Managerial response to an information system

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ABSTRACT

One of the most common problems in implementing a successful information system is its threatening nature to users of the system—particularly middle managers. The behavioral implications inherent in the implementation of an information system were studied by testing the following two propositions:

- Acceptance of an information system is positively related to involvement in the implementation of the information system.
- Acceptance of an information system is negatively related to the perception of the system as threatening.

Three hundred thirty one middle managers from five different organizations were sampled. An overall response rate of 72 percent was achieved utilizing an anonymous three-part questionnaire. Various statistical techniques were utilized to validate the proposed scales used in testing the hypotheses.

Based upon the data analysis, the two propositions are strongly supported. There is a definite positive relationship between a middle manager's acceptance of an information system and his participation in the analysis and design of the system. In addition, there is a negative relationship between a manager's acceptance of an information system and the perceived threat of the system to such behavioral factors as job satisfaction, job skill, job opportunity, job originality, job status, and job salary.

INTRODUCTION

The entire management information system (MIS) field must still be considered to be in its embryonic stage. For approximately the last two decades computer-based information systems have been utilized by industry and government and the computer's potential recognized as a vital management tool in daily operations. This increased capability has brought about complex data processing (D.P.) applications and a growing awareness of the need to integrate these applications in the form of a MIS. In turn, this has led to numerous technical and personnel problems that must be overcome if such systems are to be successful.

One of the most common problems in implementing a successful information system has been its threatening nature to users of the system—particularly middle managers. It is a widely accepted tenet that information systems should be designed, developed, and implemented for middle managers. Generally, however, their needs and perceptions about the system have been given little, if any, consideration. If these middle managers fail to understand or accept the system, it is not likely that they will use it to perform their job more effectively.

The behavioral implications inherent in the implementation of an information system were, therefore, studied. Specifically, the study determined whether or not middle managers in five selected organizations perceive the MIS as threatening in terms of various behavioral criteria factors and whether or not they accept the MIS. The following two propositions were primarily examined:

1. Acceptance of an information system is positively related to involvement in the implementation of the information system.
2. Acceptance of an information system is negatively related to the perception of the system as threatening.

The following behavioral variables were examined in this regard: job satisfaction, job skill, job opportunity, job originality, job status, and job salary. The interrelationships of these variables were also examined; therefore, as a corollary to the two primary propositions, it was proposed that a positive relationship exists between each of the behavioral variables.

It is surprising that the behavioral problems associated with information systems have not previously been investigated. Much has been written describing the characteristics of a successful management information system. However, the main emphasis has been in the direction of technical factors—hardware and software—and overall MIS considerations such as problem definition, problem analysis, and problem solving. Research in the area of user response to the MIS...
and how acceptance/lack of acceptance is related to their involvement in the implementation of the MIS and the perceived threats that the MIS has to them has not yet been undertaken. There has also been extensive research in the area of attitude measurement, but little of this area pertains to information systems. Instead, research has disclosed that there are few operational computerized management information systems considered to be successful—possibly because the human factor was not given enough consideration. As Allen Rowe observes, people are the key ingredient in a MIS. M. Scott Myers actually defines a MIS as a “process of people interacting in order to apply resources for the achievement of various goals.” Neither of these authors, however, nor any others present any empirical evidence regarding the behavioral implications of a management information system.

It is also necessary to note that during the past decade numerous terms were used to describe the different types of computer and systems applications that were being developed. The same term has been defined in different ways by various authors and in different disciplines. For this reason and to avoid any possible misinterpretation the following meanings are to be given to the following terms.

A. Management Information System—or Information System for Managers—a system that provides the proper information to the proper person, at the proper time and at the proper cost.

B. Middle Managers—composed of those members of management above the level of foreman and below the level of vice president.

