the task to combine the five reports into a final integrated report on the Bureau's future. The final report, compiled in two and a half years after the start of the study, was thought to represent the synthesis of the conflicting "views-of-the-world". The reaction to the final report, according to the researchers, has been mixed and "as

a general rule it was received with moderate approval" (Mitroff, et. al., 1977, p. 56). However participants and researchers involved in the study recognized several ideas and suggestions as exciting and innovative.

Recently Cosier, et. al (1978), expressing an implicit doubt in DIS, stated the following limitations in the studies by Mason (1969) and Mitroff, et. al. (1977):

First, neither of the above mentioned studies included any performance attesting to the benefits of DIS or a statistical validation of the results;

Second, the positive attitude towards DIS was created by coaching the subjects through formal presentations, lectures, discussions and informal contacts, which created the "demand-effect" factor;

Third, the commitment of the participants to the project, which they considered important, may have been the major determinant of the enthusiasm for DIS, which created a phenomenon similar to the "Hawthorne effect";

Fourth, in the absence of other planning approaches there is no basis for judging the relative effectiveness of the DIS; and

Fifth, because of a constant intervention of researchers and changing number of participants (especially in Mitroff, et. al. 1977, study), it is difficult to determine the unique effects of DIS.

We may agree with most of these critical remarks, except for the problem of DIS effectiveness and its evaluation. However, before we undertake a more elaborate analysis of this problem,

we shall discuss the findings of a controlled laboratory study, conducted by Cosier, Ruble and Aplin at Indiana University (1978). In this study the researchers have attempted (among other things) to examine the effects of DIS on performance and participants' attitudes. Undergraduate business students were asked to play a role of managers in a small simulated retail business, specializing in two products. Subjects were asked to make decisions with respect to price, product mix, advertising and sales promotion for eight periods (eight trials). Three markets specially constructed by the researchers, created the external environment in which the subjects operated. The best performance was when students: in Market 1 (M1) priced, advertised and promoted low and placed a high emphasis on one of the two products; in Market 2 (M2) priced, advertised, and promoted high and adopted a balanced product mix; in Market 3 (M3) all decisions were the average of the extremes of M1 and M2. A random element was introduced to create some uncertainty in all three markets and students were not informed in which market they operated. Performance feedback in the form of profits was provided to the subjects after each trial. Before the third trial, manipulation of the "planning conditions" was initiated. Three groups of students were instructed to use three different planning approaches discussed by Mason (1969). DIS approach - plan and counterplan; Devil's Advocate approach - a plan and critique of the plan; and Expert approach - one plan. The fourth group of subjects was kept as a control group.

The results of the third trial indicated that significant difference existed only in M1 and M2. In M1, as well as in M3,

DIS was outperformed by the other planning approaches, including the control group. In M2 only the control group scored higher than DIS approach. The results of the last period (trial) did not show significant difference between various "planning conditions". Nevertheless, the DIS approach was again outperformed in M1 and M2 by Devil's Advocate approach, and in M3 by all, including the control group. The final results show, according to the researchers, that "subjects built up historical information from feedback that tended to minimize the impact of planning information" (Cosier, et. al., 1978, p. 1489).

The study on DIS by Cosier, et. al. (1978) was probably the first attempt to use the dialectical method in a controlled laboratory setting and therefore it should be recognized as a major step in the field. The researchers, emphasizing the preferences of laboratory experiments over field studies, stated such advantages as minimization of extraneous influence of other variables and more readily available objective performance criteria. Though the above is often true in behavioral and psychological research, this statement should be made with some reservations when applied to problem-solving for strategic planning based on DIS methodology. The very nature of strategic planning and dialectical method is not conducive to the investigation in a controlled laboratory setting because of enormous difficulties in simulating the multitude of variables and interactive processes prevalent in realistic strategic planning and complex dynamic business environment.

Incomplete description of the research design by Cosier et. al. (1978) made the task of analysis quite difficult.

Nevertheless, after examining the findings, several remarks should be made.

First, there is a strong implication that researchers failed to realize that subjects were dealing not with complex and interactive issues of stretegic planning (ill-defined, ill-structured with high level of uncertainty and long planning horizon) but rather with issues of tactical planning or maybe simple operational decision-making (well-defined, well structured with limited amount of uncertainty and a short-range planning horizon).

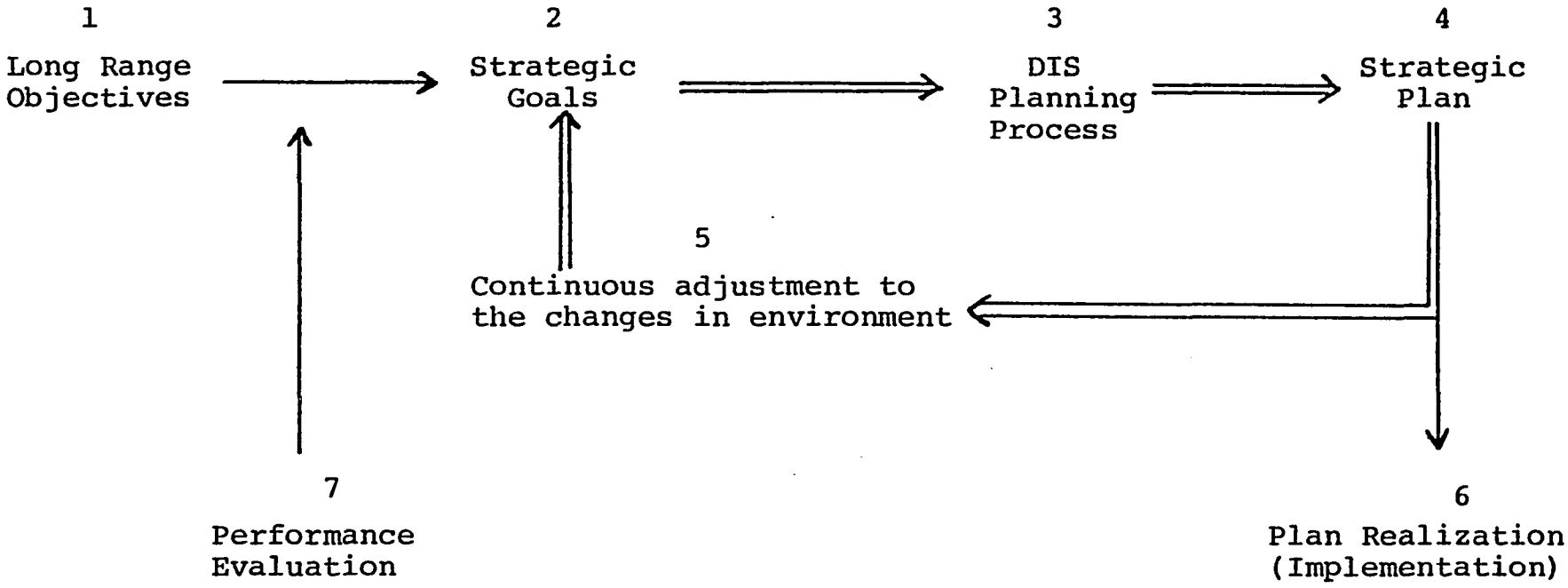
Second, obvious methodological misconceptions may be found in the interpretation of DIS effectiveness and its performance criteria. Cosier et. al. (1978) used profit as a performance criteria to evaluate the effectiveness of DIS and therefore failed to recognize two major points: first, that objective measures, such as profit, cannot be used as criteria of DIS effectiveness; perhaps their value lies in being a second order measure through the objective evaluation in the plan implementation stage; second, that the major purpose of this methodology is to facilitate through the dialectical process the development of "better" stretegic plans.

Figure 7 provides an illustration of a planning cycle.

As seen from Figure 7, the strategic planning process (illustrated by double line arrows) starts with the selection of strategic goals (Step 2) which stem from the long-range objectives problem. Then a DIS methodology (Step 3) is employed to develop a stretegic plan (Step 4). The cyclical nature of this process lies in the ability to adjust strategic goals to

Figure 7

Long Range Planning Cycle



change in internal or external environments or to institute a search for additional information if such a need becomes obvious (Step 5). As a result of the cyclical process a final strategic plan is produced. The next question is, what type of criterion should be used in the evaluation of DIS methodology? Also, how do we judge that a specific strategic plan is good or bad?

Mason (1969) suggested two criteria for a good planning technique: (1) it should expose the assumptions underlying a proposed plan so that management can reconsider them, and (2) it should suggest new and more relevant assumptions upon which the planning process can proceed. However, Cosier et. al., utilizing profit as an objective criterion, misapplied it in judging the effectiveness of DIS. In fact, the profit criterion only evaluates the practical success or failure of the outcome of the strategic plan (Step 6). In addition, the researchers failed to recognize the importance, complexity and problems of the strategic plan implementation stage. The task of developing a good model is only a minor problem as compared to problems of implementing this model in the real business environment. The success or failure of any model will be determined mainly in the implementation stage.

Again we would like to reinforce our position on DIS as a method which assists the development of strategic plans and as such its effectiveness may be evaluated by utilizing subjective effectiveness criteria. DIS is a technique which cannot be directly judged by objective performance measures (profit, cost, market share, etc.) and this constitutes one

of the major shortcomings of this method generally.

However, the major problem is the methodological design of DIS - one of the planning approaches used in the study by Cosier et. al. (1978). The researchers not only possibly misinterpreted and misapplied DIS and as a result of this drew erroneous conclusions, but also simply eliminated the spirit and nature of the Dialectical Inquiry System, as it was presented and introduced by Churchman (1971) and Mason (1969). In the Indiana University study the subjects (N=108) were assigned as single managers of 108 firms. Each of these managers was provided with a plan and counterplan developed by researchers, thus eliminating the very purpose and process of dialectical development of strategic plan. Without discussing in a structured debate the underlying assumptions of the plan and counterplan and without synthesizing the two, the very meaning and essence of DIS had been destroyed. It would also be naive to assume that the DIS technique, so foreign to the educational process of American business schools, could be recreated by a "single-minded" subject.

Thus, a final analysis shows that a first attempt by Cosier et. al. (1978) to use DIS in a laboratory controlled setting is far from being a success because of:

1. Inability to simulate a proper environment for strategic problem-solving.
2. Utilization of a second order criteria to evaluate the effectiveness of DIS; and
3. A possible misinterpretation and misuse of DIS technique.

In a recent study Cosier (1978) compared the performance

of the Dialectical Inquiry (DI) and the Devil's Advocate (DA) techniques. Seventy-eight subjects - MBA students randomly assigned to two treatments were asked to make a series of financial predictions. The task given to the subjects was structured to include three levels of goal difficulty and three decision-making contexts. In the DI the subjects were told they should consider information from a plan and counter-plan. In DA the subjects were given a plan and a critique of this plan. The researcher did not find significant difference between DI and DA over all contexts as well as between goal-difficulty conditions. The order in which the contexts were considered also did not affect the treatments. The only significant difference was found for context differences in the DI treatment ($F=9.64$, P .001). The inconclusive results of this study can be explained in our opinion, to some degree by the same methodological shortcomings encountered in the Cosier, et. al. study (1978).

First, the actual decision-making in the study was made by "single-minded" subjects without a dialectical interacting process in DI treatment. It is really difficult to imagine a "structured debate" by a single person;

Second, there are serious doubts that the differences between counterplan (DI) and critique of a plan (DA) were very effective, and

Third, again as in Cosier, et. al. (1978) the Dialectical Inquiry Technology was applied in the "letter but not in spirit." It is difficult to imagine a dialectical decision process in a limited time framework and without group effort. The

experiment and the dialectical process are almost contradictory.

Recently Emshoff and Mitroff (1978; 1979) employed a slightly modified version of the DIS to develop Strategic Assumption Analysis Methodology and Assumption Making Methodology. In both cases the authors used a four-step process, which is similar to the scheme in which we illustrated Mason's DIS (Figure): Step 1 - Identification of Assumption Bases; Step 2 - Dialectical analysis; Step 3 - Assumption Integration; and Step 4 - Strategy Synthesis.

Both the Strategic Assumption Analysis Methodology (SAAM) and Assumption Making Methodology (AMM) are built on explicit recognition of conflict and commitment of various parties in organizations to their positions. These new methodologies provide a constructive way of integrating different conflicting positions through a selection of acceptable assumptions and development of a final "best" strategy. It is interesting to note that the traditional methodologies avoided the recognition of conflict and therefore often would result in deterioration of decision-making, extreme polarization, or simply no decision at all, because of ego investment by the participants.

According to Emshoff and Mitroff, the SAAM significantly extends the pioneering work on DIS by Mason (1969). First, Emshoff and Mitroff (1979) shifted the emphasis from thesis-antithesis confrontation to confrontation of underlying assumptions. The Hegelian-Mason coupling of assumptions and elements from the "data bank" to develop a strategy is substituted by data assessment of preselected or predefined

assumptions. Thus the assumptions become of primary importance and the data bank of secondary importance. This led researchers to a provocative statement that over the long-run SAAM will produce shifts in managerial planning: "...the commitments to strategic data banks will be replaced by the development of strategic assumption banks. In other words, the key assumptions that we accept and reject as part of the planning process will form the fundamental elements of the computer support network" (Emshoff and Mitroff, 1978, p. 60). Hamilton and Moses (1974), for instance, incorporated the assumptions made by the corporate, group, and subsidiary executives in their computer-based corporate planning system.

The examination of SAAM indicates a kind of logical inconsistency. In the second step of this methodology there is a "dead-end" - the development of counter-strategies, which are not utilized in arriving at the final strategies. This omission was corrected in AMM, developed by Mitroff and Emshoff (1979). In this a more refined methodology, designed to deal with ill-structured problems, the counter-strategies (Step 2) together with original strategies (Step 1) create the strategy pool (Step 3) and then through data assessment of acceptable assumptions the "best" strategy is developed. The AMM methodology of solving ill-structured problems, of which strategic planning is one of the examples, is a considerable improvement over the SAAM methodology.

First, by employing a known "Stakeholder Analysis" technique (Ackoff, 1974) to provide a selection or specification of relevant assumptions, and

Second, by utilizing the Belief Assessment Procedure (Saaty and Rogers, 1976) to reduce the time spent on the assumption integration process by concentrating attention on more critical assumptions in terms of certainty and importance.

Comments on Dialectical Inquiry System

The Dialectical Inquiry System is based on Hegelian dialectics - a philosophical methodology known from the Nineteenth Century as idealistic dialectics. Being built on philosophical foundations of Hegelian method, the DIS inherited all the advantages and shortcomings of idealistic dialectics. According to Mulej (1978) a Yugoslavian scholar, the ideas in idealistic dialectics:

1. Are changeable and develop on themselves,
2. Are not isolated from each other, but inter-dependent,
3. Can be adverse to each other even inside the same whole, and
4. Develop out of each other without the total disappearing of the old, but under its influence and by keeping a part of it (p. 10).

This flexibility of ideas in DIS served to the advantage of this method, in comparison with existing traditional methodologies. Dialectical Inquiry System offers some visible advantages in strategic planning, though we have to recognize that empirical support for the effectiveness of DIS is not so persuasive as the theoretical arguments.

Mason (1969) and Mitroff et. al. (1977) stressed that DIS is the most suited to strategic planning. Later Mitroff and Emshoff (1979) demonstrated that it can be used in the solution of a large class of ill-structured problems. The major advantage of DIS lies in its ability and forcefulness to stimulate

a dialectical process of developing a strategic plan. Constructive debate and examination of underlying assumptions of two complete opposites (plan-counterplan) produces, in most of the cases, better understanding of the planning problem and creates awareness of the complexity of strategic planning.

DIS also reinforces the positive views on conflict, which in most of the current strategic planning methodologies, are often ignored. Utilizing synthesis and analysis the DIS technique deals with proactive as opposed to reactive planning.

However, being a product of Hegelian methodology, DIS unfortunately inherited the shortcomings of idealistic dialectics, which are bound to the world of ideas living out the material reality surrounding us. According to Hegel the whole inquiry process is managed by some kind of super-power, which he calls "Absolute Mind". The Hegelian method, as well as DIS, leave many questions unanswered and many things are taken for granted:

First, it is not clear as to what are the moving forces, origins and causes behind the dialectical process. DIS does not explain what makes the organization "click".

Second, it is not clear where the thesis (plan) and anti-thesis (counterplan) come from. Mason (1969) solves this problem by identifying the prevailing or recommended plan; Cosier et. al. (1978) and Cosier (1980) simply by developing plan and counterplan for the subjects; Mitroff and Emshoff (1979) speak about "an early existing or tentatively proposed strategy." All this makes someone wonder if the whole dialectical process of strategic plan development will not be biased towards the existing prevailing plans and underlying assumptions.

Third, it is not clear what governs the synthesis process, what determines the integration process of various assumptions, and as Churchman notes: "...why the process should lead anywhere but down blind and narrow alleys, unless there is a guide who has a superior vision over the maze. The mere opposition of thesis and antithesis does not mean that perspective of the inquirer is broad" (Churchman, 1971; p. 176).

Fourth, DIS is self-purposeful, partial and incomplete from both the theoretical and organizational points of view. It deals only with one aspect of development of strategic planning. It is not clear what are the preceding moments and outcomes of the strategic plan.

Fifth, the effectiveness of DIS can be evaluated by using only subjective criteria - attitudes of participants, better conceptualization of problem, etc. - (but not be objective measures - profit, market share increase, etc.). Churchman (1971) argues that the "verification" of a research project of the dialectical inquirer is not the establishment of a solution, but the creation of a more knowledgeable process of awareness. If Mason (1969) and Mitroff et. al. (1977) used subjective criteria to evaluate the DIS performance and Cosier et. al. (1978) unsuccessfully employed profit as an objective criterion, then Emshoff and Mitroff have not addressed themselves to this problem at all.

In addition, it should be noted that in recent publications we find different interpretations of dialectics. In Cosier et. al. (1978) it is simply a plan and counterplan designed by the researcher and provided to the subjects under study. In

Emshoff and Mitroff (1978) and Mitroff and Emshoff (1979) only the second phase is called Dialectical Analysis, leaving the reader to wonder whether the SAAM and AMM methodologies are dialectic in general.

The analysis of DIS clearly indicated the limited potential of this methodology in future research and development of problem-solving technologies. There exists a need for an advanced comprehensive and theoretically sound inquiry system, which will be able to deal with the complex and ill-structured problems and issues of strategic planning. This new inquiry system is the Dialectical Materialism Inquiry System (DMIS) - the concept and methodology of which we propose and develop in this paper. DIS and other methodologies of strategic planning have some serious deficiencies, but there is much of value that can be subsumed under the broad rubric of DMIS. The theoretical foundation of the DMIS is built on the concepts and laws of dialectical materialism, formulated in the Nineteenth Century.

Chapter V

DIALECTICAL MATERIALISM INQUIRY SYSTEM: A NEW THEORETICAL FOUNDATION FOR FUTURE CONFLICT-ORIENTED PROBLEM-SOLVING TECHNOLOGIES

The analysis of the existing problem-solving technologies shows that a fragmented approach to decision-making still exists in organizations. The need for high efficiency and continuing technological progress imposes strong requirements for specialized knowledge in management theory. This need is reflected in highly specialized theories and models of management. The problem that exists now is linking these fragmented theories and models in a neat general theory of management. Therefore in the last ten years there has been a consistently increasing interest in traditional philosophical doctrines. Works by Churchman (1971), Mason (1968), Mitroff and Sagosti (1973) in the area of inquiry systems deserved special attention. There are four main types of inquiry systems: Leibnizian, Lockean, Kantian, and Hegelian. Leibnizian IS is represented by formal (mathematical) symbolic systems. The example of DIS application is a mixed-game type of problem-solving. Lockean inquiry system represents experimental consensual systems. NGT and Delphi technologies could be viewed as examples of a Lockean IS. The Kantian inquiry system integrates Leibnizian IS and Lockean IS when two components are complementary. The Hegelian inquiry system also integrates Leibnizian and Lockean systems, but only when components are different. An example of Hegelian IS is DIS discussed in the previous chapter. In this chapter we will try to take another step towards applying a known philosophical

theory - dialectical materialism to develop a new inquiry system - Dialectical Materialism Inquiry System (DMIS) as a theoretical foundation for a Dialectical Problem-Solving Technology (DPST). Then we will use DMIS to build a new conceptual model in which problem-solving for strategic planning plays the central role. Finally this model will be used in preliminary analysis of decision-making and planning practices in U.S. and U.S.S.R.

Dialectical Materialism Laws

Any effort to develop a new problem-solving technology for strategic planning faces two complementary tasks:

1. Integrating new concepts within a larger theoretical framework, in this case DMIS, and
2. Addressing issues that have been inadequately explained by existing methodologies.

The existing methodologies have been unsuccessful in these endeavors because there has been little serious effort to perceive strategic planning from a holistic, systemized and dialectical point of view.

Dialectical materialism (the theoretical foundation of DMIS) was developed on the basis of Hegel's idealistic dialectics and Feurbach's materialistic outlook. It is derived from progressive discoveries of natural and technical science in the Nineteenth Century. These advances showed that neither metaphysics nor idealistic dialectics provide a realistic generalization of reality. At the same time, dialectical materialism is derived from human experience and knowledge of the objective world and the study of our thought processes.

Dialectics is defined as "Nothing more than the science of the general laws of motion and development of nature, human society and thought" (Marx, 1943, p. 158).

Cornforth (1971) states that dialectical materialism means understanding things just as they are ("materialism") and their actual interconnection and movement ("dialectics").

