Developments in Business Simulation & Experiential Exercises, Volume 10, 1983

AN EMPIRICAL EXAMINATION OF CONFLICT- AND NONCONFLICT-ORIENTED PROBLEM-SOLVING TECHNOLOGIES

Michael N. Chanin
Bernard N. Baruch College, The City of New York

ABSTRACT

Although there is an extensive body of literature dealing with development and application of different problem-solving technologies in strategic and operational decision-making our examination has revealed no empirical studies comparing conflict- and nonconflict-oriented problem-solving technologies. This paper presents results of an empirical investigation into the comparative effectiveness of two contrasting problem-solving technologies: Nominal Group Technique (NGT) and Dialectical Problem-Solving Technology (DPST).

INTRODUCTION

In the last 15 years considerable efforts were made to improve the effectiveness of decision-making for strategic planning and policy formulation by developing and applying new techniques and procedures of problem-solving, known as problem-solving technologies. With respect to the concept of conflict, two major types of problem-solving technologies can be distinguished: (i) conflict-oriented and (ii) nonconflict-oriented. This taxonomy is reflective of the two prevailing approaches toward the concept of conflict in organizational theory.

The traditional approach to conflict known as the "consensus" or "harmony" school of organizational theory views conflict as an undesirable, detrimental, inherently destructive and unacceptable factor in organizations (1,15,21,22). Under the influence of *this* school of thought, a number of nonconflict-oriented problem- solving technologies were developed and received widespread popularity.

A substantial body of research and literature deals with such major techniques as brainstorming (2,18,30), Delphi (3,14,31,37) and Nominal Group Technique (16,17,20,30).

The behavioral school of organizational theory recognizes conflict not only as an ever-existing phenomenon in all social organizations, but as inevitable, necessary and even desirable under specific organizational and environmental conditions (13,35,36,39). Recently this positive view of conflict was reinforced by a group of researchers who indicated that conflict has its theoretical roots in Hegelian and materialistic dialectics (4,5,24,25,29)The positive view on conflict and its dialectical conceptualization has been paralleled by the development and application of conflict-oriented problem-solving technologies. Some of these are Devil's Advocate and Dialectical Inquiry problem-solving technologies (9,10, 11,12,24), Strategic Assumption Making Methodology (19), Assumption Making Methodology (28), Strategic Assumption Surfacing and Testing (25), Dialectical Problem-Solving Technology (4,6,7). The major strength of these conflict-oriented problem-solving technologies, especially dialectical ones, lies in their ability to stimulate an effective process of strategic planning and policy formulation. Mason and Mitroff (25) argued that a dialectic should be a fundamental part of any planning process designed to deal with ill-structured, ill-defined and "wicked" problems, because it represents a method that can be applied directly towards policy, planning and strategy.

In this study the nonconflict-oriented problem-solving technologies are represented by Nominal Group Technique, developed by Andre D. Delbecq and Andrew H. Van de yen in 1968.

Gustafson et al.(20) 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 contribute ideas and also to incorporate them 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. However, the research on NGT, which provides inconsistent and often contradictory findings, has been primarily concentrated on efforts to compare this technique with other nonconflict-oriented techniques, such as Delphi, brainstorming, interacting groups, and pooled- individual groups.

A similar situation exists in the research and literature on conflict-oriented problem-solving technologies. The research findings are also basically inconsistent and contradictory. Cagier and his associates undertook a number of controlled laboratory experiments and concluded that the Devil's Advocate problem-solving technology produced better results in decision-making than did the Dialectical Inquiry problem-solving technology (9, 10,11,12,32,33). Mitroff and his collegial group supported theoretical clams of the advantages of dialectical problem-solving technologies by conducting a member of uncontrolled field studies (24,25,29). Though both groups claim to use the Hegelian dialectic some reservation should be made about the compatibility and validity of their results. Cosier and his associates conducted their laboratory studies using an individual decision- making process while Mitroff and his co-researchers applied group decision-making. In addition, the operationalization of the dialectic by Cosier is very questionable because he and his colleagues omitted a major component of the dialectical process -- structured debate and critique. Basically, they applied a method designed to deal with ill-structured problems to a well- structured problem of making financial predictions. On the other hand, Mitroff and his associates have used the dialectical problem--solving technology exclusively without the scientific benefits of comparing this method to alternative methods of strategic planning and policy

The author expresses his thanks to Roslyn L. Menzel for her valued help in preparing this paper.

formulation. Dialectical Problem--Solving Technology, based upon materialistic dialectic, has been compared in several studies to DAPST and control groups. The findings statistically favor DPST over DAPST and control groups in effectiveness of decision-making (4,5,7). Nevertheless, the absence of comparison between conflict- and nonconflict-oriented problem-solving technologies stimulated an empirical study, results of which are described in this paper.

