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# FORMAL PLANNING AND SIMULATION TEAM PERFORMANCE: A CROSS SECTIONAL APPROACH

Kent E. Curran, The University of North Carolina at Charlotte
Robert W. Hornaday, The University of North Carolina at Charlotte

## ABSTRACT

This paper utilizes a cross sectional approach to examine the relationship between simulation team planning and performance. Students in four Sections of business policy participating in the Business Management Laboratory constituted the sample. A cross sectional methodology was utilized where planning teams and nonplanning teams with different instructors were included in the same industry. The results of the data analysis revealed no statistically significant differences between the planning and nonplanning teams on the performance criteria. The results of this study in relation to three other studies undertaken by the authors are discussed. Some reflections by the authors on the complexity of simulation game research are also presented.

## INTRODUCTION

Formal business planning has long been considered to be an effective method of positively influencing organizational performance. Many of today's most popular Business Policy/Strategic Management textbooks present sections which tend to try and reinforce the validity of this proposition (see for example Thompson and Strickland, 1987; Jauch and Glueck, 1988; Byars, 1987; Pearce and Robinson, 1988). The research related to the advantages of using formal planning is, however, not unanimous in its support of the often suggested benefits.

A number of studies have attempted to relate organizational performance to firms classified as planners or nonplanners. The Stanford Research Institute ("Why companies,' 1957) examined 210 firms with exceptional growth rates in sales and earnings. Karger and Malik (1975) and Malik and Karger (1975) studied firms in the chemical and drugs, electronics, and machinery industries. Thune and House (1970) paired 36 medium to large companies on the basis of industry, size, and growth rate. Herold (1972) replicated the Thune and House (1970) study. In all of these studies companies engaged in formal strategic planning exhibited better performance than non planning firms.

Ansoff, Avner, Brandenburg, Portner, and Radosevich (1970) employed a complex methodology in which firms using operational and strategic planning were compared against nonplanning companies. Formal planners significantly outperformed nonplanners on all the study's financial performance variables. Wood and LaForge (1979) extended the planning nonplanning literature into the realm of banking. Their results indicated that banks with comprehensive long-range plans performed significantly better than partial planners, nonplanners, and a randomly selected control group.

The literature is not unanimous in its support of formal planning. A few studies have cast doubts on its value. Fulmer and Rue (1974), Kallman and Shapiro (1978), Kudla (1980), and Leontiades and Tezel (1980) found no concrete relationship between formal planning and performance.

The contradictory research results in the planning area may well be due to the use of inconsistent methodologies in the different inquiries. Even the supposed simplicity of defining terminology can easily be a major cause of methodological incompatibility between studies. For example, what is formal planning? Can unwritten plans be considered formal? Are all written plans formal? Does "formal" imply regularity (i.e. is planning undertaken only at certain times and only by certain individuals in the organization)? Assuming one can get through the formal planning definitional morass, what about organizational "performance?" What is it and how is it measured? Strategic planning scholars recognize these definitional difficulties and are groping for solutions (Robinson and Pearce, 1984; Pearce, Freeman, and Robinson, 1987).

## BACKGROUND AND PRESENT STUDY

Moving from the organizational literature to that on simulations, there appears to be a lack of both theoretical and empirical research aimed at evaluating the implications of marrying formal planning with a computer simulation. In his excellent literature review, Wolfe (1985) did not find any studies, which dealt with formal planning in simulations and concluded that this was an area where basic research was needed.

Responding to Wolfe's suggested need for empirical study, the present authors began a formal research program aimed at evaluating the relationship between formal planning and organizational performance in a comprehensive management simulation game.

The initial study in the series (Curran and Hornaday, 1987) attempted to evaluate the relationship between formal planning and organizational performance in a management simulation. In this study sixty, three member teams participated in a comprehensive total enterprise simulation game. Results of the research showed little difference between simulation teams that prepared a formal plan and those that did not.

The unexpected results of the Curran and Hornaday (1987) study prompted the authors to replicate their study (Hornaday and Curran, 1988). In the replication, the authors increased the "scale factors" used in the simulation for setting the market potential for each of the products in each of the different marketing areas. The results of this research effort indicated that the formal planning teams outperformed nonplanning teams on all profitability measures. In comparing the results of the 1987 and 1988 studies, Hornaday and Curran (1988) concluded that the differences between the two studies was attributable to the increased market potential available to the teams in the 1988 study which allowed more opportunity for the formal planning firms to excel.