C. Perceived threat—the perceived potential forced movement away from a desired position or date.

METHODOLOGY

The sample consists of 225 middle managers from five organizations possessing an actively-utilized, computer-based management information system. Two of these five organizations are agencies of the United States Government based in the Washington, D.C. metropolitan area; the other three are large eastern industrial corporations. Middle managers were selected as subjects because they are the prime users of the MIS. In the governmental agencies, this group was comprised of GS12’s, GS13’s, GS14’s and selected GS15’s. A breakdown of subjects by organization can be found in Table I. A total of seventy-two percent (246 respondents) of the questionnaires distributed (341) were returned and found usable.

Data was collected from July through October 1973. All participants completed a three-part questionnaire developed for this study. Subjects were in no way asked to identify themselves—either by name or job function. This questionnaire required the respondents to react along a six-point continuum to 57 attitudinal statements concerning the MIS and to six statements measuring their involvement in its implementation process. The statements asked and the variables being measured were arrived at based upon a review of the MIS and behavioral science literature and the author’s prior experience in the field.

Top management distributed the questionnaires with a cover letter as subjects were from several different departments and often different physical locations. Also, the subjects in this study within the industrial organizations worked on different shifts and previously started vacations of the subjects could not be re-arranged. The direct support of top management and anonymous nature of the questionnaire assured a greater response rate. At least one follow-up letter was sent to all participants in this study approximately one week after the initial distribution of the questionnaire. In two organizations, questionnaires were returned anonymously to top management and then forwarded to the author; in the other three organizations, subjects were furnished stamped, self-addressed envelopes and questionnaires returned directly to a Box number. As can be observed from Table I, the response rate was not affected by the different methods of questionnaires return.

Factor analysis was used to test the a priori scale structure. The purpose of this analysis was to reduce the number of variables to those showing a common variance and to determine if the items making up each a priori scale were in fact parallel. The a priori structures did generally, in fact, hold up.

The a priori scales were then modified as a result of the factor analysis and these modified scales were then used.

The mean score and standard deviation of each of

| Table I* |
|-----------------|-----------------|-----------------|-----------------|
| Total Subjects | Total Questionnaires | Total Usable Questionnaires |
| Returning | Distributed Within Organization | Response Rate In % |
| Questionnaires | | |
| Organization 1 | 59 | 86 | 69 | 54 |
| Organization 2 | 55 | 83 | 66 | 51 |
| Organization 3 | 38 | 44 | 75 | 30 |
| Organization 4 | 57 | 73 | 78 | 49 |
| Organization 5 | 42 | 55 | 76 | 41 |
| Total | 246 | 341 | 72 | 225 |

* The participating organizations wished to remain anonymous; therefore, no organization names will be given. Organizations 1 and 2 are governmental agencies; organizations 3, 4, and 5 are industrial firms.

** The distribution of questionnaires within each organization included all middle manager/users of the management information system within one or more specific departments.
the scales were computed and then the scales were correlated using the Pearson Product Moment Correlation in the SPSS statistical package. The scales were correlated on an individual basis by organization and then these organizations were combined and grouped together as a composite (Table II).

RESULTS

The results of this study are presented in Table II: Columns 1 through 5, for each behavioral factor, contain the correlation coefficient of one individual organization. Column 6 for each behavioral factor contains the correlation coefficient for the entire sample. As can be observed the scale reliability using the Veldman test (a) for each of the factors is greater than .632 which appears to indicate that the resultant scales, based upon the factor analysis, are quite reliable. In fact, the reliabilities of the involvement, acceptance, job satisfaction and job originality scales are greater than .8.

In addition, many of the correlation coefficients have a significance level of greater than .001. This indicates that the proposed relationships for each individual organization and for the composite grouping of organizations strongly support the basic propositions. For example, the correlation coefficient between perceived job satisfaction and acceptance of an information system for all 229 respondents is .72. Given that the significance level of .001 is .020, this result appears to be quite significant. This implies that there is a strong positive relationship between acceptance of an information system and job satisfaction.