METHOD

Sample

In the experiment discussed here the subject pool consisted of 50 senior undergraduate students enrolled in the business policy course at Baruch College at the City University of New York. They were divided into two sections with six teams in each: one section was assigned the DPST treatment, and the other the NGT. In order to examine the comparative effectiveness of different treatments, two industries were simulated with three DPST teams and three NGT teams assigned to each. All teams were required to be heterogeneous with respect to students' majors, and a conscious effort was made to have at least one accounting major student per team. The assignment of students into classes, experimental treatments and teams was made randomly.

Research Design

In this study we employed three major elements: The Executive Game (21); decision-making in the process of strategic and operational planning; and an organizational structure.

In the Executive Game six firms were competing in the manufacture and sale of a single medium-technology product. The performance of individual firms was evaluated by the firm's rank in industry, which depended on the ROI, achieved by the specific team. Though the Executive Game is rather simplistic compared to other known business games, it offers a dynamic business case, whose outcome is determined by the social process and decisions made inside the company, the competitive interaction of the firms within a specific industry, and prevailing economic conditions affecting the industry market potential. Although the game's computer program is essentially deterministic, the game itself involves a high degree of uncertainty, which stems not only from imperfect predictions of economic factors and inability to foresee decisions made by the competing firms, but also from the quite often erratic behavior of competing companies.

All firms were required to develop a strategic plan (time horizon 3 years), medium-range plans (time horizon 1 year), and to submit three annual and one final report. The time horizon for the operational plan was one quarter with a total of 12 quarters of simulated business activity. All participating firms were allowed to revise the plans at the end of the first and second years.

A list of 23 executive responsibilities was given to the subjects in each team, and was used in developing a functional organizational structure. Each firm consisted of a president and three vice-presidents with specifically executive responsibilities drawn up by the members themselves. These responsibilities were utilized by the researcher to induce intragroup conflict through a feedback report, and to assign variable rewards for individual performances. The individual reward was a maximum of one point per decision, and the team reward was a maximum of two points per quarter for finishing the game first.

Experimental Conditions

DPST was utilized along the theoretical framework of the Dialectical Materialism Inquiry System, developed by Chanin and Shapiro (8). DPST was designed to facilitate the decision-making process for strategic and operational planning. The DPST decision-making process comprises the three steps described below.

Step 1 - Development of Individual (Conflicting) Plans

The participants independently create individual or strategic operational decisions under conflicting sets of assumptions. Each firm (group) contains a president and three vice-presidents. Each vice president prepares a different conflicting strategic or operational plan 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 understandings of the business game.

Step 2 - Structured Debate

The structured debate occurs in class. Each v.p. presents his/her decision with corresponding assumptions and policies for three to four minutes (max. total 12 minutes). Then pros and cons of each plan and corresponding assumptions are examined in general discussion for three to four minutes (max. total 12 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 strategic or operational plan (forecast). After completion of the structured debate, all members of the organization agree on a joint set of assumptions and make a joint decision (maximum six minutes) on the eight decision variables. This set of assumptions is employed to develop the final strategic or operational plan (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.

The NGT was operationalized as a six-step problem-solving technology.

Step 1- Generation of forecasts and decisions

Each member of the team decides on the eight decision variables and completes the forecast on the worksheet. This work is to be done at home independently.

Step 2- Round-Robin recording of decisions

The leader asks each member of the team in turn to give his/her idea, proposal or value for the first decision variable. The leader records this information on the flip chart (visible to all team members). Then the leader moves to the next decision variable and so on until all decisions have been put on the flip chart. (max. 10 min.)