It is a noteworthy feature of dialectical materialism that, although it discards Hegel's speculative idealism, it retains not only the dialectical method but at least some of its terminology. For instance, dialectical materialism adopts and interprets materialistically among others the following concepts: the dialectical method, the monistic view of nature, man and society; the recognition of the active role of men (or mind) in knowledge and in the world; the rejection of static or old metaphysics; the optimistic view of the development and constant improvement of society through history; and the notion of dialectical logic. Dialectical materialism is far richer in content and wider in its scope and as a result of this it becomes something qualitatively new as compared with idealistic dialectics.

Dialectical materialism deals not with pure concepts but with things, objects of experience, actual men in their real environment and circumstances. Combined with consistent materialism, the dialectical method becomes a method of investigation, instead of being a pure method of argument. It should be recognized that the practice of Western, and especially American, business is based on a very pragmatic and materialistic outlook, which comes from the very nature of the business undertakings

and business relations. The moving force of business is production of material goods and services and attainment of material profits. The business organization, consistently confronted with immense technological, political, social and economic changes, is very material in its nature.

DIS does not provide a comprehensive explanation of the moving forces of organizational change and strategic planning development. In the Hegelian method, from which DIS is derived, the process of development taking place in history is due to the "Absolute Idea" realizing itself in history. DMIS, based on materialistic explanation of dialectics, is the key to understanding the process of organizational and strategic development and change. The forces of this development lie within the material world itself (i.e., people and productive and non-productive forces within and outside a specific organization). Development in this sense is a constant interaction and contradiction of opposites.

The DMIS methodology provides the theoretical foundations which allow researchers to deal with general and substantial characteristics of problem-solving and strategic planning. Resulting organizational change and development are viewed from three most important aspects:

1. What is the cause of change and development?
2. What is the mode of change and development?
3. What is the outcome of change and development?

The dialectical materialism principles, commonly known in the literature as laws of dialectical materialism, furnish the necessary explanations correspondingly:

1. The law of interpretation of opposites;
2. The law of the transformation of quantity into quality and vice versa; and
3. The law of the negation of the negation.

In the previous chapter we have already discussed the first law of dialectical materialism - the Law of Interpretation of Opposites which explains the source of conflict. This law sometimes stated as the law of the unity and struggle of opposites refers to the presence of internal tendencies or forces in all phenomena which are incompatible but simultaneously presuppose one another. This inseverable interconnection of these opposites (positivity demands negativity for its existence) and their mutual contradictory nature provides the stimulus for development.

The law of the transformation of quantity into quality and vice versa shows the mode of change and development. According to this law the consistent accumulation of insignificant and gradual changes in quantity materializes in a new quality and gradual changes in quality may bring a new quantity. Everything that changes around us has a quantitative aspect, which when substantiated in a simple increase (growth) and decrease (decay) does not yet alter the nature of that which changes. However, quantitative change cannot continue indefinitely. At a particular point it always leads to a qualitative change, and according to Hegel's "nodal" or critical point this qualitative change takes place through a relatively sudden leap. For instance, if water is being cooled up to a nodal point of $32^{o}F$ it becomes a new substance - ice; and if water is being

heated up to 212°F it turns into steam, undergoing a qualitative transformation from liquid to gas. Birth and death are examples of sudden changes resulting from the gradual changes of growth and decay. Addition of one proton to the nucleus makes the transition from one element to another, i.e., addition of a proton and an electron to a hydrogen atom, which consists of one proton and one electron, creates an atom of helium. The law of transformation of quantity into quality can be illustrated by example of atomic bombs. An isotope, uranium 235, is used in production of uranium bombs, but a more widespread isotope of this nature is uranium 238. The quantitative difference between these elements is simply in the atomic weight, depending on the number of neutrons present in each case. In addition, a "critical mass" of uranium 235 is necessary for an atomic explosion to take place.

The law of the transformation of quantity into quality and vice versa also operates within society, different economic systems, corporations and organizations. For example, the fact that cooperation of a number of people, the fusion of many forces into one single force, to use Marx's phrase, creates a "new power" which is fundamentally different from the sum of the individual powers. Quantitative growth of corporations through acquisition and merger brings them often to a qualitative change - conglomerants, multinationals, etc. Some of the companies and organizations prefer to start with a qualitative growth through extensive R&D works and active upgrading of their managerial, administrative and engineering personnel. These qualitative changes often result later in

quantitative growth: aggressive investment activities, considerable production increase, extensive development and marketing of new products, increase of the market share, etc. Very often the number of employees in an organization (especially if it started as a small family controlled business) may gradually increase without creating any fundamental change in the character of this organization. But if the number of employees exceeds a particular level the old management (i.e., owner and his son) system ceases to be adequate and the business changes its form. Ackoff (1974) notes that succeeding systems are not replacement but rather enrichment of previous efforts.

These examples show that quantitative changes are transformed at a certain point into qualitative changes with qualitative changes resting on quantitative differences. This also holds for the inverse relationships. Development and change come through the unity and conflict of opposites as a result of dissolution of an old form of unity of opposites and the coming into existence of a new one. The opposites then undergo a change themselves. Thus, as a result of quantitative and qualitative changes new entities are created and this brings us to the last law of dialectics - Negation of Negation.

The law of the negation of negation shows the outcome of any phase of change and development. Negation of negation is "An extremely general and for this reason extremely comprehensive and important law of development of nature, history and thought..." (Engels, 1939; p. 151). The development and change comes through the working out of contradictions and through qualitative and/or quantitative transformation. The direction of organizational change and development (though conditioned

by external factors) depends on conditions permanently operating within the process itself. Side by side with absolute forward movement of development, progress and advance cases of regress, decay and entropy occur in specific instances. As a new stage of development of a new entity comes into being it contains new contradictions and also inherits some features from the past, from which it has developed. The new entity also contains some elements of the future to which it leads, indicating an existence of a law of natural succession. Any new entity, therefore, has its negative and positive sides, a past and future, something passing away and something developing. A grain of barley undergoes change and is negated when it becomes a plant, which in turn is negated by the grains of barley it produces and it is then again negated - when the plant dies - negation of negation. A similar dialectical process goes on with the development of a butterfly in animate nature. We also have to recognize that in some cases of nature the movement ("ice-water-steam-water-ice") cannot be called progressive or retrogressive.

However, when we analyze the development of different societies, economic systems, social groups, separate business entities, we find together with the absolute movement towards progress and advancement some instances of regress, decay and entropy. Children negate parents, new generations negate old generations, the present negates the past, future negates the present - these are examples of the negation of negation.

Negation or negation of negation does not imply a simple 'no'; it is a positive advance, creation of a new qualitative

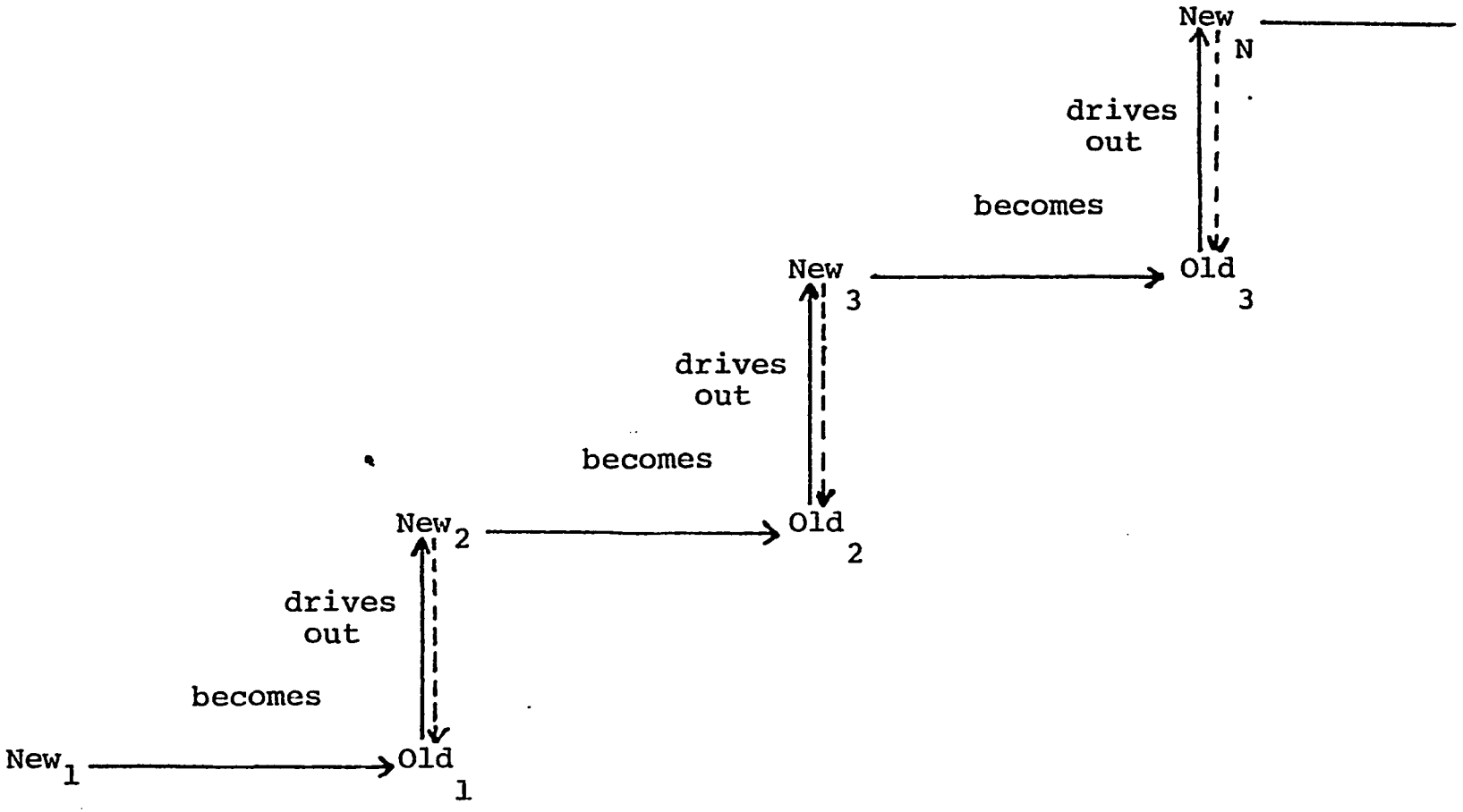
entity. This new entity comes from and in opposition to old, it inherits some characteristics from the previous entity and also contains the feature of the future entity. The succession of negations is illustrated in Figure 8 .

The human society throughout its history has undergone a series of negation steps: primitive communism; slavery, feudal society, capitalism and socialism. In philosophy the naive materialism has been negated by dialectic idealism, which has been negated in its turn by dialectic materialism. A manufacturing company which undertakes an extensive strategic program of assembly line type capital investments becomes a new organizational entity - a capital intensive entity which negates the previous labor intensive enterprise. As a result of this change the company will probably solve the problem of low productivity. At the same time, it may face a decrease in employee job satisfaction resulting, for example, from the monotonous and repetitive nature of work on an assembly line. Again, the same manufacturing company could become a new entity by negating the present through a process of diversification or merger. This will satisfy the need for growth and diversification, but will probably also create new problems of management coordination and resource allocation. The process by which the resolution of one problem or satisfaction of a specific need creates new problems is widely recognized. Blau and Scott (1962) refer to this successive process as the "dialectic process of change".

It is necessary to note that strategic planning cycles, because of their directed purposefulness, often coincide with

Figure 8

Negation of Negation



the stages of organizational development and change. This results if strategic plan implementation by the new organization negates the old organization. The importance of this point is not self-contained, but indicates the need for a timely change of organizational structures and policies, inherited from the previous entity.

A New Conceptual Model for Problem-Solving and Strategic Planning[1]

The DMIS is based not only on laws of dialectical materialism, but also encompasses and integrates in itself elements and concepts of general systems theory, cybernetics, behavioral and social sciences. As such DMIS becomes a unique theoretical framework of inquiry, especially in strategic and organizational planning and development. The dialectical methods demand that researchers should consider and understand things (systems and systems elements), not each by itself, but always in their circumstances, interconnections with other things. The use of DMIS in strategic planning provides application of a holistic approach: (1) by examining internal system of a specific business enterprise (i.e., subsystems, structures, connections and relations, organization, etc.); (2) by analyzing the specific features which characterize the specific systems properties (integration, differentiation, centralization and decentralization, stability, feedback, control, etc.); and

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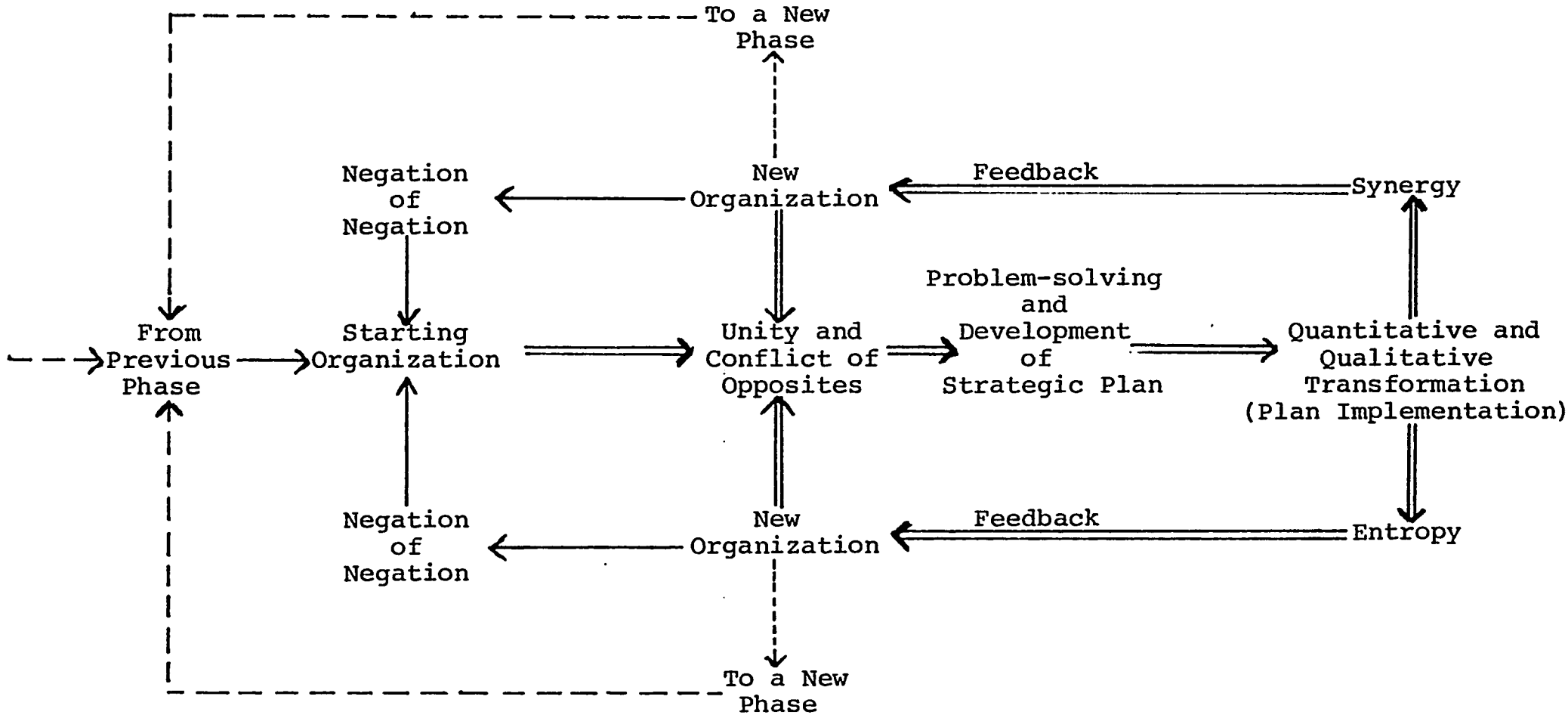
[1] Some preliminary ideas on DMIS methodology and model were presented by M. Chanin at the TIMS 4th Radical Conference on Organization in Hawaii, (1979); by Chanin and Shapiro at the TIMS/ORSA National Meeting in New York (1978) and published by Chanin and Shapiro in Proceedings, 11th Annual AIDS Meeting (1979), pp. 232-234.

(3) by examining and incorporating in strategic planning the dynamics of external environment (i.e., state of the system (market, industry, etc.) in which enterprise operates; functioning, variation, and purposefulness of the external environment, etc.). Through the dialectical materialism laws, especially the law of unity and conflict of opposites, DMIS is able to account for the behavioral and sociological complexities of the strategic planning process. It also takes into account the possible social trends and is capable of integrating them into future activities. The application of DMIS to strategic planning and development views the enterprise as an extremely complex, probabilistic multiloop and self-regulated system. It provides a new philosophical explanation of cybernetics - the science of control and communication. In the context of DMIS, the concepts of synergy and entropy acquire an extended meaning. Synergy results from quantitative and/or qualitative development due to the successful implementation of a strategic plan. It shows that cooperative actions of inter-related and semi-independent subsystems (elements) of the new organization produce a total effect greater than the sum of their effects taken independently. Entropy in the context of DMIS indicates the failure of strategic planning, whether it resulted from a poor strategic plan or whether from unsuccessful implementation of this plan. Entropy in this case means that the system is on a downward direction and moving from a higher state of organization to disorganization, and eventually if the trend is not reversed to discontinuity of its existence.

The conceptual model of strategic and organizational planning (Figure 9) is a descriptive model. As such it describes the phenomenon, process and nature of strategic planning by utilizing DMIS - integration of dialectical materialism laws with concepts and elements of systems approach cybernetics, behavioral and sociological sciences. The beginning point in this model is the "Starting Organization" which probably evolved from the previous phase of strategic planning. The unity and conflict of opposites existing in this organization becomes, as it was explained earlier, the driving force for the multitude of possible strategic plans. The human diversity of attitudes, interests, needs, educational and cultural backgrounds, different assumptions about reality and use of different elements in the existing "data bank" gives rise to the many possible plans. The development of a strategic plan is conducted by resolving the existing contradictions between different departments, services and elements inside and outside of a particular organization. Then the organization reaches a decision-consensus through unity of opposites via a "structured debate". The difference between DIS and DMIS is that the latter deals with more than two preliminary strategic plans and utilizes the natural lines (structures) of organization as the source of preliminary alternatives of the final strategic plan. Some of the techniques, which Mitroff, et. al. (1977), Emsoff and Mitroff (1978), and Mitroff and Emshoff (1979) used to facilitate the development of strategic planning can be utilized in this stage of DMIS. As a result of an extensive and open debate and analysis of various

Figure 9

DMIS: A Conceptual Model of Problem-Solving and Strategic Planning



strategic alternatives, based upon underlying assumptions and utilized data, the strategic plan is synthesized by management. The support for this form of strategic planning development is found in field research conducted by Murray (1978). The author describes a strategic plan, which was developed not within the company, but was "negotiated" (implicitly if not explicitly) with numerous Federal and State regulatory agencies and various special interest coalitions. This "negotiation" process may be viewed as a modified "structured debate."

If application of DIS in strategic planning ends abruptly at this point the DMIS methodology transfers the researcher to the next stage - plan implementation through quantitative and qualitative transformation of a specific business enterprise. The outcome of this stage may be the success of strategic planning - synergistic effect or a failure - entropy. In the first case, a more advanced higher level business organization evolves, and in the second case, an organization with a negative trend and downward direction evolves. However, in both cases the new organization is created and this new organization negates the starting (old) organization. The feedback loop channels the post-performance experience of strategic planning to the new organization. For example, it may indicate the required adjustments in strategy and structure for the next strategic planning phase. The strategic planning feedback is goal derived and provides a flexible and creative adaptation to the dynamics and interactive processes of the open systems. the new organization inherits the unity and conflict of (may be different) opposites, which will become the moving force

for the next phase of organizational and strategic planning. The multiloop movement of organization is not necessarily undirectional. Enterprise after having several bad phases (entropy cycles) may recoup and change its performance pattern to a synergistic cycle. It is presumed that all DMIS stages of strategic planning development include consistent interaction and adjustment to opportunities and threats of the external environment in which a specific enterprise operates.

The DMIS model of strategic and organizational planning is a conceptual and descriptive model. The premises of this model are to some extent philosophical; for at this stage, the problems associated with the development of an interdisciplinary, general theory of strategic planning are basically philosophical, but not technical. Nevertheless, this model provides a sound theoretical framework for in-depth investigation into strategic planning problems and development of operationally significant models.

The value of this model is found in the following:

1. It provides an interdisciplinary approach to the issues of strategic and organizational planning and development;
2. It applies the open systems approach to problems and does not treat them as isolated and mechanistic;
3. It examines existing problems dynamically, not statistically;
4. It is probabilistic, not deterministic;
5. It utilizes analysis and synthesis, deduction and induction, etc., as pair-wise parts of the same investigation.

6. It employs a holistic, not partial, approach;
7. It integrates various stages of organizational and strategic development of business enterprises; and
8. It provides a more concrete representation and generalization of the reality.

At the present time, existing strategic planning methodologies and models do not account for the effect of synergy and entropy resulting from goal-oriented behavior of business enterprises. The application of DMIS methodology in strategic planning provides interesting opportunities for using synergy and entropy as measures of organizational performance and development.

Ansoff (1965), discussing the issues of synergy in corporate strategy, differentiates between several types of synergy: sales synergy, start-up synergy, operational synergy, investment synergy, and management synergy. Ansoff also proposes a synergy assessment framework, which will estimate the contribution to the parent company, and to the new entry. Also, it will assess joint opportunities for the parent firm and the new entry. However, these ideas have not found widespread application in industry. If the problem of practical synergy measures still remain an area for future investigation, there exists a known body of research and literature on practical application of entropy measures in management, marketing, economics, etc. (Horowitz and Horowitz, 1976; Theil, 1967; Wilson, 1970).

