THE IMPACT OF INFORMATION TECHNOLOGY ADOPTION ON STATUS:

An Exchange Theory Analysis of Expert Systems Adoption

Introduction

Economic factors are promulgated as the primary decision variables in the evaluation and adoption of new technologies (e.g., Rosegger [1980])). However, this Chapter finds that status also apparently is a major concern in such decisions.

Exchange theory (Blau [1964 and 1974] and others) was used as the basis of the formulation of hypotheses in this study. In exchange theory an actor increases their status, with respect to a reference group, when they make productive contributions to the group. Status is seen as a means of recognition of contributions to the group. Effectively individuals accrue status "capital" as they contribute to the group. The adoption of information technology has the potential to provide a number of contributions to the firms and groups within firms. As a result, exchange theory can be a useful tool to investigate general issues of information technology adoption and the resulting impact on those organizations, as they relate to such issues as status.

SUMMARY OF RESULTS

The results of this empirical study indicate that status is associ-

ated with a number of expert system adoption variables. Status is found to be statistically significant in an analysis that includes independent variables such as the estimation of perceptions of manpower reductions, process improvements, and the success of expert systems, in general. Status also is found to be statistically significant in conjunction with the adoption of expert systems technology.

Status, associated with the adoption of expert systems is not found to be statistically significant with budgetary pressures. This suggests that economic measures are not the only important bases of analysis. Instead researchers and practitioners need to consider status and variables that impact status.

IMPORTANCE OF THE PROBLEM

The relationship between status and technology evaluation and adoption is an important issue for a number of reasons. First, most research on technology adoption is economic (e.g., Rosegger [1980]), and ignores such issues as status. This chapter argues that status may be a critical variable in the evaluation and adoption of a technology.

Second, previous research has only provided a limited investigation of the relationship between status and technology adoption. There has been virtually no investigation of the relationship between status and expert systems or other types of artificial intelligence.

Third, internal auditors employ expert systems to assist them in complex decision problems. Thus, understanding the status associated with the adoption of a technology by internal auditors may facilitate understanding other groups of expert system adopters.

Fourth, expert systems generally are designed to support decision making. Thus, understanding the relationship between status and adoption of expert systems can also help in understanding decision support systems and possibly other information technologies.

PLAN OF THIS CHAPTER

This chapter proceeds as follows. The next section analyzes the impact of adopting expert systems from the perspective of exchange theory and summarizes these arguments as hypotheses. The subsequent section discusses the development of the questionnaire and the choice of the respondents. The following section presents the questions used in the questionnaire and a discussion of the methods used to analyze the responses. The next section briefly discusses the findings. The final section provides a brief summary and some extensions.

EXCHANGE THEORY, STATUS AND ADOPTION OF EXPERT SYSTEMS

The hypotheses were generated from exchange theory (e.g., Blau [1964]). The hypotheses are grouped into five different categories, for purposes of presentation: Reference Group Variables; Budgetary Constraints; Benefits; Information Flow; and Adoption of Technology. For each of the resulting hypotheses, "status" refers to the increase in status capital by adopting the use of expert systems technology.

REFERENCE GROUPS

Reference group is one of the most important aspects of exchange theory. As noted by Blau [1967, p. 158], "People belong to many groups, and potentially to still others, which constitute reference groups with which they compare themselves." In the case of internal auditors concerned with the adoption of technology such as expert systems, the direct reference groups are likely to be EDP auditors (auditors specializing in technology and the audit of technology) and the firm as a whole.

As noted by Blau [1964, pp. 53-55] "agreeing with others is a way of making oneself attractive to them." Status is achieved by adopting the opinions of the reference group. As a result, we would expect that firmwide pressure to adopt expert systems would have a positive impact on status associated with internal auditors adopting expert systems technology. Thus, we have the following hypothesis:

Hypothesis 1 (H1) (Q14i and Q13) (Pressure). Status is positively related to the firmwide pressure to adopt the use of expert systems.