Step 3- Serial discussion of decision variables

The leader asks each member of the team to comment on the proposal (quantitative or qualitative) on the flip chart and to give reasons for agreement or disagreement with a particular proposal. The discussion continues until all members have had their say.

At this point, proposals may be withdrawn or added. (max. 15 min.)

Step 4- Preliminary Voting

After the discussion the leader asks each member to rank the numbers for each variable on a 5" x 8" index card (Rank - 1,2,3,4). The voting is to be done individually and without discussion. The leader then collects all the index cards, tallies the votes, and announces the results. The proposal with the highest total rank becomes the team's decision. This is done for each decision variable. (max. 10 min.)

Step 5- Final Voting- if necessary

If there is a tie for a particular decision variable, the leader asks for discussion and a final vote. The leader votes to break the tie if it occurs again. (max. 5 min.)

Step 6- Team Forecasting

The team undertakes to calculate the team forecast based on the team decision. (max. 35 mm.)

Independent and Dependent Variables

In this study the independent variables are the two problem-solving technologies: DPST and NGT. The independent variables are introduced into the research design by setting up differential starting positions--different problem-solving for different teams in the experiment. They were introduced to the subjects via short written instructions. In order to control and reinforce the compliance of subjects with the specific problem-solving technologies, they were requested to submit specially designed reports on the problem-solving technology after each decision. In addition, regular observation of each team's decision-making process and application of specific problem-solving technology was conducted by outside observers. A total of 12 points (one point per decision) were assigned to stimulate and reward the application of specific problem- solving technologies.

The following two groups of dependent variables were used in this study:
1. objective performance variables such as rank, ROI, profit, sales, etc., and 2. conflict-handling modes obtained by administering the Thomas-Kilmann Mode Instrument (34).

Hypotheses

H1. DPST groups will outperform NGT groups in economic performance.
H2. DPST groups will employ higher levels of competing and collaborating modes of conflict behavior
H3. NGT groups will show higher levels of conflict-handling behavior in compromising, avoiding and accommodating modes.

RESULTS

Hypothesis H1 predicted that DPST groups would outperform NGT groups on a number of objective performance measures. In order to identify which problem-solving technology is superior, we dichotomized all teams into high- and low-performance, based upon the ROI and the industry rank.

Table 1 presents the number of teams falling into each category after 3 years of simulated business operations.

Surprisingly, we find that all six DPST teams are high-performance teams both in terms of ROI and industry rank and all six NGT teams are low-performance teams.

TABLE 1

HIGH AND LOW PERFORMING TEAMS
ACCORDING TO ROI AND INDUSTRY RANK

Level of Performance	Problem-Solving Technology	Based on ROI	Based on Industry Rank
High	DPST	6	6
	NGT	0	0
Low	DPST	0	0
	NGT	6	6

The allocation of teams into high and low levels of performance is interesting from the point of view of their relative standing, but it does not indicate whether this difference is statistically significant. The Kolmogorov-Smirnov non-parametric test of ROI data shows that the difference (z=i.732) between DPST and NGT groups is statistically significant (p .005, two tail test). This overall superiority of DPST technology is also supported by the t-test on selected performance variables (Table 2)

TABLE 2

COMPARISON OF DPST AND NGT FOR
SELECTED PERFORMANCE VARIABLES

Performance Variable	DPST vs NGT	
	t-value	significance level
Sales in units	3.38	p<.05
Profit in dollars	2.88	p <.05
Cost per unit	-2.60	p <.05
ROI	3.39	p<.05
Industry Rank	-5.81	p<.05

In view of stable and statistically significant results we may claim that hypothesis Hi is supported and that DPST as a problem-solving technology is superior to NGT. Although the statistical results indicate the DPST is a more effective problem-solving technology, we should not make generalizations due to the limited sample size, the nature of the subject, and the exploratory nature of the study. However, as we have already mentioned, one of the possible explanations for DPST's overwhelming superiority is that this technology is conflict-oriented.

In hypothesis HZ we predicted that DPST groups would have higher levels of involvement in competing and collaborating. As is seen in Table 3 this hypothesis is only partially supported. Though both modes, competing and collaborating, have higher values in DPST groups, only the competing mode shows a statistically significant result (t=2.25, p<.05). Hypothesis H3 is only partially supported. Though we were right in predicting that NG groups would have higher levels of compromising, avoiding and accommodating, only the avoiding mode is significantly different (t=-2.22, p <.05).