However, it should be realized that DMIS methodology is not a magic formula that solves organizational problems

automatically. In fact, DMIS does not solve problems at all, but it can help management in the solution of these problems. Analysis of American firms shows that some of the companies, not knowing themselves, utilize some elements of DMIS methodology. Many managers successfully solve business problems without ever having heard of dialectical approach. But it is believed that with a conscious application of DMIS we are better equipped to manage the complexities, contradictions, interrelations and challenge of problems facing the contemporary manager. DMIS is not a predetermined and dogmatic scheme that can be imposed upon any area of business reality; it is not a substitute for the fullest and most careful data gathering of facts and thoughtful analysis of them. It is believed, however, that DMIS methodology is essential and indispensable for correct and adequate scientific investigation of strategic and organizational planning and development.

Conceptual Model and Preliminary Analysis of Practice

The size of this paper limits our efforts in fully examining the practice of strategic planning both in the Soviet Union and the United States. However, even a preliminary analysis of models, dealing with the problems of economics, management and strategic planning in the U.S.A. specifically, and the Western world generally, shows that these models are based on equilibrium assumptions. No account is given for the dynamics and change processes in the system and its surrounding environment. The dialectics of the system and its elements are simply ignored. In case such a system becomes unbalanced,

the variation of one of the variables is viewed as a regulation instrument, which will bring a system back into an equilibrium.

Examination of the literature indicates the existence of three different approaches in the development of strategic policies and plans. The first approach is represented by so-called conventional models developed by Ansoff (1965), Steiner (1969), Cohen and Cyert (1973). These strategic planning models, based on "rational decision making" are popular among economists. The major criterion in these models is the maximization of long-run profitability. A strategic plan is specifically designed to maximize return on investment using a portfolio of products, markets and/or businesses. However, conventional planning models do not provide an accurate description of strategic planning and therefore their prescriptive value becomes questionable. The scope, complexity and dynamism of problems with which managers are confronted is considerably larger than conventional models are able to deal with. There is also an assumption of centralized formal decision-making when in large organizations a single executive rarely has the informative and administrative power to make decisions independently of other executives.

The second approach to strategy formulation, known as the "organizational process," is a step-wise problem-solving methodology. This approach, developed by Simon (1957), March and Simon (1958) and Cyert and March (1963) more accurately accounts for real conditions and constraints under which managers make strategic decisions. Instead of a rational, synoptic

strategy development, strategic planning becomes a process of "bargaining" between different and very often conflicting interests and goals of various coalitions and groups in an organization. Thus, instead of "maximizing" the managerial decisions become of a "satisfying" nature.

The third approach, called "bureaucratic politics" by Allison (1971) is described by Guth (1973) and Murray (1978). This approach indicates that traditional development of strategic planning "within" is considerably limited by external institutional policies, social and political pressures. The strategic plan is developed, not by rational and synoptic planning, and not even by resolving conflicting interests and goals of various pressure groups within the organization, but by "negotiating" with the outside pressure groups and regulatory Federal, State and local agencies.

We have to note that a close analysis of specific strategic planning models shows that some of them have elements of dialectical methodology. For example, "organizational process" approach gives an implicit account of the dialectical law of unity and conflict of opposites. Ansoff (1977) speaks about forecasts for future that will seek significant discontinuities and changes in direction. This is an indication of a "sudden leap" concept in the dialectical law of transformation of the quantity into the quality and vice versa. However, none of the above methodologies provide the holistic, systematic and dialectical approach, which is so characteristic of DMIS methodology.

One may expect that the practice of management and planning

in the Soviet Union, a country where Marxistic philosophy is of national and state magnitude, will show a high degree of conformity with DMIS methodology. Some of the Soviet management and planning decisions, especially those made in the early years of development, can be perceived as such. For instance, during the early development period some of the planning decisions were realistically directed towards the need to develop industries such as energy, steel, and heavy machinery. These basic industries are the foundation of technological progress. However, a closer examination of the Soviet practice indicates that many problems of management and planning are generated by the ignorance of DMIS methodology. DeGeorge (1966; p. 3) notes that Soviet "philosophy is subordinate to ideology; theory is subordinate to practice." This not only characterizes Soviet management, but also other areas of Soviet science and practice. For many years quantum mechanics, relativity theory, and genetics theory were attacked as incompatible with certain doctrines of Marxistic-Leninistic philosophy. Later, it was decided that these theories were not only compatible but also supported the Marxistic-Leninistic philosophy.

Failure to include timely structural and organizational changes into long-range and strategic planning creates enormous problems on all levels of Soviet management: national, industry, and enterprise levels. Vain (1977) notes the existing deficiencies in the development and formation of specific industrial structures (i.e., construction of stereotypical plants) and ministries (i.e., "raw-material" approach) complicate the

solution of strategic economic problems. It also hinders the scientific-technical progress and decreases the effectiveness of production and related technology. Milner (1975) examining the problems of management in Soviet firms and enterprises, notes that in Soviet research literature the management structures are examined from a static, descriptive and unidimensional viewpoint. Existing deficiencies in research and in practical formation of organizational structures have resulted in various drawbacks in some areas of Soviet management. The constant reorganization and restructuring, usually occurring late, of Soviet management and planning systems is practical evidence of existing problems.

Analysis of Soviet literature and practice in strategic planning shows that concepts such as synergy are not taken into account when Soviet firms and enterprises are organized, enlarged and/or diversified. It is widely known that some unprofitable enterprises are still supported by extensive government subsidies. An interesting example of contradictions between theory and practice is the case of production of mass consumer goods - one of the most backward industries in the Soviet economy. Specialization and centralization of production is viewed in theory as a way towards a substantial increase in production. In practice, however, the manufacture of these needed products is extremely dispersed in numerous production shops with obsolete technology. There is also a widespread tendency to disperse production of these goods in enterprises and firms with differing production orientations. As a result of these inefficiencies the quantity of consumer products

is below demand, quality is very low, and prices are relatively high.

In recent years we note a number of interesting papers on the problems of Soviet management published in Soviet journals. In these papers Russian researchers and practitioners quite openly and frankly discuss the existing problems of management and planning. One such article, written by a distinguished professor, Volkonskii (1977), has caused quite a stir resulting in debates among Soviet management specialists. Some of the interesting and innovative ideas raised by Volkonskii deal with controversial issues of Soviet management and planning such as: economic motivation, pricing, and the theory of optimum planning. According to Volkonskii, considerable contradictions exist in economic motivation between national and public, enterprise and individual interests; between planning indicators and economic reward system; between recognition of prices as an important regulatory instrument of demand and supply and rejection of the reverse relationship. Criticizing the Soviet theory of optimal planning, he indicates that the pricing marketing mechanism should not be looked upon as secondary to planning, because it usually leads to contradictions between the plan and price-market mechanism and finally to poor performance. Sominskii (1978), discussing the normative base of Soviet planning, has shown the negative impact of these norms on Soviet management and planning.

In the USSR the emphasis is on macro-level management and strategic planning, thus leaving only a narrow range of strategic decisions to be made at the firm or enterprise level.

The opposite holds true for the USA since major strategic plans and decisions are made and developed at the corporate level. It is, in a sense, a micro-level approach modified by a firm's external environment consisting of all conditions beyond its immediate control.

Chapter VI

PROBLEM-SOLVING TECHNOLOGIES AND RESEARCH HYPOTHESES

Problem-solving in general deals with making choices between alternative courses of actions. The problem-solving process creates possibilities for the application of dialectical methodology because:

1. Alternative choices of actions which are usually in conflict can be viewed as contradicting opposites of the same problem (thesis/antithesis situation);

2. The reduction of conflict or a resolution of the conflict episode may occur through a choice of one of alternatives;

3. Problem-solving may progress so that a synthesis of several alternative actions will occur. It is necessary to indicate that the dialectical methodology, described in the previous chapter, enriches the usual methodology of problem-solving by adding a philosophical (DMIS) orientation to the problem. As a result of this, factors in the content of the problem are incorporated in the problem-solving process and a link is made between a specific problem and its stipulated actions with the larger picture of the development of the organization.

In this chapter we will first introduce a four-variable classification scheme of conflict-oriented problem-solving technologies. Then the problem-solving technologies utilized in this study will be operationalized. Finally we will present the hypotheses tested in this empirical part of our research.

Classification of Problem-Solving Technologies

Examination of the existing problem-solving technologies (nominal grouping technique, interacting groups technique, delphi-group technique, Dialectical Inquiry System, devil's advocate approach, etc.) allows us to distinguish four specific variables: task structure, procedure (protocol), conflict-handling method, and degree of control over decision-making process. Using these variables we may develop a three-point classification scheme:

1. High structure problem-solving technologies.
2. Moderate structure problem-solving technologies.
3. Low structure problem-solving technologies.

Table 2 presents a summary of problem-solving technologies and variables used in our classification scheme.

In this study, Dialectical Problem-Solving Technology represents a High Structure, Devil's Advocate Problem-Solving Technology - Moderate Structure, and Control Groups - Low Structure Problem-Solving Technologies.

A High Structure Problem-Solving Technology - Dialectical problem-solving technology (DPST) - involves a high task structure (all steps are specified and timed, a conflict-handling method is prescribed, i.e., 'structured debate'), and problem-solvers have low control over decision-making process.

A Moderate Structure Problem-Solving Technology - Devil's Advocate Problem-Solving Technology (DAPST) - represents a problem-solving technology in which the task structure is moderate, procedure is moderately specified, conflict-handling

Table 2

Problem-Solving Technology	Common Variables			
	Structure [1]	Procedure [2]	Conflict-Handling Method [3]	Degree of Control over Decision Process [4]
High structure	High	Highly Specified	Prescribed	Low
Moderate structure	Moderate	Moderately Specified	Generally outlines	Moderate
Low structure	Low	Unspecified	Unspecified	High

1. Task structure is defined as a set of prescribed activities which problem-solvers are supposed to follow; i.e., high task structure means that decision-makers strictly follow a specific set of prescribed activities in a predetermined order.

2. Procedure or protocol is defined as step-by-stip operations with particular time requirements.

3. Conflict-handling method is defined as a technique through which intra-group conflict is channeled, i.e., structured debate in dealectical problem-solving technology.

4. Degree of control indicates the level of control over the decision-making process by the participants.

method is generally outlined, and problem-solvers exhibit moderate control over the decision-making process.

A Low-Structure Problem-Solving Technology (LSPST) - is utilized by the control group. This problem-solving technology can be characterized by low task structure, unspecified procedure and conflict-handling method, and high control by problem-solvers over the decision-making process.

Operationalization of Problem-Solving Technologies

Dialectical-Problem Solving Technology (DPST)

The DPST, as any other problem-solving technology, deals with the process of strategic and operational decision-making.[1] DPST is an operationalization of a conceptual model of problem-solving for strategic and operational planning. This model utilizes Dialectical Materialism Inquiry System (DMIS) methodology (Chanin and Shapiro, 1979). However, it is necessary to note that the framework of the computer-based simulated business game provides limited opportunities in testing the DMIS conceptual model. Therefore, in this study DPST primarily deals with that part of the DMIS model which encompasses the dialectical materialism law of unity and conflict of opposites, and development of strategic and operational plans.

The DPST is a three-step decision-making process:

1. Development of individual (conflicting) plans
2. Process of the structured debate
3. Synthesis-development, a final group plan.

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[1] The planning practice at Emerson Electric may be viewed as being similar to the DPST (Heyes, 1979).

Step 1 - Development of Individual (Conflicting) Plans

The individual strategic or operational decisions are prepared by the participants independently under conflicting sets of assumptions. Each firm (group) consists of a president and three vice-presidents. The three vice-presidents prepare three different conflicting strategic or operational plans by conjoining the same "data base" (accumulated information about their own and their competitors' performance from the computer printouts) with different assumptions about the environment and different understanding of the business game.

Step 2 - Process of the Structured Debate

The structured debate is conducted in the classroom. It is undertaken in two stages:

a. First, each vice-president presents his/her decision with the corresponding set of assumptions and policies for approximately three to four minutes (maximum total twelve minutes);

b. Second, after the presentation of the three plans is completed, a general discussion of each plan is undertaken. Pros and cons of each plan and corresponding assumptions are examined for approximately three to four minutes (maximum total twelve minutes).

Step 3 - Synthesis-Development of a Final Group Plan

In the last stage the participants agree on a final mutually acceptable set of assumptions and develop a stretegic or operational plan (forecast). After the completion of the structured debate all members of the organization should agree on a joint set of assumptions and make a joint decision

(maximum six minutes) on the eight decision variables. This set of accepted assumptions is employed to develop the final strategic or operational decision(maximum 45 minutes). It should be noted that sometimes an individual's plan will be accepted with only slight modification, but as a rule the final (joint) strategic or operational decision will differ from individual ones.

Devil's Advocate Problem-Solving Technology (DAPST)

The DAPST is based on the Devil's Advocate approach described by Boulding (1956) and Mason (1969). Some American corporations employ similar or modified methods in their decision-making. It appears that this method has been used at ITT (Brown, 1966). Thurnton (1974) discusses the application of an Adversary (Devil's Advocate) Approach in the Civil Aeronautics Board. Herbert and Estes (1974) traced examples of the Devil's Advocate Approach to the Roman Catholic Church, where the "Devil's Advocate" was termed as "promoter of the faith", to the Anglo-Saxon legal system and the British Parliamentary System with its "loyal opposition," which balanced the unilateral programs of the party in power by questioning almost routinely every government proposal. The authors indicated that the Devil's Advocate Approach can be used as an internal method by appointing an internal Adversary or as an external method by finding an external Adversary, e.g. a consulting company. The Devil's Advocate approach was also used in several empirical studies by Cosier (1980, 1978) and Cosier, et. al. (1978). Under the devil's advocate approach a specifically designated employee or group of employees,

known as the planning group, develops strategic and operational plans. Then the planning group appears before the orgnaization's management where it presents and advocates the plan in a form of a (strategic) management briefing session. Management performs the devil's advocate role. Management assumes the role of an "adverse and often carping critic of the plan" (Mason, 1969, p. B-407). In this function management criticizes the plan and makes the best attempt to pinpoint the shortcomings and justifies why the plan should not be adopted.

It is believed that really good plans may withstand the most forceful criticism, and that a high quality plan can be developed when this plan is subject to very strong criticism.

The operationalization of DAPST involves a four-step decision-making process:

1. Development of strategic and operational plans (forecasts)
2. Plan presentation at the management briefing session
3. Management critique of the plan
4. Development of a final plan.

Step 1 - Development of a Plan

Each team is divided into two interchangeable groups - the planning groups and the management group. The development of the strategic and operational plans (forecasts) is made by planning group at home.

Step 2 - Presentation

The planning group presents the plan (forecast) at the management briefing session in the classroom at the beginning

of the scheduled session. At the time of presentation the members of the management group take notes and find the weak and unacceptable points in the proposed plan.

Step 3 - Critique

After several minutes of consultation (if needed) the management group presents a devastating critique of the proposed plan. However, no constructive suggestions or proposals should be presented at this time.

Step 4 - Development of a Final Plan

At this final stage both the planning group and the management group develop the final decision, undertake necessary calculations, and submit the decision and work sheets to the game administrator.

It should be noted that no specific time limits are set for each of the four above-mentioned steps. However, the participants should be able to complete the decision-making process in 75 minutes.

Low Structure Problem-Solving Technology (LSPST)

The participants in the control teams use a low structure problem-solving technology. As was mentioned under this problem-solving technology, the task structure is low and procedure and conflict-handling method are unspecified. This means that the participants in each control team are allowed to choose any set of activities and also have the opportunity (freedom) to develop a problem-solving procedure according to their needs and desires. As a result of this, members of the control teams have complete control over the decision-making process. However, as with teams utilizing DPST and

DAPST, the control teams will have to complete the decision-making process in 75 minutes.

Research Hypotheses

In order to find answers to the questions raised in the Introduction, a matrix (Table 3) of problem-solving technologies and conflict-handling behavior modes has been constructed. The matrix will facilitate a simultaneous examination of interacting effects of problem-solving technologies and conflict-handling modes.

Three kinds of hypotheses are tested in this empirical study:

First, attitudinal hypotheses dealing with attitudinal perceptions of the subjects in the experiment about conflict-handling behavior modes;

Second, performance hypotheses dealing with group performance as a function of different problem-solving technology utilization;

Third, dialectical change hypotheses which include both attitudinal and performance hypotheses.

Attitudinal Hypotheses

These hypotheses indicate perceptions about conflict-handling behavior modes into which individuals tend to engage. Each individual potentially is capable of employing all five conflict-handling behavior modes. However, some modes may be preferred or used more than others. This depends on such factors as problem-solving technology, situation and personal characteristics. In this study, all subjects are faced with the same situation - decision-making in a computer-simulated

business game. We may also assume that random assignment of students into classes and teams minimizes or at least equates the impact of individual characteristics. Therefore, it is assumed that the conflict-handling behavior mode into which students/subjects will tend to engage depends to a large degree on the type of problem-solving technology.

Table 3 summarizes the level of structure, type, theoretical background of problem-solving technologies and predicted levels of subjects' involvement for each conflict-handling behavior mode.

The examination of the literature and analysis of the preliminary results from the pilot study, conducted in the fall semester of 1979 led this researcher to the formulation of the following hypothesis.

The following two hypotheses deal with comparison of the level of involvement or in Renwick's (1975, 1977) terminology likelihood of utilization of a specific conflict-handling behavior mode across different problem-solving technologies.

Hypotheses 1

Subjects perceive considerable differences between conflict-handling behavior modes generally and in each problem-solving technology specifically (DPST, DAPST, and LSPST)

Hypotheses 2

Subjects utilizing a specific problem-solving technology will exhibit preference for conflict-handling behavior modes in the following way:[1]

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[1] The number 1 represents the highest preference.

Table 3

Problem-Solving Technologies			Conflict-handling Behavior Modes				
Type of Structure	Type of Problem-Solving Technology	Theoretical Background	Competing	Collaborating	Compromising	Avoiding	Accommodating
High	DPST	Chanin, Shapiro (1979)	High	High	Low	Low	Low
Moderate	DAPST	Boulding (1956); Mason (1968)	Medium	Medium	High	Medium	Medium
Low	LSPST	Control groups	Low	Low	Medium	High	High

1. Thomas Kilmann "Mode" Instrument (1974)

H2A Total Sample:

Competing	3
Collaborating	2
Compromising	1
Avoiding	5
Accommodating	4

H2B DPST Sample:

Competing	2
Collaborating	3
Compromising	1
Avoiding	4
Accommodating	5

H2C DAPST Sample:

Competing	3
Collaborating	2
Compromising	1
Avoiding	4
Accommodating	5

H2D LSPST Sample:

Competing	5
Collaborating	2
Compromising	1
Avoiding	3
Accommodating	4

Table 4 presents information necessary for the development of statistical and substantive hypotheses. Because we expect statistically significant differences (inequalities) for a specific mode across different problem-solving technologies

one-tail tests will be used. However, the hypotheses which we will seek to reject will be stated as equalities.

Table 4

Conflict-Handling Behavior Mode	Problem-Solving Technology		
	DPST	DAPST	LSPST
Competing	High	Medium	Low
Collaborating	High	Medium	Low
Compromising	Low	High	Medium
Avoiding	Low	Medium	High
Accommodating	Low	Medium	High

Hypothesis 3A - Competing

Given the Competing mode of conflict-handling behavior, the DPST groups will have a higher level of involvement as compared to DAPST and LSPST groups.

$$H_o : M_{dt} = M_{da} = M_{ls}$$

$$H_1 : M_{dt} > M_{da} > M_{ls}$$

Where M_{dt} is an aggregated mean for subjects using Dialectical Problem-Solving Technology.

M_{da} is an aggregated mean for subjects using Devil's Advocate Problem-Solving Technology, and

M_{ls} is an aggregated mean for subjects using Low Structure Problem-Solving Technology.

Hypothesis 3B - Collaborating

Given the Collaborating mode of conflict-handling behavior, the DAPST groups will have a higher level of involvement as compared to DPST and LSPST groups.

$$H_o : M_{dt} = M_{da} = M_{ls}$$

$$H_1 : M_{dt} > M_{da} > M_{ls}$$

Hypothesis 3C - Compromising

Given the Compromising mode of conflict-handling behavior, the DAPST groups will have a higher level of involvement as compared to LSPST and DPST groups.

$$H_o : M_{da} = M_{ls} = M_{dt}$$

$$H_1 : M_{da} > M_{ls} > M_{dt}$$

Hypothesis 3D - Avoiding

$$H_o : M_{ls} = M_{da} = M_{dt}$$

$$H_1 : M_{ls} > M_{da} > M_{dt}$$

Hypothesis 3E - Accommodating

Given the Accommodating mode of conflict-handling behavior, the LSPST groups will tend to have a higher level of involvement as compared to DAPST and DPST groups.

$$H_o : M_{ls} = M_{da} = M_{dt}$$

$$H_1 : M_{ls} \quad M_{da} \quad M_{dt}$$

Performance Hypotheses

Strategic planning with its ill-structured and ill-defined type of problems necessitates a certain and structured approach as an uncertainty-reducing method. Recently Mintzberg, et. al., (1976) and Mitroff, et. al. (1979) have argued for a structured

approach to unstructured decision-problems. Dialectical problem-solving technology (DPST) can be viewed as a member of a larger class of highly structured problem-solving technologies.