In 1989 the authors used the same high demand parameters as in 1988 (Curran and Hornaday, 1989).

However, the authors introduced environmental change into the simulation to determine the ability of planning and nonplanning teams to perform in a turbulent situation. The results of this study corresponded closely with those of the 1988 study. Planning teams appeared to be able to better handle adverse environmental fluctuations and showed significantly higher earnings, average stock price, average earnings per share, and average return on investment than did nonplanners.

The general purpose of the present paper is to extend the investigation of the relationship between formal planning and the performance of student teams competing in a comprehensive business simulation game. In the three previous studies, student teams competed within industries, which were designated as planning or nonplanning industries. Thus, planning teams did not directly compete against nonplanning teams. Reviewers of the previous research have suggested that it may be methodologically sounder to utilize a research design where both planning and nonplanning teams compete in the same industry. A second issue addressed in this study has to do with instructor bias. In previous studies statistical techniques were utilized to test for differences in team performance based on individual instructor. These tests showed no significant difference due to professor. The previous studies did not, however, provide for direct competition between student teams in different instructors' classes. The present Study examines the performance of formal planning and nonplanning simulation teams in a setting where industries are so grouped that both planning and nonplanning teams from sections taught by different instructors compete against each other. The specific hypothesis to be tested is the following:

Hypothesis: There is no difference in the performance of student simula--tion teams that develop formal long range strategic plans and those that do no formal planning.

## METHOD

The methodology used in this study generally follows the same approach as the Curran and Hornaday (1989) study. The main difference between the two studies is that the present research utilized a cross sectional allocation of teams in order to provide a competitive situation where planners and nonplanners with different instructors were included in the same industry.

### Simulation

The simulation game used in this study, as well as the three previous studies, was The Business Management Laboratory (BML) developed by Jensen and Cherrington (1984). BML is a moderately complex (Wolfe, 1978) simulation of the stainless steel flatware industry. As used in this research, participants were free to make over 50 separate decisions each quarter of play. Because BML is limited to a rnaximum of eight firms per industry, five industries were used in the simulation, BML firms competed within an industry of seven firms. All of the adjustable parameters of the simulation were set to replicate the values used in the last two studies in the research series [i.e. Hornaday and Curran (1988) and Curran and Hornaday (1989)].

### Sample

Students in four sections of business policy at a mid-sized Southeastern university constituted the sample. Each of the authors taught two of the sections. The authors grouped the participants into 35 teams. Based on research by Wolfe and Chacko (1983), students were placed in three member teams. Whenever possible, each team was constituted so that a competitive balance was achieved in terms of functional expertise. A total of 14 decisions were made during the course of the simulation (Wolfe, 1985). Four practice decisions were completed for familiarization with BML. Following these trials, a new start up position was created and ten graded decisions were made over a ten week period. The BML team score counted for 20% of each student's course grade. All participating teams realized that their grade on the simulation was going to be based on their performance in the areas of profitability, liquidity, and leverage.

### Planning

In two of the sections (one section taught by each author) all teams wrote a formal long-range plan before the start of the ten graded decisions. The plan covered the entire ten quarter time frame of the simulation. Contents of the plan included a section outlining the overall goals to be accomplished during the 10 decision cycles and a formal statement of the strategies that were to lead to the accomplishment of the overall goals. A breakdown of the specific functional policies to be utilized by the company was also presented. The final requirement for each planning team was to provide a pro forma income statement and cash flow estimate covering all ten quarters of he simulation.

Two of the sections (one taught by each author) had no formal planning requirement. These sections, through the course of normal discussion of the simulation exercise, were told that they should consider what strategy they were going to use. However, they were never asked to describe or present this strategy in any written or oral format.

### Industry Assignments

After each author completed the task of assigning each student to a simulation team, the 35 teams were assigned to five, seven team industries. Each industry contained both planning and nonplanning teams from each of the authors' sections.