TABLE 3
MEAN, STANDARD DEVIATIONS ABD t-VALUES AND STANDARD DEVIATIONS FOR THE CONFLICT-HANDLING MODES

Conflict-Handling Mode	Total Sample	DPST Groups	NGT Groups	t-Value between DPST and NGT Groups
Competing	6.67	7.75	5.58	2.28*
	(3.48)	(3.30)	(3.37)	
Collaborating	7.17	7.54	6.79	-1.44
	(1.82)	(1.84)	(1.77)	
Compromising	8.04	7.58	8.50	-1.46
	(2.20)	(2.10)	(2.25)	
Avoiding	4.71	4.04	5.38	-2.22*
	(2.16)	(1.99)	(2.16)	
Accommodating	3.42	3.13	3.71	-1.10
	(1.84)	(1.65)	(2.01)	

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

DISCUSSION AND CONCLUSIONS

This study shows the existence of a strong and statistically significant difference between DPST technology groups and groups utilizing NGT technology. The DPST groups outperformed the NGT groups on all the examined performance variables. Analysis of conflict-handling behavior modes indicates that DPST groups were considerably higher in using the most active conflict mode--competing--and lower on avoiding. Because only these two conflict modes showed statistically significant differences between DPST and NGT treatments, we may conjecture that problem-solving techniques with higher levels of competing and lower levels of avoiding as mediating variables lead to higher levels of organizational performance. However, the limited scope and exploratory nature of this research does not allow us to make broad generalizations. The most important conclusion we have arrived at from this experiment is that conflict must be recognized and dealt with by decision-makers and problem-solvers in order to increase the effectiveness and efficiency of organizations. More extensive and diversified research is needed to establish advantages or disadvantages of specific problem-solving technologies. Future research should also account for levels and types of conflict behavior involved in problem-solving processes. In addition, control should be exercised over the impact of such intervening or mediating variables as personality traits, needs and motives of problem- solvers, as well as such environmental and situational variables as group and cultural norms, task roles, and types of organization and/or technology.

REFERENCES

(1) Argyris, C. Integrating the individual and the organization. New York: John Wiley & Sons, 1964.

(2) Bouchard, T.J. **,** Jr. & Haire, M. Size, performance, and potential in brainstorming groups. Journal of Applied Psychology, 1970, 54(1), 51-55.

(3) Campbell, J.P. Individual versus group problem-solving in an industrial sample. Journal of Applied Psychology, 1968, 2(3), 205-210.

(4) Chanin, M.N. An empirical study of problem-solving technologies and conflict-handling behavior modes. Unpublished doctoral dissertation, The City University of New York, 1980,

(5) Chanin, M.N., & Lirtzman, S.I. Conflict and conflict dialectical reexamination. Paper presented at the Fifth European Congress on Operations Research and Twenty-Fifth Meeting of the Institute of Management Science, Lausanne, Switzerland, July 12-14, 1982.

(6) Chanin, M.N. & Shapiro, H.J. Problem-solving technologies; A dialectical extension. Paper presented at the Fifth European Congress on Operations Research and Twenty-Fifth Meeting of the Institute of Management Science, Lausanne, Switzerland, July 12-14, 1982.

(7) Chanin, M.N. & Shapiro, H.J. Comparison of problem-solving technologies: A free simulation approach. Developments in Business Simulation and Experiential Exercises, (ABSEL), 1982, *L* 236-239.

(8) Chanin, M.N. & Shapiro, H.J. Towards a dialectical theory of strategic planning. Proceedings, 11th Annual Meeting, American Institute for Decision Sciences, 1979, pp. 232-234.

(9) Cosier, R.A. Dialectical inquiry in strategic planning: A case of premature acceptance? Academy of Management Review, 1981a, 6(4), 643-648.

(10) Cosier, R.A. Inquiry method, goal difficulty, and context effects on performance. Decision Sciences, 1980, 11, 1-16.