It is stipulated that DPST is more suited for dealing with strategic planning problems as compared to DAPST and LSPST:

First, it stimulates and forces problem-solvers into a dialectical process of strategic and operational planning;

Second, it employs conflicting sets of explicit assumptions on which conflicting plans are developed;

Third, it helps the problem-solvers to develop an enlightened understanding of the planning problem (a new set of assumptions) and a new integrated plan.

It is presumed that the application of DPST will lead to the development and more successful implementation of strategic and operational plans in terms of objective performance.

Hypotheses 4A

Experimental groups employing DPST will tend to outperform DAPST and LSPST groups in ranking, ROI and profit measures.

Hypotheses 4B

The application of DPST increases awareness and understanding of economic and planning problems, therefore, subjects utilizing DPST will tend to outperform the DAPST and LSPST groups in scoring on business game tests (indirect measure of performance).

Dialectical Change Hypotheses

The social and economic systems of the Western world

have entered the era of massive and accelerating rates of change, which probably became the prime reason for the failure of the rules and values on which our rationality is predicated. The phenomena, generated by turbulence and uncertainty of the environment in which organizations are operating, produce not only stress and discomfort, but also question the validity of many general concepts that for a long period of time provided the foundation of our world outlook. Examination of the literature in the areas of strategic problem-solving and conflict resolution indicates that dialectical changes in human behavior are still not accounted for. Most of the behavioral research including studies on conflict and conflict resolution deal with individual attitudes from a static point of view, i.e. it takes a census of attitudes, opinions, responses at a specific point in time. No attempts are made to study these variables in a dynamic change process. Participation in problem-solving and conflict reduction exercises continuously influences the problem-solvers attitudes, opinions and perceptions about the surrounding reality because of the very dialectical process of development. The success of business enterprise and organizational performance is continuing to be measured primarily in such absolute terms as profit, return on investment, market share, number of new products, etc. It is our opinion that a more appropriate measure of organizational performance would be δ (delta) - rate of change. Therefore, the prime system of absolute measures, presently used in strategic planning should be substituted or at least augmented, by the relative

measures of change and development: rates of growth, rate of profit increase, rate of market share increase, directional measures of organizational growth, etc. It is more important to know, given equal conditions, where the organization is headed (whether it is located on an entropic or synergistic cycle) than to know what is the absolute profit in the current year. It is also more important to be able to predict from a study of behavioral attitudes and responses in the past and present time the possible changes in individual behavior in the future. Resolution of one conflict creates foundation for future conflicts. Therefore, it is important to develop at the present time knowledge which will allow us to be ready to deal with future conflicts. In summary, we have to emphasize the need for a move from census type behavioral studies and models based on them towards dialectical studies which will allow us to build dynamic theory and models.

In this study an attempt is made to test some of the dialectical aspects of the change process. The hypotheses presented below can be viewed as attitudinal - involving the change of perceptions in conflict-handling behavior (subjective measures); rates of performance improvement (objective measures); and pertaining to DMIS model testing.

Dialectical Attitudinal Hypothesis

Hypothesis 5A

The more group problem-solving that occurs during the initial decision-making process,[1] the more cooperative the

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[1] The initial decision-making process is decision-making during the first year (four quarters) of the simulated business game.

subsequent relationships between the subjects.

Hypothesis 5B

The more competing that occurs during the initial decision-making process, the more assertive the subsequent relationship between the subjects.

Dialectical Performance Hypothesis

Hypothesis 6A

Application of DPST leads to high rates of improvements in profit, ROI and ranking as compared to DAPST and LSPST groups.

Hypothesis 6B

Application of DPST leads to higher forecast accuracy in the dialectical process of strategic planning.

DMIS Model Hypothesis 7

Organizations with perceived or actually poor performance (location on the entropic cycle) tend to change the organizational structure (reelection of the president or reassignment of executive functions and responsibilities) more often than organizations with perceived or actually improving or satisfactory performance (location of the synergy cycle).

Chapter VII

METHODOLOGY

General Background

Initially, our intention had been to undertake a field study in order to test interacting modalities of problem-solving technologies and conflict-handling behavior modes in the context of strategic and operational planning. However, the idea of a field study had to be dropped when it became evident that it would be practically impossible to secure cooperation and commitment of a sufficient number of organizations to test (under controlled conditions) the hypotheses formulated in the previous chapter. The field approach also appeared to be infeasible because of the need for long-range cooperation by various organizations in order to study the dialectical effects of the long-range planning process. It was also presumed that in the absence of previous experience in managerial decision-making, the senior business students in comparison with practicing managers would be more receptive to the application of various problem-solving technologies. Finally, the existing time constraints had limited our commitment to this project. Therefore, this study utilizes an experimental technique known in the literature on laboratory experimentation as a free simulation technique. The foundations of this technique were laid by Guetzkow and his associates (1962). This group of researchers departed radically from standard laboratory techniques by exposing participants to a considerably larger number of real-world-like events simultaneously. In contrast to standard laboratory experiments

which deal with one of several independent and dependent variables and may continue from one to several hours, a free simulation experiment deals with considerably larger number of variables and may run somewhere from several days to several months. In addition, there exists a dialectical element in the free simulation technique where events that take place during the experiment are shaped, at least in part, by the changing behavior of the subjects themselves. Participants in a free simulation study possess the discretion to modify the inputs themselves ("the independent within variables") according to their own behavior.

Fromkin and Streufert defined free simulation as a research method:

> "1. where participants are placed in a complete environment which represents the criterion environment as much as possible;
>
> 2. where participants are generally free to behave within the boundaries of established rules and the interaction of simulation parameters, participants own past behavior and the past behavior of others with whom participants are interacting;
>
> 3. where participants attempt through their actions to cope with environmental (change) characteristics or the behavior of other participants; and
>
> 4. where ongoing events are determined by the interaction between experiment-determined parameters and the relatively free behavior of all participating groups." (1976), p. 423).

Recognizing the value of the simulation technique the same authors note that "one might say that experimenters who use this research method are creating field research in the laboratory" (Fromkin and Streufert, 1976, p. 423).

As a research method the free simulation approach possesses advantages and shortcomings. Weick (1965) has noted that it may produce confusion and lead to the loss of interest by the subjects in the study. However, Guetzkow (1962, 1968) and Streufert (1968) indicated that the advantages of well designed simulation experiments far outweigh the possible pitfalls because of:

1. the actually higher degree of involvement that participants tend to exhibit;
2. its potential relationship to criteria-setting;
3. little need for concern with controlling confounds because they are a part of the simulated environment; and
4. reduction in the need for artificially created events and facts as a result of a higher degree of subjects' involvement.

In order to provide a realistic simulation experiment the present study is based on the following five properties suggested by Drabeck and Haas (1967):

1. Utilization of a real group or an artificial group that is assembled long enough to become real;
2. realistic task characteristics that are familiar to the groups;
3. a realistic ecological environment;
4. interactions with the environment (e.g. input information, feedback, etc.); and
5. avoidance of subjects' awareness that they are participating in an experiment.

The research methodology discussed in this chapter will try to show that the present study not only satisfies these requirements but also provides a good foundation for examining the above-mentioned properties and the cause-and-effect relationships between specific problem-solving technologies and conflict-handling behavior modes.

Research Design

The present study is a longitudinal simulation based on statistical analyses and the application of both observation and attitudinal survey methods. The study is an ex post facto in-progress 3X5 fixed factorial design to test the aforementioned hypotheses. The ex post facto in progress includes three measuremnts of the dependent variables, which are administered at the end of the fourth quarter (first year), eight quarter (second year) and twelfth quarter (third year).

The preference for an experimental design without using a pretest is based on an argument provided by Campbell and Stanley (1963). They have stated that pretests are not really necessary when a randomized process is used - "...the most adequate all-purpose assurance of lack of initial biases between groups is randomization. Within the limits of confidence stated by the tests of significance, randomization can suffice without pretest" (1963, p. 25).

Randomized allocation of subjects into classes and teams (companies) provides an adequate control over selection, motivation, statistical regression and internal validity threats from history of prior experience. While randomization is not a perfect process, it is the only workable method by which we

can assure compatibility within some known error interval. In addition, a pretest would be counterproductive to the very idea and the purpose of this research, which is to study dependent variables in the process of decision-making for strategic and operational planning. However, one may see some kind of undesirable analogy between pretest and multiple measurements, which may affect the dependent variables. As a result of these multiple measurements, it is likely the participant's attitude and his/her propensity for persuading may be changed. However, it should be realized that this change in perceptions and attitudes is the focal point of a dialectical study. In addition, the undesirable effects of the multiple measurements of the dependent variables are minimized by:

1. A comparatively large interval of five weeks between each measure, and
2. Modifying the format of the measuring instruments.

The aforementioned hypotheses can be divided into the three following groups:

1. hypotheses dealing with participants' attitudes about conflict-handling behaviors;
2. hypotheses dealing with performance of groups using different problem-solving technologies;
3. dialectical hypotheses including both perceptual and performance changes that occur during strategic and operational planning with its longitudinal decision-making process in the context of the simulated business game.

Modifying Emory's notation (1980, p. 341-342), the basic experimental design may be diagrammed as follows:

R	X_i	O_{ijk}	(1)
R	X_i	O_{ijk}	
R		O_{ijk}	

Where:

R Indicates that groups of participants are selected randomly

X indicates independent variable or treatment (absence of X shows that no treatment was applied)

O indicates an observation or measurement of a dependent variable

i is the number of treatments or independent variables (i = 1 is DPST and i = 2 is DAPST and i = 3 is LSPST)

j is the number of measurements of the dependent variables (j = 1, 2, 3)

k is the particular dependent variables.

The basic experimental design with three measures of the dependent variables can be diagrammed in a more extensive form as follows:

		4th Quarter	8th Quarter	12th Quarter	(2)
R	X_1	O_{11k}	O_{12k}	O_{13k}	
R	X_2	O_{q1k}	O_{22k}	O_{23k}	
R		O_{31k}	O_{32k}	O_{33k}	

The first group of hypotheses dealing with participants' perceptions includes five (k = 5) conflict-handling modes as the dependent variables: competing, collaborating, compromising, avoiding, and accommodating.

The effect (E_{ij}) of a particular problem-solving technology application is measured by a vertical comparison as shown below:

4th Quarter Year 1	8th Quarter Year 2	12th Quarter Year 3	(3)
$E_{11} = O_{11k} - O_{21k}$	$E_{12} = O_{12k} - O_{22k}$	$E_{13} = O_{13k} - O_{23k}$	
$E_{11} = O_{11k} - O_{31k}$	$E_{22} = O_{12k} - O_{32k}$	$E_{32} = O_{13k} - O_{33k}$	
$E_{3k} = O_{21k} - O_{31k}$	$E_{32} = O_{22k} - O_{32k}$	$E_{33} = O_{23k} - O_{33k}$	

For example, E_{22} compares DPST and LSPST for a specific dependent variable. The second group of hypotheses deals with group performance by using such objective measures as ranking, return on investment and profit. The effect of different problem-solving technologies on group performance (PE = performance effect) is measured at the end of the 12th period by veritical comparison as shown below:

$$PE_1 = O_{1k} - O_{2k} \qquad (4)$$

$$PE_2 = O_{1k} - O_{3k}$$

$$PE_3 = O_{2k} - O_{3k}$$

In this case k indicates the type of a dependent variable (k = 1 is ranking, k = 2 is return on investment and k = 3 is average quarterly profit). For instance $PE_1 = O_{11} - O_{21}$ compares ranking for groups using DPST and DAPST technologies.

To determine the effects of the dialectical process (DE

is the dialectical effect) is a more complex operation in comparison with the measurements needed for the first two groups of hypotheses. In this case we are interested in comparative changes generally and rates of change specifically. Therefore, we have first to find annual changes for each problem-solving technology (horizontal comparison) and second to compare these with corresponding changes in groups employing other problem-solving technologies (vertical comparison). Using the extended form (2) of the basic experimental design we write all possible combination for examination of the first set of attitudinal hypotheses as follows:

Comparison of changes in Years 1 and 2

$$DE_1 = \frac{O_{11k} - O_{12k}}{O_{21k} - O_{22k}}$$

$$DE_2 = \frac{O_{11k} - O_{12k}}{O_{31k} - O_{32k}}$$

$$DE_3 = \frac{O_{21k} - O_{22k}}{O_{31k} - O_{32k}}$$

Comparison of changes in Years 1 and 3

$$DE_4 = \frac{O_{11k} - O_{13k}}{O_{21k} - O_{23k}} \qquad (5)$$

$$DE_5 = \frac{O_{11k} - O_{13k}}{O_{31k} - O_{33k}}$$

$$DE_6 = \frac{O_{21k} - O_{23k}}{O_{31k} - O_{33k}}$$

Comparison of changes in Years 2 and 3

$$DE_7 = \frac{O_{12k} - O_{13k}}{O_{22k} - O_{23k}}$$

$$DE_8 = \frac{O_{12k} - O_{13k}}{O_{32k} - O_{33k}}$$

$$DE_9 = \frac{O_{22k} - O_{23k}}{O_{32k} - O_{33k}}$$

Let us assume that we are measuring changes for the collaborating (k=2) mode of conflict-handling behavior. By reading the notations in the numerator and the demoninator, for example $DE_5 = O_{111} - O_{231}/O_{231} - O_{331}$ we know that we are measuring the changes in the subjects' involvement into the collaborating behavior mode for DPST groups in comparison with control groups (LSPST) during two years of strategic and operational planning.

Subjects

The subject pool was composed of 200 senior undergraduate students enrolled during the spring semester of 1980 in Business policy courses at Bernard Baruch College, the City University of New York. Six students dropped the course, three of them after the first questionnaire administration. Therefore the mortality rate was 3 percent. Because of truancy the first questionnaire was administered and data collected from 179 subjects (92.3% of students who finished the courses), correspondingly second questionnaire - to 186 subjects (95.9%) and third questionnaire - to 188 subjects (96.9%).

A total of six sections, three day and three evening, were utilized in the present study. The six sections of the business policy course were assigned as follows: two sections to DPST treatment, two sections to DAPST treatment and two sections to LSPST (control) treatment. A total of 51 teams (27 "day student" firms and 24 "evening student" firms) were randomly organized into three day industries and three evening industries. Allocation (registration) of students into specific teams (firms) was based on a random process and can be

considered a random sample from the same population. The following symmetrical matrix was used for a random process of team allocation into specific industries. Each industry as shown in Table 5 is composed of three DPST, three DAPST and three LSPST teams.

Table 5

Problem-Solving Technology	Industry No. 12	Industry No. 13	Industry No. 17
LPST Control	1, 2, 3	7, 8, 9	4, 5, 6
DAPST	4, 5, 6	1, 2, 3	7, 8, 9
DPST	7, 8, 9	4, 5, 6	1, 2, 3

Because of insufficient number of students registered for the evening sections only eight teams were organized in each section. An assymetric matrix was constructed for random assignment of teams into industries as shown in Table 6 .

Table 6

Problem-Solving Technology	Industry No. 18	Industry No. 19	Industry No. 20
LPST Control	1, 2, 3	7, 8, 9	4, 5
DPST	4, 5, 6	1, 2, 3	7, 8
LSPST Control	7, 8, 9	4, 5, 6	1, 2

As shown in Table 6, the DAPST section did not have team No. 6, DPST Section - team No. 9, and LSPST section - team No. 3.

Coding and decoding of the computer printouts was done by the game administrator and subjects of a particular team did not know in which specific industry they were operating. However, the composition of each industry was held constant throughout the whole experiment. This not only had increased uncertainty but also precluded personal exchange of information between teams operating in the same industry. The teams consisted of subjects who were not familiar with each other. In addition, all teams were composed of students who worked together as a team for the first time.

Thus, the whole process of selecting and allocating subjects into sections, teams and industries was made randomly, the only non-random aspect of the subject assignment was that all teams were required to have students with different specialization areas. No attempts were made to account for differences in personality, sex, age, class, prior business experience, average grade-point, or schools. It was presumed that these differences would be handled by randomization.

Description of the Simulation

Problem-solving for strategic and operational planning has been employed in this study to investigate the interacting modalities of problem-solving technologies and conflict-handling behavior modes. The present experiment based on the following three major elements:

1. The "Executive Game"

2. Strategic and operational planning

3. Organizational structure.

The vehicle used to simulate the decision-making process is the "Executive Game" by Henshaw and Jackson (1978). The concept of this model is similar to many others used as business games (Churchill, 1970; Niland, et. al., 1969; McFarlon, 1970; Barton, 1973). In this game up to nine firms are competing in the manufacture and sale of a single medium-technology product. The major objectives in this game are to achieve highest profits, return on investment and the most important - the highest rank in the industry. The game allows not only application of principles of business administration to realistic situations but also provides an imaginary business environment in which subjects can practice the art and science of strategic and operational planning and problem-solving at the top management level. The game offers a dynamic business case, whose outcome is determined by the internal functioning of the top executives, external interaction of the competing firms, and prevailing economic conditions affecting the industry market potential. Although the computer program is essentially deterministic, the game itself involves a high degree of uncertainty, which stems not only from imperfect predictions of economic factors, but also from unpredictable and very often erratic behavior of competing firms. Every quarter the teams representing independent firms have to make decisions regarding the price of the firm's product, marketing budget, Research and Development budget, plant maintenance budget, scheduled production volume, plant investment budget, raw materials

purchase budget, and dividends. These decisions are made quarterly in accordance with the developed strategic and medium-range plans. The computer implements the team's decisions exactly as received, except when a specific decision is infeasible. However, in the production volume the computer will correct volume by selecting the smaller of 1.4 times of the current production capacity and availability of raw materials for processing. Team decisions are fed into the computerized model, which simulates both the internal operations of the firms and their interactions under prevailing economic conditions. The computer provides various reports based on this simulation, including income statement, cash statement and balance sheet. In addition, it provides participants (quarterly) with information about competitors' price, sales volume, profit and dividends paid, (annual) carryover inventories, owner's economic equity, average marketing, R & D budgets and profits, return on investment and final ranking of the firms in the industry. These reports together with the textbook serve as a "data bank" to be used by the subjects in their problem-solving process.

All teams are required to develop strategic and medium-range plans. Because of the nature of the product manufactured by all firms, the strategic planning time horizon was assumed to be three years, medium-range - one year, and short-range (operational) - one quarter. After completing two trial and one actual decisions, all teams submitted strategic and medium-range plans for the first and second years, using a special forms (see Appendices I & II), designed by the instructor. However, only DPST groups were asked to submit the statement

of policies and assumptions which is in accordance with the assumptional analyses used in the dialectical approach. The remaining teams were required to submit the strategic plan and statement of policies (strategy) desired to achieve the firm's goals and objectives.

The simulation continued for 12 periods during the spring semester of 1980. The decisions were made weekly on Tuesdays, with performance feedback (computer printouts) provided to the subjects on Thursdays. After completing four quarters each team was required to submit an annual report, using a specially designed form. The report included a managerial audit and analyses of the financial statements. All teams were allowed to revise the strategic plan and medium-range plan for the second year if the teams found itself in considerable deviation from the originally planned goals. A second revision of the strategic plan was also allowed at the end of the second year.

To facilitate the implementation of the firm's long-range policies, a special organizational structure was developed in order to create a departmental (functional) type of organization in the experimental groups and an organic type of organization in the control groups. Four subjects were assigned to each team (firm) composed of a president and three vice-presidents. Subjects were asked to elect the president and three vice-presidents, and to allocate 23 executive functions between themselves. Together with the possibility of the plan revisions all teams were allowed to change the organizational structure, which in the context of this simulation meant

the selection of a new president and/or reassignment of executive functions.

It should be emphasized that the experiment was made an integral part of the business policy course generally and the "Business Game" specifically. It was, of course, essential that subjects should take the experiment seriously and participate in all decision-making sessions. A principal of "No participation - no points" similar to real business world principle "No work - no pay" was implemented for the duration of the game. This not only considerably increased the attendance but also improved the communication between the would-be absentee and his teammates and the instructor. Absence without a justifiable reason led to automatic loss of 2 points for not participating in the decision-making process and one point loss in individual performance for avoiding personal responsibilities.

Though the experiment was made an integral part of the course, additional efforts were made to conceal the true purpose of the experiment in order to prevent subjects from trying to out-guess the experimenter or from trying to provide the experimenter with responses that they thought he wanted.

A concept of "vested interest" was incorporated into the present experiment. This concept implies that problem-solvers participating in group decision-making have both high individual stakes in the outcome of these decisions and the ability to affect the results of the group decisions by exhibiting a high degree of persuasion and influence on the other teammates.

The "vested interest" of individual problem-solvers is a total of 12 points or one point per decision. At the same time group performance is rewarded by a maximum of 24 points. The experiment can generate situations where individual performance may be poor (low budgeting for marketing expenses and high price per unit leading to excessive Finished Goods Inventory) despite good overall team performance (higher ranking) and vice versa. Therefore, very often the individual problem-solvers try to maximize their own performance before accommodating their teammates. They perceive the individual performance as a controllable or at least a partially controllable variable and the group performance as an uncontrollable variable; group performance depends not only on the group decision but also it is a function of external economic conditions and the competitors decisions.

Thus, the application of this concept permits the experiment to closely approximate the actual situational climate in the real business world. Therefore, the "vested interest" intensifies and strengthens the commitment or participants (Stagner and Rosen, 1969; Pen, 1952) and also enhances the sense of realism leading to an increase in the depth of the exposure of the subjects to the simulated decision-making process (Baldwin, 1969). The perception of "vested interest" was consistently reinforced by using lectures, discussions and providing feedback on individual performance after each decision.

