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SIMULATION: A METHOD OF APPRAISING COMMUNICATION NETWORKS IN MANAGERIAL DECISION MAKING

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ABSTRACT

A great deal of small group research has dealt with small group decision making. Much of this research has been concerned with interpersonal processes and the influence of communication networks on group performance. This was a pilot study which evaluated the influence of two kinds of communication networks on the quality of managerial decisions and individual participant satisfaction. The decision making task was the ADSIM computer simulation exercise. The emphasis of the study was on non face to face groups and used telephones. in offices as the primary channel of communication. The networks used were the wheel and the chain. The results indicated that the chain out performed the wheel in both profitability and stock market value. Overall satisfaction was approximately the same between both groups, as was both groups' perception of the degree of organization. The wheel network was considered to be more authoritarian than the chain.

INTRODUCTION

The study of networks in complex organizations may allow the more accurate determination of message exchange patterns which occur internally, and give insight into the systemic nature of the organization. It has been argued that large scale network analysis may allow for an understanding of systemic relationships and the identification of potentially entropic areas. Farace 1972 [2]. Farace 1973 [3] has stated further that "the primary goal of network analysis is to determine the particular pathways through which information moves in a giver organizational setting." Thus network analysis attempts to identify message diffusion patterns in the organization, not the hierarchical or authority networks. Recent evidence indicates that different functions of communication will result in different communication networks.

One of the major problems in studying network analysis has been the lack of realism in the experimental paradigms used [1]. This study is partly an attempt to inject realism into the literature. These results are from a pilot study using a computer based decision- making simulation to evaluate the impact of communication networks on managerial decision making. It should be mentioned, however, that there are two basic kinds of communication situations; non face to face (e.g., telephone conversations, inter office memos) and face to face communication (e.g., staff meetings.) This investigation created the former as opposed to the latter situation.

METHOD

Subjects

The subjects (n = 20) for this study were drawn from a senior level class in a College of Business Administration at a Southwestern University. The subjects were both male and female and they participated 0.1 a voluntary basis in return for extra credit in their course work. All of the volunteers had extensive experience with the decision making simulation (ADSIM) prior to their participation in the study [7]. The subjects were originally asked to volunteer for one of the three nights during which the study was to be conducted. However, due to the uncontrollable computer problems, the study had to be aborted on two of the three evenings originally scheduled and rescheduled for two other evenings. The students were asked to volunteer for the two rescheduled evenings in order to complete the study.

Independent Variables

The independent variables in the study are two types of communication networks commonly referred to as the wheel network and the chain network [5]. Each network was made up of five members. (See figure 1.)

FIGURE 1
COMMUNICATION NETWORKS

Dependent Variables

The dependent variables in the study ware individual measures of satisfaction, and group level measures of decision making quality. The group level measures of decision quality were the net profit and the computed stock market value for each hypothetical firm in the simulation. The stock market value in ADSIM is a function of debt management, profitability, and the firm's dividend strategy. Self report questionnaires and peer evaluation forms were used as individual measures of satisfaction. All firms were allowed a given amount of time (20 minutes) to make the required decisions (promotion, maintenance expenditure, raw materials ordered, price, research and development budget, production scheduled, declared dividends and capital investment.)

Task

The task assigned to the experimental groups was the development of strategies, and operational level decisions appropriate to a computerized business simulation. The simulation (ADSIM) allowed the students to establish strategies for managing a hypothetical firm in a simulated business environment. The more effective their decision-making process, the more profitable the firm, and the more valued its stock.

Design

The original design of the study required six five man teams. However, due to computer problems, the last replication had to be aborted and the final design results are based on a sample of twenty (four five person teams). The subjects were randomly assigned to teams and the teams were randomly assigned to one of the two network types. This resulted in two levels of treatment with two replications of each level.

Procedure

Each of the ten subjects (per night) was randomly assigned to one of the two "firms." Each of the two firms was randomly assigned to one of the two experimental conditions (communication networks.) Each firm represented a competing business enterprise within the same industry. The firms competed, two at a time against each other, and against three dumy firms. Each dummy firm followed a set of standard decisions which were incentive to the decisions of the experimental treatment firms. These standard decisions were the same for each replication. The dummy firms were used in the industry in order to create a more realistic (five firm) environment for the simulation.

The simulation was run on an ITEL AS/6 computer system using a DEC writer as an input device. The job control language, simulation variables and standard decisions were stored in disc files prior to the start of the study. The team decisions were entered into the job file using the STANFORD WILBUR interactive text editing feature. Job submission was also accomplished throught WYLBUR. The simulation output was printed on a remote job entry printer located in the building where the study was being conducted. The output from the simulation was distributed to each of the team members by runners who were volunteers working for extra credit in their course work.

During the actual study, each team member was placed in a private office, isolated from other team members in order to insure against unplanned interaction. The individual team members were given only the phone number(s) of the team member(s) with whom lie/she was allowed to communicate in accordance with the appropriate network structure.

The team members were provided with the initial starting values (equal for each firm) and were required to make three sets of decisions. Due to time considerations, the full set of ADSIM decisions was limited by not allowing the teams to sell any securities or buy any economic data. Also, each team was required to spend exactly $250,000 for plant investment. The members of each team were permitted to communicate by phone in accordance with their network structure during the decision making period. No communication was permitted outside of the decision making period. When the decision making was completed each team member was required to submit a sheet containing the decisions in order to insure that the decisions were known throughout the network. The decision sheets were collected by the runners and taken to the computer entry terminal where they were checked to see that each team member's decision agreed with all of the other team member's decisions.