### Environmental Changes

To maintain consistency between this study and the 1989 study, three separate environmental changes were incorporated into the simulation game. All changes were initially introduced after the third decision of the graded cycle. These environmental factors were presented to the student teams in the form of news releases. These messages were printed on transparency film and shown to the class by each instructor without comment. The three environmental issues were: (1) A military action which had the potential of disrupting the supply of raw materials needed to manufacture the companies' products. (2) An expiring labor contract and the threat of a strike. (3) A political action groups attempt to require companies in the industries to add expensive equipment to better protect the environment. (A more complete description of the environmental changes and how they were used during the duration of the simulation can be found in Curran and Hornaday, 1989.) Though each of the environmental factors is described separately, the news releases were intermixed so that the students needed to consider the potential impact of all three environmental issues on their decision making from the fourth decision to the end of the simulation.

Performance Measures

At the completion of the 10 simulated quarters eight financial performance measures were calculated for each team. These eight measures were (1) total earnings, (2) average stock price, (3) average earnings per share, (4) average return on investment, (5) average debt/equity ratio, (6) total forced loans, (7) ending plant capacity, and (8) ending total assets. Of these measures only number six may need some explanation. Total forced loans represent automatic loans, which are given to a team when they encounter a cash shortage due to improper budgeting.

## RESULTS

An ANOVA analysis tested for differences in performance between formal planning teams and nonplanning teams. The results indicate that the hypothesis of no difference cannot be rejected. While planning teams achieved higher total earnings, average stock prices, earnings per share, and returns on investment, none of these differences were statistically significant (Table 1). On only one of the criteria - ending plant capacity - was there a significant difference. Planning teams had more plant capacity at the end of the 10 decisions than did nonplanners.

## DISCUSSION

These results are in stark contrast to the results of the 1988 (Hornaday and Curran, 1988) and 1989 (Curran and Hornaday, 1989) studies which indicated that planning firms clearly outpaced the nonplanners in total earnings, average stock price, average earnings per share, and return on investment. All three previous studies also showed planners to have less capacity than nonplanners. The present study indicated the opposite. A further discrepancy was in the forced loan performance of planning teams. Planners had a higher (though non-significant) dollar amount for forced loans than did the nonplanners. In the three previous studies in this series, planners had recorded a lower level of forced loans than did nonplanners. These results tend to be in line with the "real world" research studies of Fulmer and Rue (1974), Kallman and Shapiro (1978), Kudla (1980), and Leontiades and Tezel (1980) which also showed no significant performance differences between planners and nonplanners.

Recall that this study differed from the previous studies in that planners and nonplanners competed directly within the same seven team industries. Since BML is an interactive simulation, it is reasonable to assume performance differences between industries. A two-way analysis of variance tested for industry effect (Tables 2 and 3). This analysis confirmed that industry had a significant effect on average stock prices and earnings per share. Adjusting for industry effect, however, did not change the statistical significance of the differences between planners and nonplanners.

Thus, even after controlling for industry effect, the study shows no statistically significant differences between planning and nonplanning teams competing directly in the BML simulation and subject to adverse environmental changes. On the other hand, considering the results of the last three studies taken together (Hornaday and Curran, 1988; Curran and Hornaday, 1989; and the present study), a generally positive picture of relationship between formal planning and simulation performance emerges. In all three of these studies, planning teams outperformed nonplanning teams, albeit not to statistical significance in the last study.

## THOUGHTS ON FUTURE FORMAL PLANNING RESEARCH

After reviewing our efforts to examine formal planning through the use of student groups and simulations, some reflections on the complexity of this type of research seem appropriate. First, the inconsistencies of the results point once again to the importance of proper control methods when using student academic performance as an outcome variable. No attempt was made to control for student ability or classroom motivation in these four studies. Therefore, it is possible that unusually bright, capable, or ambitious students assigned to either planning or nonplanning teams may have skewed the results. It is also possible in an interactive simulation Such as BML for an otherwise excellent team to suffer because it happens to be competing in an underpriced industry. Such a team will outperform its direct competitors, but it will not be able to maintain the market share and pricing levels necessary to produce high earnings. As a result, this team will not compare well with most of the teams in an industry that had proper prices.