Because of the relatively short period of time and the nature of the simulated experiment, several techniques were

utilized in order to increase the involvement of the subjects in the experiment and to stimulate the development of attitudes of sufficient intensity to permit their measurements. To the extent possible we employed the following five ways to increase involvement as proposed by Weick (1965):

1. Involvement through instructions;
2. Involvement through visibility of performance;
3. Involvement through exchange;
4. Involvement through performance data;
5. Involvement through tasks.

Weick (1965) also suggested the use of "Involvement through hiring" that could not be used because of game constraints.

Involvement through instructions

Weick cautioned against lengthy instructions, which may weaken the effect of specific manipulations and induce caution and confusion of the subjects due to the fear that they have forgotten some of the instructions and are behaving incorrectly. He also proposed to use less elaborate manipulations and brief instructions and to allow sufficient time for subjects to familiarize themselves with the setting and specifics of the experiment. Therefore, our instructions about problem-solving technologies were limited to two double-spaced typewritten pages. Sufficient time was allocated for answering questions relevant to the simulation mechanism prior to making the first actual decision. Profit and other data generated from two trial decisions were used in the learning process and then discarded.

Involvement Through Visibility of Performance

Weick (1965) advises that visibility is more likely to produce high involvement if the subjects are acquainted and if they also take the situation seriously (p. 251). Two trial decisions helped the subjects of each team to become sufficiently acquainted. In addition, the results of individual performance were made visible to all members of each team.

Involvement Through Exchange

This was achieved by using grade-points towards the final grade as a reward for performance. However, it should be noted that Weick indicates that such a reward is seldom influential in increasing subject involvement. He propsoes application of prior rewards to "obligate" the subjects. Because no such reward was available this approach was considered to be infeasible.

Involvement Through Performance Data

Weick stresses that performance feedback in terms of error made (negative feedback) is more meaningful than feedback in terms of profits (positive feedback). However we recognize that there exists a considerable body of literature especially in education, which stresses the importance of positive rewards (positive feedback), for example, in a learning process. According to Weick if participants attribute the poor performance to the experimenter rather than to themselves, the subject involvement will decrease. However, this was not the case with this experiment. The subjects attributed poor individual or team performance to themselves or their teammates and outside external environmental conditions. Therefore, in

such cases the involvement is improved "to the extent that the blame ramifies internally," and as a result of this "a vivid experience is apt to result" (p. 253).

Involvement Through Tasks

Weick advises the use of tangible rather than intellectual tasks and novel rather than routine tasks. This advice was followed in the present study; of course the task faced by the subjects was tangible - they have been dealing with actual decision-making and real business elements (profits, budgeting expenses, production volume, dividends, etc.). In addition, the subjects were provided with actual performance feedback. Nevertheless, the major factor of the experiment was the novelty of the simulation. The subjects had never experienced integrated and interpersonal decision-making. The subjects expressed genuine interest and fascination with the experience in learning of managerial skills through actual decision-making.

Independent Variables

The following three independent variables were chosen for the study:

1. High structure problem-solving technology (DPST);
2. Moderate structure problem-solving technology (DAPST); and
3. Low structure problem-solving technology (LSPST).

The independent variables are introduced into the research design by setting up differential starting positions - different problem-solving technologies for different teams in the experiment. The first two independent variables have been introduced

via short written instructions to the subjects. No special written instruction was provided to the control groups using Low Structure Problem-Solving Technology. The subjects in the control groups were told that they may adopt any decision-making process that they consider appropriate for their team.

Two trial periods which preceded the experiment were used to break-in the subjects into specific problem-solving technologies. In order to control and reinforce the compliance of the subjects with the specific problem-solving technologies, they were requested to submit a specially designed report on the problem-solving technology after each decision. In addition, regular observation of teams' decision-making process and application of specific problem-solving technology were conducted by outside observers. In order to stimulate application of a specific problem-solving technology the subjects were told that these technologies are used in the real business world and utilization of them will lead to high team performance if they consistently follow and apply corresponding problem-solving technologies. In addition, a total of 12 points (1 point per decision) were assigned to stimulate and reward the application of specific problem-solving technologies. Based upon self-report and raters' observation reports, the teams were given weekly feedback on how well they complied and utilized specific problem-solving technologies.

Dependent Variables

Two groups of dependent variables are investigated in the present study:

First, variables that deal with the perceptions of the subjects about the application of conflict-handling behavior modes (collaborating, competing, avoiding, accommodating and compromising); and

Second, variables that deal with a team's performance in terms of profit, ROI and ranking.

The first group of variables is derived from attitudinal scales administered after subjects have completed the fourth (1st year), eighth (2nd year) and twelfth (3rd year) decisions, but before they receive the annual results.

The second group of variables-objective measures of teams' performance are obtained from annual computer printouts provided by the game model. In addition, we also obtain through observation and teams' reporting the number of changes in the teams' organizational structures.

Intragroup Conflict Management

Two types of conflict are induced and reinforced in this experiment:

1. Intergroup conflict
2. Intragroup conflict

All teams assigned to one industry are competing between themselves for the leadership in the industry - the highest rank. The team's rank is a combination of a firm's achievement in sales, profits, market share, dividends paid, etc. An indicator of strong competition among firms is that almost all groups have indicated the first three ranks as a major objective of their strategic plans.

The intragroup conflict is based on the structural conflict

programmed in the mathematical model of the simulated business game. A company which achieves a specific level of activity (sales, production, revenues, costs) has to find not only an acceptable level of expenditures but also a proper proportion of expenses for various budgeted items (marketing, R & D, maintenance, plant investment, raw materials and dividends). If a company does not want to jeopardize its financial health (a substantial increase in negative cash leading to very high finance charges) it may increase expenditures in one or several desired items, e.g. marketing or dividends only by decreasing expenses in other areas (i.e., R & D, maintenance or Plant Investment).

Intragroup conflict is created by assigning particular executive functions to members of the team. The assignment of functions was done by the members of teams themselves, and in most of the cases, it involved the creation of functional departments, managed by a vice-president, i.e. production department, marketing department, finance and accounting department, etc. The intragroup conflict is induced by a reward of twelve points or 1 point per one decision. The vice-presidents receive automatically this point unless he/she performs poorly in the areas of their responsibility. Depending on the magnitude and intensity of the resulting consequences (from a poor decision) the individual executive may lose a part or the whole point for a decision. Together with the computer printouts about the team's performance the individual members receive written statements about lost points for poor performance in areas of their responsibilities.

It is interesting to note that the induced and consistently reinforced conflict has created in the majority of teams a good competitive environment for decision-making. Only in two teams the conflict became to some degree counter-productive in such a way that proposals from individual subjects were ignored by the remaining members of the team. These two subjects even requested a transfer to other groups. However, after intervention by the researcher both teams were able to develop proper channelling of the existing conflict and to make joint team decisions. It was indicated to all subjects that good managers, in addition to knowledge and ability to make good individual decisions, should be able to communicate this knowledge and be able to influence the team decisions.

Conflict-Handling Instrument

An examination of the literature has revealed five major instruments measuring conflict-handling modes: Blake and Mouton (1964, Lawrence and Lorsch (1967), Hall (1969), Thomas and Kilmann (1974) and Ackelsberg's (1977). Our analyses of each of these instruments has indicated that the Thomas-Kilmann instrument is more suited for the present study. The Thomas-Kilmann instrument (Appendix III) contains 30 pairs of statements representing five modes of conflict-handling behavior. Each mode is coupled with the other four modes an equal number of times. Subjects are asked to choose a statement (A or B from each pair) that best describes their behavior in a conflict situation. A behavior pattern is obtained by summarizing the

number of statements endorsed by each subject in every conflict-handling behavior mode.

The choice of the Thomas-Kilmann instrument has been made because it is one of the newest and relatively well researched instruments in the literature on conflict management (Kilmann and Thomas, 1977; Ruble and Thomas, 1976; Jamieson and Thomas, 1974; Thomas and Schmidt, 1976). Thomas and Kilmann (1978) in a comparative study of Blake and Mouton (1967), Lawrence and Lorsch (1967), Hall (1969) and Thomas and Kilmann (1974) instruments have found that their instrument generally has a higher test-retest reliability than the other scales. Only Hall's instrument shows somewhat higher test-retest reliability for competition and Lawrence and Lorsch's instrument for Accommodation. Similarly, relatively higher scores were found in testing internal consistencies (coefficient α) for Thomas-Kilmann instrument in comparison with Lawrence and Lorsch's and Hall's instruments. However, Hall's instrument shows high scores for Collaboration and Accommodation and Lawrence-Lorsch for Accommodation. With respect to convergent validity, Hall's and Thomas-Kilmann's instruments are correlated across all five modes ($p<.05$). Convergence between other pairs of instruments varies, according to authors, marked by mode of conflict-handling. The second advantage of Thomas-Kilmann's instrument is that it significantly reduces the social desirability bias for the overall population. The Lawrence and Lorsch scale also acquired popularity among researchers on conflict management. However, it was felt that

that student-subjects would not be able to appreciate the inherent abstraction of Lawrence and Lorsch's proverbs.

Performance Evaluation

Profit, return on investment and ranking are three objective measures of team performance during three years of competition. As we have already stated, the success of failure of a particular company primarily depends on the problem-solving technology employed by this company and a combination of individual and group skills in decision-making. However, the effect of the latter is minimized by the random process of subject allocation into classes, industries and teams. In addition, all teams in a specific industry are faced with the same, though constantly changing, external economic environment and because of this cannot acquire a competitive edge. Individual performance on six game tests is a secondary and indirect measure of performance. It is expected that teams utilizing specific problem-solving technologies and conflict-handling behavior modes or a combination of both will out perform other teams. In order to eliminate the possible rater-rater bias, each test was graded blindly by one instructor.

Data Analysis

The magnitude of questions raised in the present study, the different nature of attitudinal dependent variables and performance dependent variables require the application of diverse statistical techniques.

First, the dependent variables are measured on ordinal, interval and ratio scales. In the case of ordinal data (i.e. final ranking of teams in each industry) the rank order is known

but the distances between the ranks are not known. Therefore, parametric statistics theoretically are not suitable because assumptions underlying their application are not met. Nevertheless, Labovitz (1970) has indicated that any ordinal-level variable can be analyzed, except for extreme cases, by interval statistics, because some small theoretical error will be offset by the "...use of more powerful, more sensitive, better developed, and more clearly interpretable statistics with known sampling" (p. 155).

Second, the statistical analyses of the data should take into account the existing methodological specifics of the Thomas-Kilmann forced-choice instrument.

Third, a relatively large sample size (about 200 subjects) will probably force the application of parametric statistics in analyzing attitudinal hypothesis because adequate non-parametric procedures to deal with relatively large sample sizes are not available.

Application of a forced-choice scale developed by Thomas-Kilmann (1974) warrants some discussion of methodological and statistical issues relevant to the forced-choice instruments. The forced-choice instruments were developed in the late 1950's - early 1960's in the context of personnel assessment because of dissatisfaction with conventional scales. According to Baier (1951), the forced-choice instruments work because the unscored alternatives act as suppressors, that is, the suppression of non-valid variance in an otherwise valid item raises the validity of the pair. While there are several ways to score a forced-choice instrument, normally the individual

being rated receives a positive score if the item most descriptive of him is a discriminating item. Thus, the essence of the forced-choice approach is the grouping of items to make them appear to be of equal value and actually to be of unequal value as discriminators (Zavala, 1965).

In recent years forced-choice methods have been widely used in research. However, it is still too early to evaluate the forced-choice methods. Some experts believe that these instruments have great potential for psychological and educational testing. Other experts still question the value of forced-choice instruments. Scott (1968), citing results of his own research, and studies by Buxton (1966), Cozan (1955) and Travers (1951) question the validity of forced-choice scales by pointing out that evidence concerning the relative validities of forced-choice and single-stimulus tests is not so clear as it implied by the majority of studies supporting forced-choice instruments. Nevertheless, a large number of studies and reviews on forced-choice instruments indicate that the form of this instrument is superior in validity to a single-stimulus form (Berkshire and Highland, 1953; Cronbach, 1960; Ghiselli, 1954; Gordon, 1951; Hicks, 1970; Meranda and Clarke, 1952; and Zavala, 1965).

Below are some of the advantages of forced-choice instruments usually cited by the latter group of researchers:

1. minimization of the social desirability bias in the responses of the subjects;
2. reduction of rater's ability to produce any desired outcome (low fakability);

3. lowering of the average intercorrelation among the valid items;
4. a better distribution of ratings and derived statistics are relatively free of the usual pile-up at the top of the scale;
5. elimination of the influence from status or rank of the subjects being rated;
6. it provides a quick, objective, machine-scorable method.

On the other hand, the researchers criticizing the forced-choice scales usually stress the following disadvantages:

1. they suffer from lack of item interdependence; in some cases, inappropriate scoring may create ipsative type of scale with corresponding statistical problems;
2. they cause resistance by some subjects to make difficult choices;
3. they can strain the subjects' endurance and patience resulting in reduced cooperation.

It should be noted though the format of the Thomas-Kilmann instrument is ipsative, it is not a pure ipsative scale. In a pure ipsative scale, the measures are systematically affected by other measures and sum of ranks, mean and standard deviation are constant across different individuals. Therefore, ipsative scales possess limitations undesirable in any research: (1) the usual statistics are not applicable; and (2) the ipsative procedure produces spurious negative correlations.

Using Hick's (1970) classification, which differentiates between pure ipsative and partially ipsative scales, we may characterize Thomas-Kilmann's instrument as a partially ipsative

instrument. The scoring of Thomas-Kilmann scale does not produce the same mean and standard deviation for each of the five conflict-handling behavior mode across different individuals. In addition, Block (1957) indicates that there is an almost complete functional similarity between the results obtained from partially ipsative ratings treated normatively and usually received normative ratings data. Some reconciliation of the validity problem as it relates to Thomas-Kilmann's instrument also comes from Cronbach and Gleser (1957). They indicated that in the final analyses the goal for testing is to allocate each subject to the proper category and therefore the accuracy of measurement is of value to the extent it is instrumental in achieving this goal. Thus, the Thomas-Kilmann instrument not only will allocate individuals into specific conflict-handling behavior modes but also will provide normative measures for examination of the above-stated hypotheses with the help of conventional statistics.

The statistical analysis of the experimental data will be divided into three parts:

1. Reliability, validity and correlation analysis of dependent variable scales;
2. Testing the various hypotheses;
3. Testing the dialectical changes which occured as a result of group decision-making.

Both parametric and non-parametric statistics will be employed for descriptive and comparative purposes. The parametric statistics include analyses of means, variances, t-test, F-test, ANOVA, Pearson correlation analyses.

The Thomas-Kilmann instrument is a relatively new scale, though it has been actively used in recent years. Therefore, valuable information may be obtained from the analyses of internal consistency (Cronbach's 1951 coefficient alpha) and test-retest reliability of this scale.

In the second part of the analyses, testing of various hypotheses is undertaken. The alternate hypotheses have been tested against null hypotheses first for the attitudinal and then the substantive hypotheses will be tested for the performance variables.

The third part of data analysis will involve examination of dialectical changes in subjects' attitudes in terms of conflict-handling behavior modes and changes in teams' performance occuring during the longitudinal decision-making process for strategic and operational planning. The Thomas-Kilmann instrument was administered three times. Therefore, the accumulated data will allow us to analyze whether the attitude changes were occuring consistently or whether after a specific period of time the attitudes have achieved some kind of a steady-state condition. The same holds also for relative performance of teams. We may also find some answers to such a question as whether specific problem-solving technologies stimulate a more or less dynamic process of changes.

Pilot Study[1]

In order to test the effectiveness of the simulation and

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[1] Chanin, M. N. and H. J. Shapiro, "An Empirical Study of problem-solving technologies and conflict-handling behavior modes." to be presented at the 1980 AIDS National Meeting in Las Vegas in November, 1980 and published in AIDS Proceedings.

receptiveness of the students to different problem-solving technologies, a pilot study was conducted in the fall semester of 1979 utilizing sixty-two undergraduate evening students enrolled in two sections of the Business policy course. A total of 16 four-subject teams were randomly organized into two industries, each of which included four DPST and four control groups.

The following hypotheses were formulated in this study:

Hypotheses 1 - It is expected that the most prevalent modes of conflict-handling behavior will be in a descending order as follows: All groups - collaborating, compromising, and competing; DPST groups - competing, collaborating, and compromising; control groups - collaborating, compromising, and avoiding.

Hypotheses 2 - The DPST groups are expected to have significantly higher level of involvement in competing and collaborating and significantly lower level of involvement in avoiding and accommodating modes in comparison to control groups. No difference is expected between the two treatments on compromising.

Hypotheses 3 - The application of DPST leads to a higher level of group performance (ranking and ROI).

Examination of Table 7 shows that compromising is the most prevalent mode of conflict-handling behavior. This contradicts the general research findings that collaborating is the most prevalent mode. The explanation of this probably lies in the nature of students as subjects. Except for compromising our findings are generally supportive of hypothesis 1. Hypothesis 2

Table 7

Means, Standard Deviations, Prevalence Ranks and t-Values For The Conflict-Handling Modes

Conflict-Handling Mode	Total Sample (n=62)	Prevalence Rank	DPST Groups (n=30)	Prevalence Rank	Control Groups (n=32)	Prevalence Rank	Value Between DPST and Control Groups
Competing	6.18 (1.87)	3	7.135 (1.46)	2	5.25 (1.83)	5	2.27*
Collaborating	6.63 (1.36)	2	6.50 (1.69)	3	6.75 (1.04)	2	-0.36
Compromising	7.375 (1.75)	1	7.375 (2.00)	1	7.375 (1.60)	1	0.0
Avoiding	5.437 (1.09)	5	5.00 (0.76)	4	5.875 (1.25)	4	-1.70
Accommodating	5.250 (1.34)	4	4.50 (0.76)	5	6.00 (1.41)	3	-2.65**

* Statistically significant at $P<.05$ one-tail test

** Statistically significant at $P<.01$ one-tail test

is supported only partially with significant difference found in the predicted direction for competing and accommodating and no significant difference between collaborating and Avoiding. The hypothesis on compromising was also supported. All 16 teams were ranked on ROI. A Mann-Whitney U Test did not produce a significant difference between the two treatments. However, when all teams were dichotomize into two groups - high and low performance - the first group included 5 DPST and three control groups.

The results of this study were mixed, partially due to the small sample size and partially due to the exploratory nature of the experiment. However, the findings were interesting and promising and stimulated the present research.

Chapter VIII

ANALYSIS OF THE RESULTS

As stated in Chapter VII a realistic simulation must possess the properties suggested by Drabeck and Haas (1967). The present study adequately possesses those properties:

1. Though the teams were created artificially in the context of the classroom, they nevertheless became real groups in terms of participation and emotional involvement. Many students indicated that the business policy course as it was taught was the most challenging interesting and useful course that they had taken.
2. Through the use of trial periods, the lectures on the various topics pertaining to the game, weekly feedback on performance and interactions between themselves, the groups gained increasing familiarity with the task characteristics.
3. A realistic internal environment was created for all teams by using the assignment of executive functions, responsibility and rewards for adequate performance, and submission of plans, annual reports, etc. (as in the real business world).
4. The teams interacted with each other in a specific industry to create an external enviornment. Also the teams received long-run economic data which was updated periodically and may have changed substantially, hence providing uncertainty and greater interaction with the environment.
5. The subjects were not aware that they were participating

in an experiment. Enough precautions were taken with the result that the students perceived the experiment as a part of the business policy course.

Through observations of the problem-solving process by outside raters and reports by the teams themselves it was established that the experimental groups adhered to the specific problem-solving technologies which were assigned to them. For example, the DPST groups were asked to rate the perceived differences among alternative plans or decisions on a 1-5 scale; the mean over the 12 decisions for all DPST teams was 3.92 indicating a sufficiently high degree of difference between alternate plans or decisions. This indirectly also indicates that the individuals in DPST teams made their plans with different "world views" and hence met the most important criterion of DPST.

The analysis of the data collected in this study will be presented in the six following segments:

1. Demographic data
2. Reliability and structural validity of the scale
3. Attitudinal hypotheses
4. Performance hypotheses
5. Dialectical Hypotheses
6. Miscellaneous findings and observations

Demographic Data

As we have already indicated 194 subjects took part in the present study. Because of the absence of a few students on each day when questionnaires were administered the number of completed questionnaires varied from 179 in the first

administration to 186 on the second and to 188 in the third. Table presents a breakdown of the sample according to age and sex for each administration.

As seen from Table 8 , the number of males slightly exceeded females (year 1 - by 12.8%; year 2 - by 7.6%, and year 3 - by 6%). As expected the majority of students, both male and female, were in 20-24 years age bracket, followed by 25-23 years age bracket.

Table 9 breaks down the sample of subjects by the status of students. More than half of the students, participating in the experiment were full time day students with the number of full-time evening and part-time evening students being approximately equal.

Table 10 presents information on the students' subject areas. The marketing area had the largest representation, followed by accounting and management. Finally, Table 11 breaks down subjects into non-supervisory (including working part-time or unemployed) and supervisory subgroups. The subjects employed in a supervisory position represent on the average about 29% of the total sample.