The decision sets for each team and the pre-programmed dummy firms were entered into the stored job file utilizing the WILBUR terminal and the job was submitted from the terminal. When the output was received, it was separated by team and distributed to the respective team members for use in making the next round of decisions.

RESULTS

Performance

The two dependent variables used to measure group performance were profit and stock market value. The Chain network performed less well than the Wheel in the first trial in both profit making and stock market value. However, in the second and third trials the Chain out performed the Wheel in both profit making and stock market value. (See figure 2) It has been the result of many studies that centralized or groups which represent bureaucracies tend to be less innovative and creative. In contrast, groups that are more decentralized seem better able to cope with problems which demand more creativity [4].

It is important however, to identify the nature of the problems which the group is to solve. Shaw [8] argues that centralized groups perform better when confronted with simple problems such as identifying colors, symbols, and numbers etc. In contrast, decentralized groups perform better when dealing with discussion problems, math problems, sentence construction etc.

Stabilization

A large number of studies have patterned themselves after Leavitt's [6] network but the results are not always consistent. It had been argued that some networks are more successful because of their structure. Leavitt's [6] original research findings indicated that the Y, Wheel and Chain organized themselves into patterns of interaction that were continuously repeated. In contrast, members of the circle did not organize themselves. Guetzkow and Simon [5], however, believe that once a group has worked out a pattern of interaction, it will perform effectively regardless of the network used.

The results of this study indicated that both groups felt approximately the same about being well organized and systematic. (See table 1) The results therefore are only partially consistent with the literature.

TABLE 1
INDIVIDUAL LEVEL MEASURES

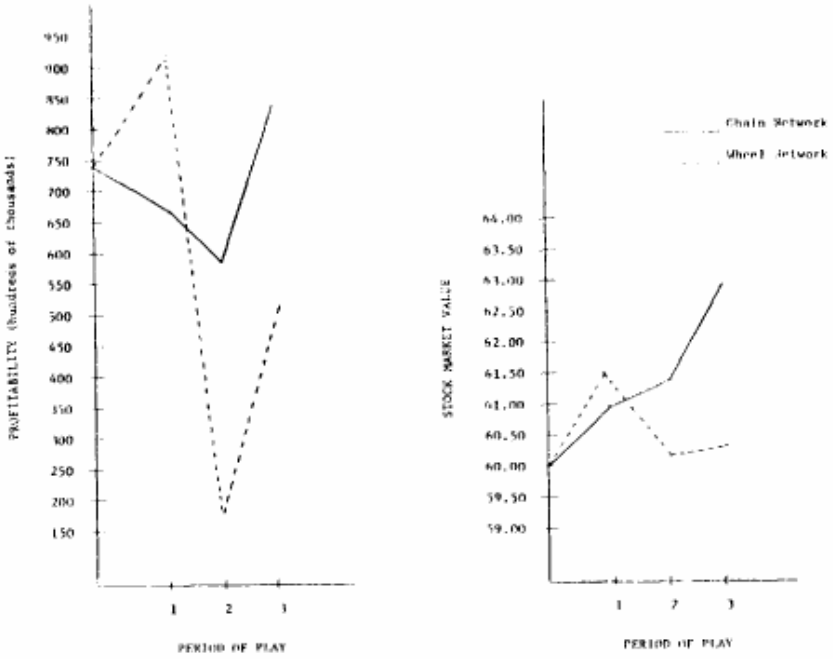
	Network 1 (Chain)	Network 2 (Wheel)
Overall Satisfaction with results	3.06	3.1
How well organized and systematic was the group?	3.5	3.5
Style of leadership	3.0	3.6

Note. Scale ranged from 1 to 7. The higher the value the less structured, more satisfied with and more autocratic the situation.

Group Satisfaction

The literature argues that in the case of the centralized group structure (Wheel) the leader is the only one satisfied and in the case of the decentralized group structure (Chain) the peripheral members are satisfied as well [5]. Another advantage of the decentralized network is that they tend to provide the most cohesiveness to group members. Again the group members self-report of satisfaction do not differ a a great deal (See table 2). It must be stated, how-

FIGURE 2
PROFITABILITY AND STOCK MARKET VALUES



ever, that with additional trials satisfaction with the chain might have been higher than the wheel. In other words, the chain might cause confusion initially [5], but with network learning, satisfaction with the chain might have increased.

Leadership

Two extremes of leadership were presented to the subject for evaluation: authoritarian and democratic. Consistent with the literature the subjects rated the wheel as being more authoritarian than the chain (See table 1).

DISCUSSION

The methodology employed in this paper can be quite easily employed in the classroom to demonstrate the relationship between organizational communication (network flow) and the quality of managerial decisions. An added advantage, and one that is critical, is that the students are engaging in realistic kinds of decision making. The majority of the early network research failed to bridge this gap. Although the sample size was small and the number of trials limited, the results generally support the literature. The authors believe that the methodology employed in this study indicates a valid method for the use of simulation to demonstrate the relationship between network flow and the quality of managerial decisions.

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