Even with these difficulties, there are still opportunities in this field of research. First, more attention should be paid to controlling for student ability and interest. For example, a pre-testing for student ability and interest could provide better team balance. At the extreme, very strict controls can be maintained if student teams are allowed to work on their decisions only at certain times in observed decision rooms. A second approach is to use outcome variables other than team financial performance as criteria in evaluating the effects of team planning (See for example Teach, 1989).

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**TABLE 1**

**Analysis of Variance**

**Detailed BML Plan versus No Plan Teams**

| Criteria | Mean Plan n=19 | Mean No Plan n=16 | F | p. |
|---|---|---|---|---|
| Total Earnings ($ 000s) | 348 | 323 | 0.516 | .477 |
| Average Stock Price | 2.41 | 2.23 | 0.707 | .407 |
| Average Earnings per Share | .07 | .06 | 1.409 | .244 |
| Average Return on Investment | .06 | .04 | 1.330 | .257 |
| Average Debt/Equity Ratio | .16 | .18 | 0.044 | .835 |
| Total Forced Loans ($ 000s) | 243 | 229 | 0.046 | .831 |
| End Plant Capacity (Hours 000s) | 22.5 | 18.9 | 6.450 | .016* |
| End Total Assets ($ 000s) | 1208 | 1046 | 2.221 | .146 |

* Probability of no difference < .05.
** Probability of no difference < .01.

**TABLE 2**

**Two-way Analysis of Variance**

Criterion: Total Earnings ($ 000s)

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 0.79 | .56 |
| Planning | 1 | 0.46 | .50 |
| Industry | 4 | 0.84 | .51 |
| Interaction | | | |
| Planning/Industry | 1 | 2.63 | .05* |
| Residual | 25 | | |
| $R^2$ .10 | | | |

Criterion: Average Stock Price

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 2.54 | .05* |
| Planning | 1 | 0.46 | .50 |
| Industry | 4 | 2.96 | .03* |
| Interaction | | | |
| Planning/Industry | 1 | 0.51 | .72 |
| Residual | 25 | | |
| $R^2$ .31 | | | |

Criterion: Average Earnings per Share

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 3.25 | .02* |
| Planning | 1 | 1.08 | .30 |
| Industry | 4 | 3.61 | .01** |
| Interaction | | | |
| Planning/Industry | 1 | 0.81 | .52 |
| Residual | 25 | | |
| $R^2$ .36 | | | |

Criterion: Average Return on Investment

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 1.53 | .21 |
| Planning | 1 | 1.35 | .25 |
| Industry | 4 | 1.55 | .21 |
| Interaction | | | |
| Planning/Industry | 1 | 1.23 | .32 |
| Residual | 25 | | |
| $R^2$ .20 | | | |

* Probability of no difference < .05.
** Probability of no difference < .01.

**TABLE 3**

**Two-way Analysis of Variance**

Criterion: Average Debt to Equity Ratio

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 0.51 | .76 |
| Planning | 1 | 0.28 | .86 |
| Industry | 4 | 0.62 | .64 |
| Interaction | | | |
| Planning/Industry | 1 | 0.74 | .77 |
| Residual | 25 | | |
| $R^2$ .08 | | | |

Criterion: Total Forced Loans ($ 000s)

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 0.89 | .49 |
| Planning | 1 | 0.09 | .75 |
| Industry | 4 | 1.10 | .37 |
| Interaction | | | |
| Planning/Industry | 1 | 1.05 | .39 |
| Residual | 25 | | |
| $R^2$ .13 | | | |

Criterion: End Plant Capacity (Hours 000s)

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 2.63 | .04* |
| Planning | 1 | 7.26 | .01** |
| Industry | 4 | 1.51 | .22 |
| Interaction | | | |
| Planning/Industry | 1 | 1.32 | .29 |
| Residual | 25 | | |
| $R^2$ .30 | | | |

Criterion: End Total Assets ($ 000s)

| | df | F | p. |
|---|---|---|---|
| Main Effects | 5 | 2.47 | .06 |
| Planning | 1 | 2.67 | .11 |
| Industry | 4 | 2.40 | .07 |
| Interaction | | | |
| Planning/Industry | 1 | 1.49 | .23 |
| Residual | 25 | | |
| $R^2$ .28 | | | |

* Probability of no difference < .05.
** Probability of no difference < .01.