In order to eliminate the demographic data as a source for possible variations in conflict-handling behavior modes, a number of t-tests have been undertaken to examine the influence of sex, student's status, major area of study, and job responsibilities. The only difference was found between males and females in two modes. Males (mean = 6.26) were found to be significantly more competitive ($t = -1.67$; $p < .05$; one-tail test) than females (mean = 5.55). Females exhibited a

Table 8

Subjects According To Age and Sex For Year One, Two & Three

	Year 1			Year 2			Year 3		
Age	Male	Female	Total	Male	Female	Total	Male	Female	Total
20-24	55	45	100	59	52	111	55	54	109
25-29	25	15	40	20	14	34	24	13	37
30-34	14	9	23	14	11	25	14	14	28
35-39	6	6	12	6	7	13	5	5	10
40-44	1	1	2	1	1	2	1	2	3
45-49	0	1	1	0	0	0	0	0	0
50 and over	0	1	1	0	1	1	0	1	1
TOTAL	101	78	179	100	86	186	99	89	188

Table 9

Subjects: According to Student Status

Student Status	Year 1		Year 2		Year 3	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Day students Part-Time	12	6.7	7	3.8	11	5.9
Day Students Full-Time	99	55.3	105	56.5	101	53.7
Evening Students Part-Time	36	20.1	36	19.4	34	18.1
Evening Students Full-Time	32	17.9	37	19.9	41	21.8
Missing Information	0	0.0	1	0.5	1	0.5
TOTAL	179	100.0	186	100.0	188	100.0

Table 10

Subjects: According to Major Area of Study

Major	Year 1		Year 2		Year 3	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Marketing	67	37.4	74	39.8	71	37.8
Accounting	43	24.0	47	25.3	47	25.0
Management	34	19.0	39	21.0	38	20.2
Finance	15	8.4	14	7.5	14	7.4
Statistics	2	1.1	2	1.1	6	3.2
Computer Science	9	5.0	9	4.8	6	3.2
Missing Information	9	5.0	1	0.5	6	3.2
TOTAL	179	100.0	186	100.0	188	100.0

Table 11

Subjects: According to Job Responsibilities

Job Responsibility	Year 1		Year 2		Year 3	
	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency	Absolute Frequency	Relative Frequency
Non-Supervisory	110	61.5	117	62.9	132	70.2
Supervisory	56	31.3	55	29.6	48	25.5
Missing Information	13	7.3	14	7.5	8	4.3
TOTAL	179	100.0	186	100.0	188	100.0

significantly higher (t = 2.22; P .05; one-tail test) tendency to be more compromising than men. However, no significant difference was found between males and females when these two groups were analyzed by each problem-solving technology.

Reliability and Structural Validity of the Scale

Any measuring instrument should provide the researcher with dependable, stable, accurate, consistent and predictable results. Two major reliability tests of the measuring instrument that allow to judge the quality of the instrument are internal consistency and test-retest interpretations of reliability.

Internal consistency reliability measure shows whether the items are homogeneous. The internal consistency of an instrument is measured by coefficient alpha (Cronbach, 1951). According to Cronbach (1951) alpha of .5 can be viewed as sufficient level of internal consistency. Table interprets the results of the present study and results of Thomas and Kilmann study (1978), where the authors examined the internal consistency of Lawrence and Lorsch (1967), Hall (1969) and Thomas-Kilmann "Mode" instruments of conflict behavior.

As seen from Table 12 the Thomas-Kilmann "Mode" instrument exhibits a generally higher level of internal consistency as compared to Lawrence and Lorsch (1967) and Hall's instruments. Generally coefficients are in the low-to-moderate range. Only for collaborating the internal-consistency coefficient in Hall's (1969) instrument is higher than in Thomas Kilmann (1974) instrument. The average alpha coefficient for the

Table 12

Internal Consistencies (Coefficient α) on Items of Conflict-Handling Behavior Modes on Lawrence-Lorsch, Hall and Thomas-Kilmann Instruments in Present and Thomas-Kilmann (1978) studies

Modes of Conflict-Handling Behavior	Instruments			
	Lawrence-Lorsch (1967)	Hall (1969)	Thomas-Kilmann (1974)	
	Results of the Thomas-Kilmann (1978) (N=86)			Results of the Present Study (N=188)
Competing	.37	.61	.71	.59
Collaborating	.40	.73	.65	.65
Compromising	.46	.45	.58	.67
Avoiding	.45	.39	.62	.41
Accommodating	.59	.57	.43	.66
Mean	.45	.55	.60	.60

"Mode" instrument is .60 both in the present study and in the Thomas and Kilmann (1978) study, while the average for the Lawrence-Lorsch and Hall instruments were .45 and .55 respectively. A comparison of the coefficients in the present study and in the Thomas and Kilmann (1978) study shows that though coefficients for collaborating and the average alpha are equal, some differences were found for competing (.59 vs .71), compromising (.67 vs .58) and large differences for avoiding (.41 vs .62) and accommodating (.66 vs .43).

Test-retest reliability shows stability of results obtained with the same instrument administered several times. Test-retest reliability scores for each conflict-handling behavior mode on four instruments in Thomas-Kilmann (1978) and the present studies are shown in Table 13. Mean reliabilities are introduced in order to facilitate overall comparison of the four instruments.

As seen from Table 13 the test-retest reliabilities range from low to moderate on individual scales. Average reliabilities for the Thomas-Kilmann (1974) instrument both in Thomas-Kilmann (1978) (mean = .64) and present study (mean = .59) compare favorably with other instruments: Blake-Mouton (.39), Lawrence-Lorsch (.50) and Hall (.55). It should be noted that Blake-Mouton items for compromising and competition as well as Lawrence-Lorsch for compromising are especially unstable. A comparison of test-retest reliabilities in the present study with those in Thomas-Kilmann (1978) show that they are quite similar with the largest difference being for compromising (.66 vs .50). An overall conclusion that may be derived from

Table 13

Test-Retest Reliabilities of Scores on Four Instruments for Conflict-Handling Behavior Modes in Thomas-Kilmann (1980) and Present Studies

Instruments	Conflict-Handling Behavior Modes					
In Thomas-Kilmann (1978) study:	Competing	Collaborating	Compromising	Avoiding	Accommodating	Mean
Blake-Mouton (1964)	.27	.57	.14	.47	.43	.39
Lawrence-Lorsch (1967)	.59	.53	.33	.42	.63	.50
Hall (1963)	.66	.54	.41	.61	.53	.55
Thomas-Kilmann (1974)	.61	.63	.66	.68	.62	.64
In the Present study:						
Thomas-Kilmann (1974) Comparison of Year 1 & Year 2	.64	.57	.43	.44	.60	.54
Comparison of Year 1 & Year 3	.66	.55	.59	.55	.65	.60
Comparison of Year 2 & Year 3	.72	.60	.48	.63	.71	.63
Average of three scores	.67	.57	.50	.54	.65	.59

this study and the Thomas-Kilmann (1978) study is that internal consistency and test-retest reliability coefficients for Thomas-Kilmann (1974) "Mode" instrument are sufficiently high to justify utilization of the "Mode" instrument.

As Loevinger (1957) has indicated "structural validity" means that the format of the instrument and the calculation of individual scores is consistent with the intended definition of the concept being assessed. Kilmann and Thomas (1977) stressed that the primary purpose of conflict-handling behavior instruments is to assess the relative frequency of the five modes rather than their absolute frequency. They define "relative frequency" as one which "involves conclusions regarding the approximate proportion of total conflict-handling behavior devoted to each mode, the frequency of each mode relative to the others, the order of frequency of the modes, etc." (p. 318). On the other hand they view absolute frequency of a given mode as a product of both its relative frequency and the total frequency in a given setting. If the five modes in Thomas-Kilmann (1974) "Mode" instrument are mutually exclusive and exhaustive and if these modes assess the relative frequency the scores for modes on the instrument should be approximately ipsative. This means that a lower score on one mode would lead to a corresponding increase accross the scores of the other modes. The average intercorrelation of scores on an ipsative instrument with n items can be calculated from the following expression $-1/(n-1)$. In case the instrument is strictly ipsative then the average intercorrelation between modes would be -.25. However Kilmann and Thomas (1977) found

that the Lawrence-Lorsch and Hall instruments showed average intermode correlations of .12 and .06, which are significantly greater than -.25 ($p<.001$ and $p<.01$ respectively) because, a high self-rating on one mode is not accompanied by correspondingly lower self-rating on other modes. In fact the authors found a non-significant tendency for the other modes to increase on the average. Thomas and Kilmann (1977) suggest two factors which may influence the subjects rating: (1) perceptions of the amount on conflict present; and (2) subject's constant errors in using the response scales. However, because of the ipsative format, the Mode instrument avoids this influence according to the authors. In order to examine their statements and to find the average interrelation between modes we correlated five modes for each of the three administrations.

As seen in Table 14 the highest and the only statistically significant intercorrelation is between compromising and accommodating in year 1 ($r = .23$, $p<.05$). The lowest coefficient is -.23 between competing and accommodating (-.23, nonsignificant). Our calculations show that the average intercorrelation coefficient for the Thomas-Kilmann instrument is .09. This may indicate the following:

1. The claim by Thomas-Kilmann (1977) is probably too optimistic in that their instrument is free from perceptions of the amount of conflict present and from subject's constant errors in using this response scale. In addition we have noted the absence of an average intercorrelation coefficient cited in studies using Thomas-Kilmann instrument (1974).

Table 14

Intercorrelation Coefficients Between Conflict Handling Behavior Modes for the Three Administrations

Conflict Handling	Year 1					Year 2					Year 3				
Behavior Mode	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Competing	-	.14	-.03	.14	-.03	-	.05	-.01	.12	-.23	-	.18	.09	-.03	.08
2. Collaborating		-	.17	.03	.09		-	.01	-.05	-.03		-	.15	-.07	.04
3. Compromising			-	.08	.23*			-	-.14	.08			-	-.04	-.10
4. Avoiding				-	.06				-	-.08				-	-.11
5. Accommodating					-					-					-

The average intercorrelation for the five modes during the three years is .09.

* Statistically significant at $P < .05$, two-tail test.

and/or 2. The Thomas-Kilmann instrument as we indicated earlier is probably only partially ipsative.

Attitudinal Hypotheses

Hypothesis 1

This hypothesis stated that subjects are able to perceive considerable differences between conflict-handling behavior modes generally and in each problem-solving technology. In order to validate this statement we conducted a number of one-way ANOVA tests in all three technologies and for all three years. The independent (qualitative) variable was the problem-solving technology and the dependent (quantitative) variables - the five conflict-handling behavior modes (competing, collaborating, compromising, avoiding and accommodating). In Tables 15-16-17 we have summarized for each year and technology the information about sum of squares degrees of freedom, mean square, F value and level of significance (p).

Analysis of these tables indicates that there exists in all tests a very high level of statistical significance (p .0001) between the five conflict-handling behavior modes. A comparison of mean squares shows that variation between conflict-handling modes considerably exceeds the variation within conflict-handling modes. Examination of means for avoiding and accommodating indicates that they are generally lower than means for competing, collaborating and compromising. Therefore, in order to eliminate the possible effect of avoiding and accommodating on the F and p values a second set of one-way ANOVA test was undertaken to examine whether the subjects

Table 15

Analysis of Variance

Year 1

Source	Sum of Squares	D.F.	Mean Square	F	p
DPST:					
Between Conflict-Handling Modes[1]	144.73	4	36.18	17.81	.0001
Within Conflict-Handling Modes	162.48	80	2.031		
Linearity	64.86	1	64.86	31.93	.0001
Dev. from Linearity	79.87	3	26.62	13.11	n.s.
DAPST:					
Between Conflict-Handling Modes	302.34	4	75.78	64.35	.0001
Within Conflict-Handling Modes	93.96	80	1.175		
Linearity	165.56	1	165.56	140.96	.0001
Dev. from Linearity	136.78	3	45.59	38.82	n.s.
DPST:					
Between Conflict-Handling Modes	172.05	4	42.76	20.24	.0001
Within Conflict-Handling Modes	169.00	80	2.11		
Linearity	9.02	1	9.02	4.271	.05
Dev. from Linearity	162.03	3	54.01	25.57	n.s.

[1] Conflict-Handling Behavior Modes are Competing, Collaborating, Compromising, Avoiding, Accommodating.

Table 16

Analysis of Variance

Year 2

Source	Squares	D.F.	Square	F	p
DPST:					
Between Conflict-Handling Modes	213.51	4	53.38	38.75	.0001
Within Conflict-Handling Modes	110.21	80	1.378		
Linearity	108.00	1	108.00	78.40	.0001
Dev. from Linearity	105.51	3	35.17	25.53	n.s.
DAPST:					
Between Conflict-Handling Modes	246.37	4	61.59	34.32	.0001
Within Conflict-Handling Modes	141.13	80	1.76		
Linearity	130.15	1	130.15	73.78	.0001
Dev. from Linearity	116.22	3	38.74	21.96	n.s.
LSPST:					
Between Conflict-Handling Modes	183.27	4	45.82	21.28	.0001
Within Conflict-Handling Modes	172.21	80	2.153		
Linearity	51.59	1	51.59	23.97	.0001
Dev. from Linearity	131.67	3	43.89	20.33	n.s.

Table 17

Analysis of Variance

Year 3

Source	Sum of Squares	D.F.	Mean Square	F	p
DPST:					
Between Conflict-Handling Modes	167.60	4	41.90	20.16	.0001
Within Conflict-Handling Modes	166.30	80	2.08		
Linearity	122.82	1	122.82	59.09	.0001
Dev. from Linearity	44.78	3	14.93	7.18	n.s.
DAPST:					
Between Conflict-Handling Modes	271.92	4	67.98	38.58	.0001
Within Conflict-Handling Modes	140.96	80	1.76		
Linearity	128.266	1	128.27	72.76	.0001
Dev. from Linearity	143.657	3	47.89	27.18	n.s.
LSPST:					
Between Conflict-Handling Modes	223.12	4	55.78	25.48	.0001
Within Conflict-Handling Modes	175.14	80	2.19		
Linearity	69.52	1	69.52	31.76	.0001
Dev. from Linearity	153.60	3	51.20	23.79	n.s.

perceive differences between competing, collaborating and compromising. The F and p values were obtained in the set of ANOVA tests:

Year 1: DPST - $F(2.48) = 4.42$, $p<.05$
DAPST - $F(2.48) = 7.58$, $p<.005$
LSPST - $F(2.48) = 24.51$, $p<.0001$

Year 2: DPST - $F(2.48) = 7.33$, $p<.01$
DSPST - $F(2.48) = 6.66$, $p<.01$
LSPST - $F(2.48) = 11.42$, $p<.0001$

Year 3: DPST - $F(2.48) = 0.39$, $p<.68$
DAPST - $F(2.48) = 8.77$, $p<.001$
LSPST - $F(2.48) = 14.74$, $p<.0001$

These results with the exception of DPST in Year 3 are generally supportive of the findings summarized in Tables 15, 16,17. We may conclude that subjects are able to differentiate not only between the five conflict modes (competing, collaborating, compromising, avoiding and accommodating) but also between competing, collaborating and compromising. Therefore Hypothesis 1 is supported. An interesting interpretation of these results is that they indirectly support the statement made in the previous section that conflict-handling behavior modes are mutually exclusive.

Hypothesis 2

Hypothesis 2 stated that subjects utilizing a specific problem-solving technology will exhibit differencial preferences for specific conflict-handling behavior modes. These preferences can be viewed as a relative frequency of utilization of one mode as compared to another. Table 18 summarizes means, standard deviations and ranks obtained from the results of our study for the total, DPST, DAPST and LSPST samples in Years 1, 2, 3. In addition in order to substantiate the statements about the ranks and mutual interaction of different conflict modes we performed 120 pairwise t-tests.

In H2A (for total sample) we hypothesized the ranks of the conflict modes as compromising - 1, collaborating - 2, competing - 3, accommodating - 4 and avoiding - 5. This hypothesis is basically supported by the results from all three years except that avoiding was ranked as 4, and accommodating as 5. Competing significantly ($p<.001$) differed from collaborating, compromising, avoiding and accommodating. No significant differences were found between collaborating and compromising in Year 2 and Year 3. However differences between collaborating and avoiding, and collaborating and accommodating as well as differences between compromising and avoiding and accommodating were statistically significant at $p<.001$.

In H2B (for DPST) we hypothesized the ranks as follows: compromising - 1, competing - 2, collaborating - 3, avoiding - 4 and accommodating - 5. As seen from Table 18 competing was ranked - 3 and collaborating - 2. However, no statistical

Table 18

Means, Standard Deviations and Preference Ranks
for Total, DPST, DAPST and LSPST Sample in Year 1, 2 and 3

Conflict-Handling Behavior Mode	Problem-Solving Technologies											
	Total			DPST			DAPST			LSPST		
	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank	Mean	Std. Dev.	Rank
1	2	3	4	5	6	7	8	9	10	11	12	13
Year 1:												
Competing	6.04	2.91	3	6.41	3.19	3	6.37	2.75	3	5.16	2.58	3
Collaborating	7.30	1.74	2	6.98	1.71	2	7.55	2.70	2	7.37	1.80	2
Compromising	7.83	2.32	1	7.52	2.49	1	7.97	2.23	1	8.04	2.13	1
Avoiding	5.27	2.26	4	5.46	2.19	4	5.23	2.13	4	5.10	2.53	4
Accommodating	3.57	2.16	5	3.64	2.26	5	2.87	1.83	5	4.37	2.17	5
Year 2:												
Competing	5.94	2.85	3	6.32	2.54	3	6.25	3.07	3	5.19	2.81	4
Collaborating	7.46	2.05	2	7.19	1.90	2	7.79	2.02	2	7.39	2.21	2
Compromising	7.88	2.21	1	7.85	2.194	1	7.87	7.87	1	7.90	2.38	1
Avoiding	5.01	2.40	4	5.21	2.44	4	4.60	2.34	4	5.22	2.41	3
Accommodating	3.54	2.11	5	3.39	1.86	5	3.38	1.97	5	3.88	2.47	5
Year 3:												
Competing	6.18	3.41	3	6.90	3.13	3	6.17	3.55	3	5.46	3.43	3
Collaborating	7.54	2.03	2	7.23	1.94	2	7.55	2.06	2	7.83	2.07	2
Compromising	7.88	2.29	1	7.31	2.27	1	8.25	2.15	1	8.07	2.37	1
Avoiding	4.81	2.38	4	4.87	2.36	4	4.72	2.45	4	4.85	2.36	4
Accommodating	3.58	2.43	5	3.69	2.38	5	3.32	2.44	5	3.76	2.48	5

significant differences were found between competing and collaborating and competing and compromising and between collaborating and compromising. The t-tests of the remaining pairs of modes showed statistical significance between $p < .01$ and $p < .001$. Thus hypothesis H2B is only partially supported.

The H2C hypothesis for DAPST was completely supported. The modes were ranked as indicated: competing - 3, collaborating - 2, compromising - 1, avoiding - 4, and accommodating - 5. Except for compromising and collaborating pairwise comparison of all conflict modes showed a statistical significance between p .05 and p .001. Finally, the H2D hypothesis for LSPST stated that conflict modes will be ranked as follows: competing - 5, collaborating - 2, compromising - 1, avoiding - 3 and accommodating - 4. The results show only compromising and collaborating were ranked as expected. However, hypothesized ranks for competing, avoiding and accommodating were not supported. Only in Year 2 avoiding was ranked 3. It is interesting to note that in LSPST no differences were found between competing and avoiding, collaborating and compromising. Remaining pairs of modes were found to be significantly different at $p < .01$ and at $p < .001$.

Thus, the hypothesis about the subjects preferences to utilize a specific conflict-handling mode are supported partially. However, several conclusions should be made:

1. It appears that there is a hierarchical pattern of preferences for conflict-handling behavior modes: compromising - 1, collaborating - 2, competing - 3, avoiding - 4 and accommodating - 5. This pattern

remains stable and it is not affected by the problem-solving technologies or a time factor.

2. In some cases, where there is no statistical significance between conflict modes the differences in ranks are not so clear.

The findings of this study question the validity of the earlier studies by Blake and Mouton (1964), Lawrence and Lorsch (1967) and Burke (1970) which have stressed collaborating as the most preferred mode of conflict behavior. One of the reasons explaining this is the influence of the social desirability factor on the five conflict-handling modes. Thomas and Kilmann (1975) suggested two reasons explaining the popularity of collaborating:

1. The relative magnitude of the average scores on the conflict modes may be simply a reflection of the social desirability of the questionnaire items.
2. The possibility that some conflict-handling modes are regarded more positively than others creates the "halo effect".

Thomas and Kilmann found that Pearson correlations calculated between mean desirability ratings and mean self-assessment ratings for the set of statements representing each of the five conflict-handling behavior modes varied for Lawrence-Lorsch (1967) instrument between .71 (n.s.) for compromising to .92 ($p<.05$) and .93 ($p<.01$, one-tail) for collaborating and competing respectively, and for the Hall (1969) instrument coefficients varied from .51 (p .05, one-tail) for collaborating to .91 ($p<.001$, one-tail) for competing.

Hypothesis 3A

Hypothesis 3A stated that given the competing mode of conflict-handling behavior the DPST groups will have a higher level of involvement (relative frequency) as compared to DAPST and LSPST groups. Also DAPST groups will have a higher level compared to LSPST groups.

Tables 19-20-21 contain information on means, standard deviations and significance level for t-tests between problem-solving technologies for each conflict behavior mode in Years 1, 2 and 3. As seen from Tables 19,20,21 this hypothesis received only partial support. The values of the aggregate means for each problem-solving technology were in the predicted order. However no significant differences were found between DPST and DAPST groups. The significant difference between DAPST and LSPST groups in Year 1 and Year 2 disappeared in Year 3. Thus the only stable and statistically significant ($p<.01$) relationship was found between DPST and LSPST technologies. A one-way ANOVA was used to test the variances of DPST, DAPST and LSPST groups in Year 3. However the results were not significant: $F(2,182)=2.74$ at $p<.07$. Thus, this hypothesis is supported only partially, therefore the null hypothesis is rejected and the relationship between aggregate means can be expressed as

$$M_{dt} > M_{ls} \quad \text{but} \quad M_{dt} \approx M_{da} \quad \text{and} \quad M_{da} \approx M_{ls}$$

Hypothesis 3B

In this hypothesis we predicted that DPST groups involvement in the collaborating mode will be higher than in DPST and LSPST groups and in DPST groups higher than LSPST groups.