The data should be interpreted by using the following procedure. A high positive correlation statistic on the behavioral factors—job satisfaction, job skill, job opportunity, job originality, job status, and job salary—implies that there is low threat to those factors while a high negative statistic implies that there is a high threat to those factors.

DISCUSSION

To describe and analyze the data presented in Table II, this section examines each of the factors, determines which relationships exist, why they exist, and whether or not any pattern can be observed. In order to determine relationships between scales, each of the hypotheses will first be analyzed by individual organizations and then in composite form. Thus, the individual organizations participating in the survey can compare their data to other organizations and to the composite grouping.

Organization 1

The data for this organization shows that a strong positive relationship exists between acceptance of an information system and a manager's involvement in the implementation of that system (.36). This occurs possibly because the information system was designed by this organization's management and by a group of external consultants. This system was designed on a large scale third generation equipment, taking into account all of the users of the system. With regard to a manager's acceptance of an information system and a manager's perceived behavioral threats, a very strong positive relationship exists between acceptance and job satisfaction (.67), job skill (.64), job originality (.62), and job status (.60). In addition a strong positive relationship exists with the other behavioral

### TABLE II

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* The correlation coefficients are based on the reliability of the scale using the following form. *This data is based upon the entire sample of 229 cases.

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Columns 1, 2, and 3 contain data from the large governmental organization. Columns 4, 6, and 7 contain data from the small governmental organization.
criteria and acceptance—job opportunity (.30), job salary (.35) and involvement (.36)—but they are not as strong as the former scales. This indicates that job opportunity, job salary, and involvement are not perceived as important as the other factors as it relates to acceptance. The data, therefore, appears to indicate that those individuals accepting the information system do not in any way feel threatened by it. Individual middle managers within this organization are very satisfied with their job, perceive that they have a high skill level, possess much job originality, and have a high degree of job status.

Upon examining the interrelationships of the various behavioral factors, generally one finds a strong positive relationship. The only major exception is the interrelationship of job salary to involvement (.05) which is not significant.

Organization 2

The data for this organization, a large governmental agency based in the Washington, D.C. area, indicates that all the proposed relationships are true. This organization has large third generation IBM computing equipment on which their information system was implemented in 1970. Primarily this information system is an output reporting system designed by external consultants with the advice of this organization's top management.

There appears to be a very strong positive relationship between acceptance of an information system by managers using the system, their involvement in it (.55); and acceptance of the information system and the lack of threat of the system. Individuals within this organization do not find the information system threatening. For example, the relationship between job satisfaction and acceptance (.83) is very strong in a positive way when one considers that a significance level of .001 is .42. The corollary propositions—the relationships between the behavioral variables—is also very strong. The data for this organization in comparing it with the other organizations is far greater than those in significance level and strength. All this appears to indicate that the individuals in this organization are not threatened in any way and accept the information system. This fact could be the result of employment by the government from which one's job is quite secure.

Organization 3

The data for this large industrial firm is quite similar to the data for organization 2. This organization primarily uses its information system in the evaluation of various centers. As a consequence, therefore, it was designed by accountants for accountants to meet their needs. This small IBM computer system is used also to keep track of inventories and for warehousing purposes.

A very strong positive relationship exists between acceptance of an information system and involvement and acceptance and all the behavioral factors. It appears that the three most important factors relating to acceptance are job satisfaction (.76), job skill (.71), and job originality (.76). The other factors, though significant, are not as important. A conclusion that could be reached is the more satisfied a person is with his job, the more likely he is to accept the information system.

Among the interrelationships of the behavioral factors, job status appears to be less significant than the others. For example, the data appears to indicate that there is no relationship between job status and job salary or job status and involvement. This appears to indicate that salary and the amount of involvement in the information system by the manager has no bearing at all on his job status. This conclusion is quite plausible as the information system in this organization was primarily designed by the controller and his staff and many users of the information system were not involved in its analysis and design.