(11) Cosier, R.A. The effects of three potential aids for making strategic decisions on prediction accuracy. Organizational Behavior and Human Performance, 1978, 22(2), 295-306.

(12) Cosier, R.A., Ruble, T., & Aplin, J.C. An evaluation of the effectiveness of dialectical inquiry systems. Management Science, 1978, 24 (14), 1483-1490.

(13) Cyert, R., & March, J.G. A Behavioral Theory of the Firm. London: Prentice-Hall, 1963.

(14) Dalkey, N.C. Predicting the future. The Rand Corporation, P-3948, October, 1968.

(13) Davis, R.C. The fundamentals of top management. New York: Harper & Row, 1951.

(16) Delbecq, A.L., & Van de Ven, A.H. A group process model for problem identification and program planning. Journal of Applied Behavioral Science, 197 2, 466-92.

(17) Delbecq, A.L. **,** Van de Ven, A.H., & Gustafson, D. Group techniques for program planning: A guide to nominal group and delphi processes, Glenview, Illinois: Scott, Foresman & Co., 1975.

(18) Dunnette, M.D., Campbell, J., & Jaastad, K. The effect of group participation on brainstorming effectiveness for two industrial samples. Journal of Applied Psychology, 1963, 47, 30-37.

(19) Emshoff, J.R., Mitroff, 1.1. Improving the effectiveness of corporate planning. Business horizons, October 1978, pp. 49-60.

(20) Gustafson, D.H., Shukla, R.K., Delbecq, A., & Walster, G.W. A comparative study of differences in subjective likelihood estimates made by individuals, interacting groups, Delphi groups, and Nominal groups. Organizational Behavior and Human Performance, 1973, 9 280-91.

(21) Henshaw, R.C., & Jackson, J.R., The Executive Game. Homewood, Illinois: Richard D. Irwin, Inc., 1978.

(22) Katz, E. & Kahn, R.L. The Social Psychology of Organizations. New York: John Wiley & Sons, 1967.

(23) Likert, R. New Patterns of Management. New York. McGraw-Hill, 1961.

(24) Mason, R.0.A dialectical approach to strategic planning. Management Science, 1969, 15(3), B-403-414.

(25) Mason, R.O., & Nitroff, 1.1. Challenging Strategic Planning Assumptions. New York: Wiley, 1981.

(26) Mitroff, 1.1. Dialectic squared: A fundamental difference in perception on the meanings of some key concepts in social science. Decision Sciences, 1982, 13(2), 222-223.

(27) Mitroff, 1.1. & Mason, R.O. The metaphysics of policy and planning: A reply to Cosier. Academy of Management Review, 1981, 6(4), 649-651.

(28) Mitroff, 1.1. & Emshoff, J.R. On strategic assumption-making; A dialectical approach to policy and planning. Academy of Management Review, 1979, 4(1), 1-2.

(29) Mitroff, I.I., Barbara, V.P. & Kilmann, R.H. The application of behavioral and philosophical technologies to strategic planning: A case study of a large federal agency. Management Science, 1977, 240), 44-58.

(30) Osborne, A.F. Applied Imagination. New York: Scribners, 1957.

(31) Sackman, H. Delphi Critique. Lexington, Mass.: Lexington Books, 1975.

(32) Schwenk, C.R. Some effects of planning aids and presentation media on strategic decision-making. Paper presented at the Western Academy of Manage- ment Meetings, San Diego, California, April 1981.

(33) Schwenk, C.R. Effects of inquiry methods and ambiguity tolerance on prediction performance. Decision Sciences, 1982, 13(2), 207-221.

(34) Thomas, K.W. & Kilmann, R.H. Thomas-Kilmann conflict mode instrument. Tuxedo, New York: XICOM, Inc., 1974.

(35) Thompson, J.D. Organizations in Action. New York~ McGraw-Hill, 1967.

(36) Thompson, V. Modern Organizations, New York: Knopf, 1961.

(37) Turoff, M. The design of a policy Delphi. Technological Forecasting and Social Change, 1970, 2(2), 149-171.

(38) Van de Ven, A.H. Group decision-making effectiveness. Kent State University: Center for Business and Economic Research Press, 1974.

(39) Zaleznik, A. Power and politics in organization life. Harvard Business Review, 1970