Table 19

Means, Standard Deviations and Significance Level For t-Tests Between Problem-Solving Technologies

Year 1

	DPST	DAPST	LSPST	t-test 2 vs 3	t-test 2 vs 4	t-test 3 vs 4
Modes	2	3	4	5	6	7
Competing	6.4098 (3.185)	6.3710 (2.753)	5.1633 (2.577)	0.471	0.013*	0.010**
Collaborating	6.9836 (1.708)	7.5484 (1.695)	7.3673 (1.799)	0.134	0.129	0.295
Compromising	7.5246 (2.494)	7.9677 (2.290)	8.0408 (2.131)	0.154	0.123	0.432
Avoiding	5.4590 (2.188)	5.2258 (2.130)	5.1020 (2.527)	0.275	0.219	0.392
Accommodating	3.6393 (2.259)	2.8710 (1.833)	4.3673 (2.167)	0.021*	0.045*	0.001***

one-tail test

* Statistically significant at $p \leq .05$ level

** Statistically significant at $p \leq .01$ level

*** Statistically significant at $p \leq .001$ level

Table 20

Means, Standard Deviations and Significance Level For t-Tests Between Problem-Solving Technologies

Year 2

	DPST	DAPST	LSPST	t-test 9 vs 10	t-test 9 vs 11	t-test 10 vs 11
Modes	9	10	11	12	13	14
Competing	6.3226 (2.540)	6.2540 (3.074)	5.1864 (2.813)	0.446	0.011*	0.024*
Collaborating	7.1935 (1.889)	7.7937 (2.017)	7.3898 (2.213)	0.044*	0.301	0.148
Compromising	7.8548 (2.194)	7.8730 (2.067)	7.8983 (2.376)	0.481	0.459	0.475
Avoiding	5.2097 (2.437)	4.6032 (2.339)	5.2203 (2.407)	0.079	0.491	0.077
Accommodating	3.3871 (1.859)	3.3810 (1.971)	3.8814 (2.471)	0.493	0.109	0.111

one-tail test

* Statistically significant at $p \leq .05$ level

Table 21

Means, Standard Deviations and Significance Level For t-Tests Between Problem-Solving Technologies

Year 3

	DPST	DAPST	LSPST	t-test 16 vs 17	t-test 16 vs 18	t-test 17 vs 18
Modes	16	17	18	19	20	21
Competing	6.9016 (3.129)	6.1692 (3.551)	5.4576 (3.426)	0.111	0.009**	0.130
Collaborating	7.2295 (1.944)	7.5538 (2.061)	7.8305 (2.069)	0.183	0.052	0.229
Compromising	7.3115 (2.270)	8.2462 (2.151)	8.0678 (2.370)	0.01*	0.039*	0.332
Avoiding	4.8689 (2.363)	4.7231 (2,446)	4.8475 (2.355)	0.367	0.480	0.387
Accommodating	3.6885 (2.384)	3.3231 (2.437)	3.7627 (2.480)	0.199	0.434	0.161

one-tail test

* Statistically significant at $p \leq .05$ level

** Statistically significant at $p \leq .01$ level

Examination of Tables 19,20,21 shows the opposite that DPST groups had the lowest level of involvement as compared to DAPST and LSPST groups. In Year 3 the LSPST groups had the highest mean for collaborating. No stable significant relationships between DPST, DAPST and LSPST groups were found in all three years. The one-way ANOVA produced $F(2,182)=1.324$, non significant. Therefore the null hypothesis statement is almost supported and we may substitute for =.

$$\text{i.e. } M_{dt} \approx M_{da} \approx M_{ls}$$

Hypothesis 3C

This hypothesis stated that given the compromising mode of conflict behavior the DAPST groups will have higher level of involvement as compared to LSPST and DPST groups. Analysis of the results for compromising in Year 3 shows support for this hypothesis. The DAPST groups had the largest aggregate mean (8.25) and were significantly different from DPST groups (mean = 7.31) at $p<.01$ and from LSPST group (mean 8.07) at $p<.05$. A one-way ANOVA produced $F(2,182)=2.983$ at $p<.053$, almost significant. As a result of this H_o is rejected and we may state the new relationship between aggregate means of DPST, DAPST and LSPST technologies as follows:

$$M_{dt} < M_{da}, \quad M_{da} \approx M_{ls} \quad \text{and} \quad M_{dt} < M_{ls}$$

Hypothesis 3D

Developing this hypothesis we expected that given an avoiding mode of conflict the subjects in LSPST groups will tend to use this mode more frequently because of the low structure of the problem-solving technology as compared to DPST and DAPST groups. However examination of results shows

that means for all three technologies are approximately the same and t-tests as well as ANOVA test ($F(2.182)=.07$, $p<.93$) support this finding. It is interesting to note that all groups utilize the same level of avoiding behavior in all three years. Therefore H_o is accepted.

Hypothesis 3E

For the accommodating mode of conflict behavior we predicted that LSPST groups will have a higher level of involvement as compared to DAPST and DPST groups. In all three years the aggregate mean for LSPST groups was slightly larger than for DPST and DAPST groups with DAPST groups having a little higher mean as compared to DPST groups. Except for the first year the t-test and one-way ANOVA ($F(2,182)=0.59$, tests did not produce significant differences. Therefore, H_o is accepted with the following relationship.

$$M_{dt} = M_{ls} \text{ and } M_{dt} \approx M_{da} \text{ and } M_{da} \approx M_{ls}$$

In concluding our discussion of the above examined hypotheses we would like to make the following observations:

1. It seems that the type of problem-solving technology has affect only on competing and compromising modes of conflict behavior.
2. The statistically significant difference was found primarily between DPST and LSPST groups with no difference between DPST and DAPST and between DAPST and LSPST. This indicates that DAPST is intermediate to both DPST and LSPST technologies.
3. There is a possibility that there may exist an intervening variable (e.g. level of performance) that affects involvement in the specific conflict behavior modes.

Performance Hypotheses

We have already emphasized the need for a structured approach to unstructured strategic problems through a high or medium structure problem-solving technology. At the present time, "organizing" of the problem-solving process becomes very important because of the consistently increasing uncertainty in the organizational environment and inherent conflicting nature of different alternatives of a strategic plan.

Hypothesis 4A stated that DPST groups will outperform DAPST and LSPST groups on a number of objective measures of performance. Using ROI as a criterion variable we ranked all teams according to the value of ROI and performed a pairwise Wilcoxon Signed Ranks test for performance of DPST, DAPST and LSPST groups. The Wilcoxon Signed Ranks test uses information about the direction of the differences and the ranks of the differences. This test uses as statistics the sum of ranks associated with either the positive or negative sign whichever is smaller. Table 22 summarizes the results of the Wilcoxon Signed Ranks test. As seen from this table statistically significant differences exist between DPST and LSPST groups in years 1 and 3. No significant differences were found between DPST and DAPST and between DAPST and LSPST groups. It is interesting to note that similar differences exist between problem-solving technologies in terms of conflict-handling behavior modes. The only stable statistical differences were found between DPST and LSPST groups for competing and compromising.

Table 22

Wilcoxon Signed Ranks Test For Performance of DPST, DAPST & LSPST Groups based upon ROI

	DPST vs. DAPST	DPST vs. LSPST	DAPST vs. LSPST
Year 1	45.0 n.s.	16.0 Statistically Significant at a=.005 in a one-tailed test	48.5 n.s.
Year 2	62.0 n.s.	53.0 n.s.	45.5 n.s.
Year 3	48.0	39.0 Statistically Significant at a=.05 in a one-tailed test	44.0

In order to identify which of the three problem-solving technologies is superior we trichotomized all teams into high, medium and low level of performance based upon the ROI and industry rank. Using ROI we divided all teams as follows: High - teams which were ranked 1-17, Medium - teams ranked 18-34, and Low performance - teams ranked 35-51. The same principle was used by applying ranks in each industry: High - 1 to 3, medium - 4 to 6, and low 7 to 9 ranks.

Table 23 presents the number of teams falling into each category for all three years. Examination of this table shows that in the high level of performance category the majority of teams are DPST groups followed by LSPST and DPST groups. The medium level of performance category is dominated by the DAPST groups followed by DPST and LSPST groups. In the low performance category the majority of teams are LSPST groups. Based on the results in Table 23 we may categorize DPST as high performance technology, DAPST as moderate performance technology and LSPST - low performance technology. If DPST and DAPST show a relative stable performance, the performance of LSPST groups can be characterized as extreme: on one hand in the last year four teams were ranked first and one team second; on the other hand three teams were ranked ninth and two teams eighth; no teams were ranked third or fourth.

The allocation of teams into high, medium and low levels of performance is interesting from the point of view of relative standing, but cannot be tested statistically. Therefore in order to establish the advantage of a specific problem-solving technology a number of t-tests were conducted for such variables

Table 23

High, Medium & Low Performing Teams According to Problem-Solving Technologies Based Upon ROI and Industry Rank

Level of Performance	Technologies	Year 1		Year 2		Year 3	
		Based on ROI	Based on Industry Rank	Based on ROI	Based on Industry Rank	Based on ROI	Based on Industry Rank
High 1-17 / 1-3	DPST	10	11	9	7	8	9
	DAPST	5	5	4	5	4.	4
	LSPST	2	1	4	5	5	5
Medium 18-34 / 4-6	DPST	5	4	3	7	6	5
	DAPST	5	6	7	6	7	8
	LSPST	7	7	7	4	4	5
Low 35-51 / 7-9	DPST	2	2	5	3	3	3
	DAPST	7	6	6	6	6	5
	LSPST	8	9	6	8	8	7

as sales in units, profit, cost per unit, ROI and absolute ranking. Table 24 presents the results of these tests. Examination of these results shows no significant differences between DPST and DAPST groups in Year 1 and 2. In Year 3 the DPST groups together sold 635 thousand units as compared to 599 thousand units sold by the DAPST groups ($t=1.69$, $p<.05$). The DAPST groups' cost per unit ($27.64) was also lower than cost per unit in DAPST groups ($28.80) ($T=2.0$, $p<.01$). The comparison of DAPST and LSPST groups shows only one significant relationship in Year 3. The profit of DAPST groups (808 thousand dollars) was almost double of the LSPST groups (438 thousand dollars) with $t=2.10$ at $p<.05$. Based on the above analysis we may characterize the relationship between DPST and DAPST as well as between DAPST and LSPST as weak and inconclusive. The only stable relationship in terms of performance was between DPST and LSPST technologies, except in Year 2, when almost all relationship became insignificant. To illustrate the difference between these two technologies we examine the profit in Year 3. DPST groups earned 1 million dollars in profit as compared to 438 thousand dollars earned by the LSPST groups ($t=2.10$, $p<.05$). Similarly the average ROI for a DPST was 14.36% as compated to 12.2% for a LSPST team ($t=1.71$, $p<.05$).

Table 25 presents results of one-way ANOVA tests for profit and cost per unit in Year 3. As seen from the table there exist significant differences in profit earned by teams in each technology as well as in costs.

In order to develop our understanding of the relationship

Table 24

t-Values for Selected Performance Variables

		Sales in Units	Profit in Dollars	Cost Per Unit	ROI	Absolute Ranking
Year 1	DPST VS. DAPST	1.20	1.41	-1.44	1.36	-1.55
	DPST VS. LSPST	2.04*	3.51**	-1.49	2.38**	-3.01**
	DAPST VS. LSPST	1.01	2.37*	-1.20	1.65	-1.24
Year 2	DPST VS. DAPST	0.79	0.28	-0.53	0.85	-0.85
	DPST VS. LSPST	1.25	0.61	0.83	2.00*	-1.42
	DAPST VS. LSPST	0.80	0.47	0.98	1.65	-0.72
Year 3	DPST VS. DAPST	1.69*	1.07	-2.00*	1.02	-1.31
	DPST VS. LSPST	2.00*	3.48***	-2.39*	1.71*	-1.69*
	DAPST VS. LSPST	0.53	2.10*	-0.90	1.20	-0.68

* Statistically significant at $p < .05$, one-tail test.
** Statistically significant at $p < .01$, one-tail test.
*** Statistically significant at $p < .001$, one-tail test.

Table 25

Analysis of Variance for DPST and LSPST Groups in Year 3

Source	Sum of Squares	D.F.	Mean Square	F	Sig.
PROFIT IN DOLLARS:					
Between Groups	2774656.353	2	**********	5.499	0.0071
Within Groups	12110031.059	48	252292.314		
Linearity	2684112.029	1		10.639	0.0020
Dev. from Linearity	90544.324	1	90544.324	0.359	0.5519
COST PER UNIT:					
Between Groups	33.367	2	16.684	3.248	0.0475
Within Groups	246.564	48	5.137		
Linearity	33.007	1	33.007	6.426	0.0146
Dev. from Linearity	0.360	1	0.360	0.070	0.7923

between modes and performance we utilized the Pearson correlation coefficient. With the Pearson technique we have correlated our variables within each technology and between years. Looking first at DPST we see that in Year 1 the variable sales in dollars correlate negatively with collaborating ($r=-0.43$, $p<0.05$) and compromising ($r=-0.43$, $p<0.05$). Sales in dollars also correlate significantly, but in a positive direction, with avoiding ($r=0.41$, $p<0.05$). Looking at Year 3 we see no significant relationships. With sales per unit in Year 1 there are again two significant negative correlations with collaborating ($r=-0.45$, $p<0.05$) and with compromising ($r=-0.50$, $p<0.05$). When looking at Year 3 we see significant relationships between sales per unit and compromising ($r=0.44$, $p<0.05$); sales per unit and competing ($r=0.41$, $p<0.05$) and sales per unit and accommodating ($r=-0.59$, p 0.05).

Cost in dollars in Year 1 correlates significantly with collaborating ($r=-0.49$, $p<0.05$) and compromising ($r=-0.49$, $p<0.05$). In Year 3 cost in dollars correlates significantly with competing ($r=0.43$, $p<0.05$) and accommodating ($r=-0.51$, $p<0.05$). Finally for DPST the variable cost per unit for Year 3 correlates significantly with compromising ($r=-043$, $p<0.05$).

In viewing DPST as a whole we see no consistant relationship through the years and therefore cannot make any definite statements about modes and performance.

With the DAPST technology the only significant relationships are in Year 3. These are between sales in units and accommodating ($r=-0.45$, $p<0.05$) cost per unit and avoiding

($r=0.44$, $p<0.05$) and between game ranking and three variables; collaborating ($r=-0.58$, $p<0.01$), avoiding ($r=0.53$, $p<0.05$), and accommodating ($r=0.44$, $p<0.05$). Again we cannot make any statements regarding the relationships between modes and performance because of inconsistant and unstable results between different years.

The LSPST technology has the most significant correlations. In Year 1 the significant relationships are : sales in dollars and avoiding ($r=0.50$, $p<0.05$); sales in units and avoiding ($r=-0.52$, $p<0.05$); cost in dollars and avoiding ($r=-0.50$, $p<.05$); game ranking and collaborating ($r=-0.48$, $p<0.05$); absolute ranking and collaborating ($r=-0.57$, $p<0.01$); and cost per unit with three variables, competing ($r=-0.51$, $p<0.05$), collaborating ($r=-0.65$, $p<0.01$) and avoiding ($r=0.52$, $p<0.05$). In Year 3 the significant relationships are profit per unit with two variables, collaborating ($r=-0.41$, $p<0.05$) and accommodating ($r=0.43$, $p<0.05$). Again as with the two other technologies we cannot state any firm conclusions with LSPST because of the lack of consistency between years.

In hypotheses 4B we stated that the very nature of DPST increases awareness and understanding of the problem through the structured debate and critical evaluation of various alternatives. Therefore it was expected that subjects in DPST groups will tend to outperform the DAPST and LSPST groups in scoring on the business game tests. Table contains information on means, standard deviations, t-values and significance level for DPST, DAPST and LSPST groups.

The analysis of Table 26 shows that no significant

Table 26

Performance[1] Means, Standard Deviations, and t-Value for Problem-Solving Technologies

	Mean	Standard Deviation	t-Value
DPST	2.8180	0.685	-0.05 n.s.
VS.			
DAPST	2.8237	0.712	
DPST	2.8180	0.685	1.66*
VS.			
LSPST	2.6046	0.690	
DAPST	2.8237	0.712	1.67*
VS.			
LSPST	2.6046	0.690	
DPST-Industry 5	2.9004	0.595	2.00*
VS.			
LSPST-Industry 6	2.5629	0.618	

* Statistically Significant at p .05, one-tail test.

[1] This is an indirect measure of students performance using the average score of six tests from the business game.

differences were found between DPST and DAPST groups. However both DPST and DAPST were significantly different ($p < .05$, one-tail test) from LSPST. A comparison of problem-solving technologies on the level of industries showed only one statistically significant difference between Industry 5 (DPST) and Industry 6 (LSPST). Thus, the hypotheses 4B is supported partially. These results not only support our previous findings that DPST is superior to LSPST but also indicates that DAPST may have advantage over LSPST.

Summarizing our findings for performance hypotheses we may state the following:

1. There exists a stable and significant difference between DPST and LSPST in terms of performance.
2. No significant relationships were found between DPST and DAPST on one hand and DAPST and LSPST on the other hand.
3. The Pearson correlations between modes of conflict-handling behavior and performance variables were found to be inconsistent, unstable and often contradictory from one year to another.
4. The relative success of DPST groups in terms of performance as compared to LSPST groups may be attributed to the sequence or a combination of two conflict-handling behavior modes: competing and compromising.

Dialectical Hypotheses

Accelerating changes of life create a strong need to measure the dynamic movements of these changes, e.g. direction,

intensity, rates of acceleration, etc. However, the present measurement system still reflects the traditional views of stability and smooth transitionality. Two major problems exists in this respect:

1. The need to change the traditional views, which is a long process in itself. For example, only recently has price (inflation) accounting gained a widespread acceptance.
2. Need for a comprehensive methodological system dealing with measurements of the change processes.

It is not the task or intent of this paper to deal with the development of such a system and therefore our discussions of dialectical hypotheses is limited to dialectical hypotheses formulated here. However, a superficial examination of changes in the value of conflict modes (Tables 19,20,21) and in performance standing (Table 23) indicates consistently ongoing changes. For example, the level of collaborating used by LSPST groups in Year 1 and 2 stayed the same, but increased in Year 3. The DPST groups showed a decreasing level of avoiding from Year 1 to Year 3, but approximately stable pattern of applying the accommodating mode of conflict behavior. The DAPST groups became slightly less competitive but more compromising. Examination of the competing mode of conflict-behavior shows an interesting pattern. The level of statistical significance of t-tests between DPST and DAPST (not significant) and between DPST and LSPST (significant at $p<.05$, $p<.01$) has a consistent pattern - increase in the level of statistical significance when at the same time the differences

between DAPST and LSPST showed a decreasing level of significance. The differences between DPST, DAPST and LSPST groups in terms of accommodating being statistically significant in Year 1 become non-significant in Year 3. As seen from Table 23 the LSPST groups, depending on the criterion had only 1 or 2 teams in the high performance group when at the same time DPST was represented by 10 or 11 groups. By Year 3 the number of LSPST groups increased to 5 and the number of DPST groups decreased to 8 or 9. It appears that in the short-run the advantages of DPST are considerably higher than in the long run. Therefore, if the case is a one-shot problem the application of DPST is highly recommended. Performance of DAPST groups approximately stayed the same over time; the LSPST groups showed a considerable improvement from Year 1 to Year 3.

In hypothesis 5A we stated that the more group problem-solving that occurs during the initial decision-making process, the more cooperative the subsequent relationship between subjects. Table 29 contains information pertaining to this hypothesis as well as hypothesis 5B. As seen from Table 29 the values of collaborating in Year 1 were approximately the same, with the highest level of collaborating in DAPST groups. However, the highest level of cooperativeness was found in LSPST groups. A t-test showed only one significant difference between the level of cooperativeness in DPST and LSPST groups ($p<0.5$). In this case the relationship between collaborating and cooperativeness follows the hypothesized relationship. However this is not sufficient support for hypothesis 5A,

Table 29

Means and Standard Deviations for Competing, Collaborating in Year 1 and Assertiveness and Cooperativeness in Year 3

	Year 1		Year 3	
	Competing	Collaborating	Assertiveness	Cooperativeness
DPST	6.4098 (3.185)	6.9836 (1.708)	5.397 (4.394)	-0.809 (3.018)
DAPST	6.3710 (2.753)	7.5484 (1.695)	5.759 (4.028)	-0.098 (2.582)
LSPST	5.1633 (2.577)	7.3673 (1.799)	4.690 (4.973)	1.163 (2.613)

therefore, at best this hypothesis can be only partially supported.

Hypotheses 5B stated that the more competing that occurs during the initial decision-making process, the more assertive the subsequent relationship between the subjects. The value of the competing mode is almost equal for DPST and DAPST group and significantly higher as compared to LSPST groups. The value of assertiveness for both DPST and DAPST is also higher than for LSPST groups. In this sense the hypothesis is supported, but because of the absence of statistically significant differences between DPST and LSPST and DAPST and LSPST groups we have to reject hypothesis 5B.

Thus both hypotheses 5A and 5B are not supported.