Organization 4

This organization, headquartered in a small city with rural plant sites, has an IBM computer system upon which the information system has been implemented. Managers in this organization really did not participate in the implementation process, but were forced to use the outputs of the system. Also many of these managers are located at various plants within a fifty mile radius of headquarters.

The data for this organization differs quite appreciably from the data from the other organizations. None of the propositions are strongly supported. In fact, acceptance of an information system is negatively related to perceived job salary (−.33). This implies that an individual's acceptance of an information system is threatening to his perceived salary level. Interpretation of this fact could lead to the conclusion that salary level is perceived to be lowered because of
the information system. In addition, there appears to be no significant relationship between acceptance and job opportunity. Maybe the people in this organization do not feel that the information system gives them many additional opportunities possibly because of the location of this company and/or the backgrounds of the individual participants.

The remainder of the data generally supports the positive relationship purported. It does not appear to be as conclusive as the other organizations because the significance level is .005. Some of the interrelationships of the various behavioral factors are very low. For example, the following factors are quite low—job skill to job salary (.18), job status to job salary (.14), involvement to job status (.01), job salary to involvement (.19).

Organization 5

The data for this organization in general supports the propositions undertaken in this study. The relationship between acceptance of an information system and a manager's involvement in the implementation process is positive but less than the .005 significance level (.34). This statistic indicates that involvement is not as important a factor relating to acceptance as some of the other factors. The relationship between acceptance of an information system and an individual's perceived job satisfaction (.53), job skill (.59), and job originality (.59) is positive and very strong indicating that these factors are more important to an individual's acceptance of an information system.

The relationship between acceptance of an information system and job opportunity (.40) and job status (.28) is positive, but not as strong as the previous relationships. There is no appreciable relationship positive or negative (.06) between acceptance of an information system and perceived job salary. No possible explanation for this relationship could be found. The various interrelationships of the behavioral factors are all positive and generally they are quite strong. In fact the relationship between job satisfaction and job originality (.88) is extremely strong.

The composite

Upon examining the composite data (Column 6, Table II) one can observe that a very strong positive relationship exists between acceptance of an information system and the amount a manager was involved in its implementation and acceptance of an information system as it relates to each of the behavioral factors. It appears, however, that the data falls into two groupings:

- acceptance of the information system with job opportunity (.42), job salary (.35), and amount of involvement (.43).

Both of these groupings have a greater than .001 significance level but the first one ranges from .63 to .73 while the second one ranges from .35 to .43. This data implies that the key factors relating to acceptance of an information system are perceived job satisfaction, perceived job skill, perceived job originality, and perceived job status. What appears to be a significant finding is that involvement in the information system is not as important a factor as those above. Also, these composite findings, in general, support the findings of each organization.

In addition, the correlational data presenting the interrelationships of the various behavioral factors are all positive, have a significance level of greater than .001 and with the exception of involvement, are very strong. The following relationships appear to be the strongest: job satisfaction with job originality (.87) and job satisfaction with job skill (.81).

CONCLUSION

Based upon the data analysis, the two propositions appear to be strongly supported. There is a definite positive relationship between a middle manager's acceptance of an information system and his participation in the analysis and design of that system. In addition there is a negative relationship between a manager's acceptance of an information system and the perceived threat of the system to such behavioral factors as job satisfaction, job skill, job opportunity, job originality, job status, and job salary. The data presented in Table II clearly indicates that a manager who accepts the information system generally was involved in its analysis, design, or implementation and does not feel threatened by the system. Another way to demonstrate this conclusion is in Figure 1. This figure shows the positive relationship that exists between acceptance and participation and the negative relationship that exists between acceptance and threat and participation and threat.

Based upon the data presented it appears that in order to implement a successful information system the needs of the users (middle managers) must be taken into consideration. This can best be accomplished by getting them involved in the implementation process. If they participate in the design of the MIS, they will be more likely to accept it and use it as an aid in the decision making process. This fact should be considered by all systems analysts when designing information systems.

REFERENCES