Two hypotheses (6A and 6B) were designed to test the dialectical performance change. However it appeared infeasible to undertake the testing of these hypotheses because of the following reasons.

1. Only some teams submitted information needed for testing of hypotheses 6A and 6B.
2. The preliminary analysis detected many errors and mistakes in the collected information.

Hypothesis 7 stated that organizations with perceived or actually poor performance (location on the entropic cycle of the DMIS model) tend to change the organizational structure more often than organizations with perceived or actually improving or satisfactory performance (location on the synergy cycle). Observation of the teams and reports provided by these teams show that 15 teams out of a total of 51 teams,

changed the organizational structure at least once. Among 15 teams, 2 teams finished the three year operations as high performing teams, 5 teams (including 2 with two organizational changes) were found in medium level of performance and 8 teams (including 4 teams with two organizational changes) were found in the low performing group. Therefore hypotheses 7 is basically supported.

The reasons for organizational change most often reported by students were: poor management of the team by the president; inadequate allocation of organizational functions and responsibilities; need to do something in order to improve the situation, etc.

Miscellaneous Findings and Observations

The hypotheses tested and reported on in the previous sections of this chapter have been only partially supported. It seems that the five modes do not adequately explain behavior in conflict situations. In order to find some meaningful explanations we therefore also tested the two two-demensional models of conflict behavior (Kilmann and Thomas, 1975). The first model uses assertiveness and cooperativeness as the two dimensions of conflict and the second - the integrative index and the distributive index. These terms were defined in Chapter II.

In the literature on strategic planning we find the use of proactive and reactive strategies. These basically also incorporate conflict in the problem-solving process. Hence we can use these two as another two-dimensional model of conflict-handling behavior where proactiveness implies that

the problem-solver takes the initiative and seeks alternatives for dealing with changes that may occur; and, reactiveness implies that external pressures of conflicting forces necessitates some action from the problem-solver. In other words the reactive dimension is an expression of passive behavior on the part of the decision maker.

In terms of the five modes we can define the two new dimensions as follows:

1. Proactiveness = Competing + Collaborating

2. Reactiveness = Avoiding + Accommodating

Compromising is again a neutral point between the two dimensions.

In order to examine the validity of the two dimensional approach we performed Pearson correlation analysis: first, we correlated the six dimensional variables with five conflict-handling behavior modes; second we correlated the six dimensions with some performance variables. The analysis was conducted across the three technologies for each of the three years. The results indicate that the correlations are consistent and similar over the three years. Therefore, we only report the results of the third year in Tables 28,29,30.

Examination of the competing mode in DPST, DAPST and LSPST (Tables 28,29,30) shows the same pattern of relationships with the dimensional variable. However, the correlations are higher in DPST and LSPST as compared to DAPST. In all the three technologies competing has a strong positive correlation with assertiveness, distributiveness and proactiveness. This may be explained by the fact that in Year 3, the high performance group was comprised of DPST and LSPST teams. If we

Table 28

Pearson Correlations Between Conflict-Handling Modes and Dimensions for DPST

	Conflict-Handling Behavior Modes				
Dimension	Com-peting	Collabo-rating	Compro-mising	Avoid-ing	Accommo-dating
Assertiveness	0.89***	0.43*	0.39	-0.69***	-0.85***
Cooperativeness	-0.74***	0.27	-0.34	-0.001	0.82***
Distributive Index	0.93***	0.16	0.42*	-0.46*	-0.94***
Integrative Index	0.45*	0.73***	0.18	-0.83***	-0.34
Proactivness	0.85***	0.57**	0.11	-0.61**	-0.75***
Reactiveness	-0.86***	-0.29	-0.58**	0.72***	0.87***

* Statistically significant at $p<.05$, two-tail test.

** Statistically significant at $p<.01$, two-tail test.

*** Statistically significant at $p<.001$, two-tail test.

Table 29

Pearson Correlations Between Conflict-Handling Modes and Dimensions for DAPST

	Conflict-Handling Behavior Modes				
Dimension	Com-peting	Collabo-rating	Compro-mising	Avoid-ing	Accommo-dating
Assertiveness	0.76***	0.52*	0.04	-0.82***	-0.76***
Cooperativeness	-0.66**	0.58**	0.02	-0.12	0.42*
Distributive Index	0.91***	0.11	0.02	-0.58**	-0.80***
Integrative Index	0.31	0.82***	0.05	-0.83***	-0.45*
Proactiveness	0.78***	0.51*	-0.12	-0.79***	-0.71***
Reactiveness	-0.70***	-0.51**	-0.20	0.83***	0.78***

* Statistically significant at $p<.05$, two-tail test.

** Statistically significant at $p<.01$, two-tail test.

*** Statistically significant at $p<.001$- two-tail test.

Table 30

Pearson Correlations Between Conflict-Handling Modes and Dimensions for LSPST

	Conflict-Handling Behavior Modes				
Dimension	Competing	Collaborating	Compromising	Avoiding	Accommodating
Assertiveness	0.84***	0.68***	0.18	-0.79***	-0.90***
Cooperativeness	0.77***	0.09	0.28	-0.01	-0.59**
Distributive Index	0.94***	0.47*	0.02	-0.59**	-0.91***
Integrative Index	0.49*	0.83***	0.37	-0.91***	-0.66**
Proactiveness	0.90***	0.62**	-0.03	-0.69***	-0.86***
Reactiveness	-0.74***	-0.70***	-0.37	0.85***	0.88***

* Statistically significant at $p<.05$, two-tail test.

** Statistically significant at $p<.01$, two-tail test.

*** Statistically significant at $p<.001$, two-tail test.

are to believe assertiveness, distributiveness and proactiveness lead to high performance then we find support in our results. Out of 17 high performance teams 13 were DPST and LSPST and only four were DPST teams.

The analysis of the correlations for the other four modes shows a similar pattern, consistent with theoretical expectations. However, there were some inconsistent results:

1. For collaborating there is a strong positive relationship with cooperativeness in DAPST teams only.
2. For avoiding we would expect significant negative correlation with cooperativeness for the three technologies. However, the results show almost no correlation.
3. For accommodating we would expect no relationship with the integrative index. However we find in DAPST ($r=-.45$, $p<.05$) and LSPST ($r=-.67$, $p<.01$) a moderately negative relationship between integrativeness and accommodating.

The results are supportive of our earlier statement of the neutrality of the compromising mode to the six dimensions. The only exception was found in DPST, where compromising was moderately related to distributiveness ($r=.42$, $p<.05$) and negatively related to reactiveness ($5=-.58$, $p<.01$).

The Pearson correlations for the six dimensions and the performance variables were mostly insignificant. However, the few interesting results in Year 3 are:

1. In DPST, distributiveness is positively related to sales in units ($r=.53$, $p<.05$); and reactiveness is

negatively related to sales in units ($r=-.41$, $p<.05$), cooperativeness is negatively related to total cost ($r=-.62$, $p<.01$); and distributiveness is positively related to total cost ($r=.50$, $p<.05$).

2. In DAPST, cost per unit is negatively related to assertiveness ($r=.48$, $p<.05$), integrativeness ($r=-.43$, $p<.05$), and proactiveness ($r=-.44$, $p<.05$), and positively related to reactiveness ($r=.50$, $p<.05$).
3. For LSPST, there were no significant correlations between the six dimensional variables and the performance variables.

In conclusion the correlation of the six dimensions of conflict behavior with conflict-handling modes were consistent with our expectations, and the correlations of the six dimensions with the performance variables were not meaningful.

Chapter IX

SUMMARY AND CONCLUSIONS

Summary of Findings and Results

Conceptual

The indepth analysis undertaken in chapters II and III indicates that the state of the art in the conflict and problem-solving areas is still in the early stages of development. However one thing that becomes clear is that there is a need for a holistic and intergrative approach to conflict management and problem solving.

Refering to Figure 1, it becomes evident that the previous research in both areas has focused on only parts of the inputs-process-modes-outputs sequence. There are primarily two reasons for this:

1. a narrow perspective on and a misunderstanding of the nature and origin of conflict, and
2. the absence of holistic inquiry systems which integrates conflict and problem solving.

This research looked at the whole sequence in order to get an understanding of the workings of the input-output model. In this research we used the Dialectical Materialism law - the law of interpretation of opposites - to widen the understanding and to show generic roots of conflict. The law provides the theoretical explanation for the constant presence of conflict as well as the changes in intensity of conflict. Based on the above law we introduced and developed the concepts of Conflict Management Continuum (CMC) and Conflict Management Space (CMS).

The existing inquiry systems provide us with only a partial understanding of organizations and the problem solving technologies derived from these inquiry systems suppress or eliminate conflict from organizational processes. Hence we introduced in Chapter V the Dialectical Materialism Inquiry System (DMIS). Based on DMIS we developed a new conceptual model of problem solving and strategic planning, which incorporates the evolutionary nature of organizations through the process of organizational development and change. (See Figure 9 .)

In order to operationalize the decision making aspect of this conceptual model and to introduce a conflict oriented problem solving technology we next developed the Dialectical Problem Solving Technology (DPST).

These new concepts allowed us to set up and test various hypotheses.

Empirical

In order to examine the applicability of DPST we compared it with DAPST and LSPST. The three technologies were treated as independent variables. Conflict-handling behavior and performance were the dependent variables. The conflict-handling behavior was measured by the Thomas-Kilmann Mode Instrument, the reliability and structural validity of which was tested first.

The Thomas-Kilmann Instrument provides control for the influence of the social desirability factor and gives the relative frequency measures of each mode. Our findings indicate that the reliability (Cronbach-α and test-retest)

of this instrument is moderate, but better than other instruments as reported in Chapter VIII. However in terms of the average intercorrelation coefficient (r=.09) we did not find this instrument to be superior to Lawrence-Lorsch and Hall instruments.

Next we tested attitudinal, performance and dialectical hypotheses. There were three attitudinal hypotheses of which Hypothesis 1 was completely supported and only partial support was found for Hypotheses 2 and 3.

We found that for Hypothesis 1 that subjects were able to perceive considerable differences between conflict handling modes generally and in each problem-solving technology specifically. We found that for Hypothesis 2 that in DAPST the modes were ranked, as expected, in terms of preference as follows: 1) compromising, 2) collaborating, 3) competing, 4) avoiding, and 5) accommodating. In DPST, the compromising, avoiding and accommodating modes were ranked as expected. Also in LSPST, only compromising and collaborating were ranked as expected. In general we conclude that there is a stable hierarchical preference for conflict-handling behavior modes: 1) compromising, 2) collaborating, 3) competing, 4) avoiding, and 5) accommodating. This pattern is not affected by a particular problem-solving technology or by time. The pattern found in this study does not correspond with that found in earlier studies which showed collaborating as the most preferred mode.

We found that for Hypothesis 3 that only for the competing and compromising modes are there differences between the

technologies. We may conclude the following:

1. It seems that the type of problem-solving technology has affect only on competing and compromising modes of conflict behavior.
2. The statistically significant difference was found primarily between DPST and LSPST groups with no difference between DPST and DAPST and between DAPST and LSPST. This indicates that DAPST is intermediate to both DPST and LSPST technologies.
3. There is a possibility that there may exist an intervening variable (e.g. level of performance) that affects involvement in the specific conflict behavior modes.

The performance hypotheses were generally supported by the profit, ROI and ranking results. The indirect measure of performance (quiz grades) also supported the advantages of DPST and DAPST over LSPST. From the results given in Chapter VIII we conclude the following:

1. There exists a stable and significant difference between DPST and LSPST in terms of performance.
2. No significant relationships were found between DPST and DAPST on one hand and DAPST and LSPST on the other hand.
3. The Pearson correlations between modes of conflict-handling behavior and performance variables were found to be inconsistent, unstable and often contradictory from one year to another.
4. The relative success of DPST groups in terms of

performance as compared to LSPST groups may be attributed to the sequence or a combination of two conflict-handling behavior modes: competing and compromising.

The dialectical hypotheses 5A and 5B were generally not supported by the data. The reason for this may be that the cooperativeness and assertiveness dimensions are affected to a large degree by variables other than the collaborating and competing modes, respectively. The dialectical hypotheses 6A and 6B were not tested because the data was not complete. Hypothesis 7 dealing with the performance cycle in the DMIS model was basically supported. High performance teams (synergistic cycle) changed their organizational structure less frequently as compared to moderate and low performance teams (enthropic cycle).

Discussion

In order to explain the conceptual and empirical findings and results the following points should be raised:

1. One must be wary of making sweeping generalizations from our results since we do not have any prior studies with which the findings of this study may be compared. Hopefully, replications of this research will provide the foundation for comparative evaluation and possible generalization of the results.
2. This research shows the existence of a very strong and statistically significant difference between high structure problem-solving technologies (DPST) and low structure problem-solving technologies (LSPST).

However, no significant differences were found between DPST and DAPST on one hand and DAPST and LSPST on the other. One possible explanation of this may be that the business simulation as a task is not sensitive enough to differentiate between DPST and DAPST and between DAPST and LSPST.

3. It is also possible that in the perceptions of student subjects the level of conflict in DPST and DAPST is not adequately differentiated. In LSPST groups, because of a lack of structure individuals emerge as informal leaders through a cooperative process and try to impose a structure on the problem-solving process; this in turn makes LSPST closer to DAPST in terms of perceived level of conflict.
4. Even though only two conflict modes were found to be statistically significant between technologies the analysis of p-values over time shows a consistent decrease indicating that with a longer duration of the experiment all five modes may become statistically significant.
5. The Pearson Correlation analysis showed that in any technology the modes are used in pairs. For example in DAPST there is a strong positive correlation between collaborating and compromising which may suggest that the two modes are used concurrently or sequentially. This may indicate that one mode serves as the primary strategy and the other as a fall back strategy.

6. From the observation of teams participating in this experiment we conjecture that performance feedback may influence the choice of conflict behavior modes. For instance, high performance teams may reinforce the previously utilized pattern of modes and low performance teams may frequently change the pattern of conflict modes.

Managerial Implications and Applications

The most important conclusion we have arrived at from this research is that conflict must be recognized by decision makers and problem solvers in order to increase the effectiveness and efficiency of organizations. Conflict is inherent in all situations in one form or another. But recognizing conflict is not enough since it can take many different forms. Hence, managers must also be able to diagnose the level and type of conflict in order to get constructive rather than counterproductive outcomes. The concepts of CMC, CMS and DMIS can be useful in this regard.

Care may be used to diagnose the level of conflict which will suggest that some managerial action be taken to reduce or increase conflict to bring it to the optimal level (Chapter II). We have stated that conflict can be productive and therefore when we have a low level of conflict management should stimulate it. However, when conflict is destructive management should try to reduce it.

CMS, of which CMC is only one dimension, provides managers with two additional dimensions (conflict entity and conflict process) which can be used to develop a holistic view of

conflict in organizations. This three dimensional description of conflict may further suggest the need for appropriate managerial actions.

The conceptual model of strategic problem-solving and planning, based on DMIS may be utilized for understanding and possible implementation of such managerial activities as organizational development, corporate planning, diversification, market penetration, developing social programs, etc.

If managers deal systematically with conflict situations then an increase in understanding of conflict can take place. The greater the use of concepts developed in Chapter II, the greater will be the benefits from the learning curve. In this regard the criteria for evaluation outcomes of conflict situations collected and compiled by Thomas, Jamieson and Moore (1978) may prove useful to managers (Table 31).

These criteria may also allow for further development, testing and refinement of DPST and hence improve its applicability in real organizations. Our analysis shows that especially for one-shot problems which have to be dealt with under time constraint, DPST has considerable advantage over DAPST and LSPST.

Future Research

Our research has yeilded some concepts and answers which may be applicable in real organizations. However it raises many more questions than it answers. These questions may be answered by further research. Hence, we suggest some directions for future research:

Table 31

Criteria for Evaluating Conflict Outcomes

Organizational welfare	Effect upon human resources	Expenditures of organizational resources	Personal Welfare	Satisfaction variables
Quality of decisions - creativity of decisions - commitment to implementing decision - feedback and information flow - organizational adaptability and viability	Individual resources - intellectual and physical resources - absence and turnover rates - individual productivity Relationship resources - trust	- time and energy spent on conflict issues - training costs for collaborative skill building - goal displacement from organizational concerns to personal battles - disruptions (disorder, protest, violence)	Power and effectiveness variables - maintaining/augmenting one's allocation of organizational resources - obtaining/controlling strategic information - favorableness of reputation - husbanding time and energy for key personal concerns	- self esteem, face - frustration - job satisfaction - using familiar behaviors - perceived equ of resource share - exhilaration - fatigue

1. Replication of this study will help in concretizing and generalizing our findings.
2. Testing of the conflict-oriented problem-solving technologies using a more sophisticated business game (e.g., the Harvard Business Game) may provide better differentiation between them.
3. It may be useful to test the conflict-oriented problem-solving technologies (DPST, DAPST) against the harmonious problem-solving technologies (NGT, Delphi).
4. In order to examine the dialectical aspects of problem-solving a longer time horizon may be necessary.
5. Future studies should use more output variables as outlined in Figure 1 and Table 31 in order to examine the impact of the preceding elements of the input-process-mode-output sequence.
6. A focus on the input variables (Figure 1) will give more insight into the problem-solving process. Future research should examine group problem-solving in terms of homogeneous vs. heterogeneous groups, different personality types, different skill levels, etc.
7. No attempt was made in this research to examine the impact of intervening or situational variables on the problem-solving process and its outcomes. Therefore further research may take into account such variables as organizational climate, group norms, leadership styles, etc.

8. Present research shows that a single conflict mode does not adequately explain conflict behavior. Hence, future research should look at concurrent and/or sequential utilization of modes.
9. In our research the three two-dimensional models (Chapters II and VIII) did not provide valuable information about conflict behavior. Nevertheless, these models may be useful in future studies.
10. Analysis of performance feedback indicates that more attention should be given to this element in future research design.
11. Improvements in present measuring instruments or new instruments are necessary to more clearly delineate between the modes and make research results more meaningful.
12. Finally, we suggest that a longitudinal field test be undertaken to determine the usefulness of conflict-oriented problem-solving technologies, specifically DPST.

APPENDIX I

Long-Range Stretagic Plan for 1980-1982

Team #_____ Outline

President_____

1st Vice-Pres._____
2nd Vice-Pres._____
3rd Vice-Pres._____

1. Goals and Objectives

ITEM	Strategic Plan	Medium-Range Plan		Strategic Plan Revision 1		Strategic Plan Revision 2
	Year 3	Year 2	Year 1	Year 3	Year 2	Year 3
Ranking						
ROI (%)						
Owners' Economic Equity (dollars)						
Profit (dollars/unit)						
Sales Volume (units)						
Market Share (%)						
Production Capacity (units)						
Labor Cost (dollars/unit)						
Materials Cost (dollars/unit)						

2. Policies

1. Pricing
2. Marketing
3. Research and Development
4. Maintenance
5. Production Policy
6. Plant Investment
7. Raw Materials Ordering Policy
8. Dividend Policy
9. Finished Goods Inventory
10. Raw Materials Inventory
11. Cash

3. Assumptions

1. Long-range assumptions about economic trends based upon General Price Index, Economic Index, Seasonal Index, and Annual Inflation Rate.

2. Average Industry Price.

3. Average Industry Marketing Expenses.

4. Average Industry Research & Development Expenses.

5. Total Industry Potential.

6. Total Industry Sales.

APPENDIX II

Team #_____

President_____

1st Vice-Pres._____
2nd Vice-Pres._____
3rd Vice-Pres._____

Analyses

of Strategic and Medium Range Performance

ITEM	Medium-Range Results						Strategic-Range Results						
	Year 1			Year 2			Actual	Year 1		Year 3		Year 3	
	Plan	Actual	Diff.	Plan	Actual	Diff.	3rd Year	Plan	Diff.	Plan	Diff.	Plan	Diff.
Ranking													
ROI (%)													
Owners' Economic Equity (dollars)													
Profit (dollars/unit)													
Market Potential (units)													
Sales Volume (units)													
Market Share (%)													
Production Capacity (units)													
Labor Cost (dollars/unit)													
Materials Cost (dollars/unit)													

APPENDIX III

Baruch College
The City University of New York
Spring 1980

Post-Decision Questionnaire

Now that you have completed four more decisions it would be appreciated if you would complete the attached questionnaire which is concerned with your attitudes, views and possible future relationships with other members of your organization.

In responding to each item, try to think of yourself and your teammates within the framework of the company and executive decision-making, rather than as classmates. In other words, try to divorce yourself from the classroom environment and relate to the environment of the simulated business game and the strategic and operational decisions of your company.

Please carry out this phase of the exercise independently, without any consultation with the members of the class.

Your responses to this questionnaire will not affect your grades.

The purpose of this questionnaire is to improve the teaching and learning process at Baruch College.

I would appreciate your frank and honest responses.

Thank you.

Name:_____

Team:_____

Thank you

Michael Chanin
Game Administrator

Self-Report Questionnaire

Background Information

1. Sex of respondent:
   1._____Female
   2._____Male

2. My present age is:
   1._____under 20
   2._____20-24
   3._____25-29
   4._____30-34
   5._____35-39
   6._____40-44
   7._____45-49
   8._____50-54
   9._____55 or over

3. My major field of study is:
   1._____marketing
   2._____management
   3._____accounting
   4._____finance
   5._____statistics
   6._____computer sciences

4. My average grade point at Baruch is_____

5. My job responsibilities are best descrobed as:
   1. Non-supervisory_____
   2. Supervisory_____

6. I am a
   1._____part-time day student
   2._____full-time day student
   3._____part-time evening student
   4._____full-time evening student

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