In addition, we would expect the direct reference group to have more influence if it is larger than if it is smaller.

> There are fundamental differences between the dynamics of power in a collective situation and the power of one individual over another. The weakness of the isolated subordinate limits the significance of his approval or disapproval of the superior. The agreement that emerges in a collectivity of subordinates concerning their judgment of the superior on the other hand has far-reaching implications for developments in the social structure. (Blau [1964, p. 23])

As a result, we would expect the status associated with the adoption of expert systems to be larger if the reference group is larger. As a result, we have the following hypothesis.

Hypothesis 2 (H2) (Q14i and Q3b) (Number of EDP). Status is positively related to the number of EDP auditors.

BUDGETARY CONSTRAINTS

An important issue is the relationship between the status that accrues with the use and/or adoption of a technology and the direct budgetary impact. Blau [1964, p. 132] suggests that "Status can be considered capital, which an individual can draw on to obtain benefits, which is expended in use and which can be expanded profitably by investing it ..." Since status is considered a source of capital, this would suggest that status functions under its own 'budgetary' constraints, and does not rely on a monetary budget. This leads to the following hypothesis.

Hypothesis 3 (H3) (Q14i and Q14a) (Budget). Status is not related to budgetary pressures.

BENEFITS

Blau [1964, p. 47], noted that "Men who make essential contributions to a group as a whole, or its members individually, have an undeniable claim to superior status." In the case of internal auditing, such contributions from expert systems could include manpower reductions (H4), improvement of the audit process (H5) or perceived success of expert systems (H6). As a result, we have the following hypothesis:

Hypothesis 4 (H4) (Q14i and Q14c) (Manpower). Status is positively related to the perception of the ability of expert systems to reduce manpower needs.

Hypothesis 5 (H5) (Q14i and Q14d) (Improvement). Status is positively related to the perception of the ability of expert systems to improve the audit process.

Hypothesis 6 (H6) (Q14i and Q14e) (Success). Status is positively related to the perceived success of expert systems.

INFORMATION FLOW

The information flows that bring the information of the technology to the potential adopter is a critical issue. With no information flow, there is no information relating to the benefits and thus, no information to build status associated with the technology. Two of the primary organizations that can bring information to the internal auditor department heads regarding different technologies are the Institute of Internal Auditors (IIA) and the EDP Auditors Association (EDPAA). This leads to the following hypothesis.

Hypothesis 7 (H7) (Q14i and Q14g) (Information Flow). Status is positively related to the perceived information flow on the use of the expert systems received from IIA and the EDPAA.

The extent to which information flow is operationalized into formats for use in evaluation of the technology is also critical to adoption. One measure of information operationalization at this time was the cost of expert system shells. Expert system shells are software that can be used to speed the expert system development process. At the time of this questionnaire, rule-based systems for internal auditing purposes had been built or were under construction, by a number of firms, using inexpensive shells that cost around $300.

In addition, as noted by Blau [1974, p. 212], "A man who commands services others cannot do without ... can attain power over them by making the satisfaction of their needs contingent on their compliance with his directives." Thus, if the adopter has knowledge that others do not have, such as the tools of technology, including expert systems, then that adopter may derive status. Thus, we have the following hypothesis:

Hypothesis 8 (H8) (Q14i and 14h) (Suitability). Status is positively related to the perception of being able to build expert systems for use in internal auditing using inexpensive expert system shells (e.g., $300).

ADOPTION OF TECHNOLOGY

Ultimately, social exchange theory would argue that the technology would be adopted if that adoption were to have a substantial impact on the status capital of the adopter. Thus, because of the benefits of the technology, we would expect the following hypothesis.

Hypothesis 9 (H9) (Q14i and Q5) (Adopt/Non Adopt). Status is positively related to whether expert systems are adopted.

Questionnaire Analysis

Only a portion of the questionnaire was devoted to the study of status associated with expert systems technology in internal auditing.

QUESTIONS

The questions used in the questionnaire are summarized below. (The complete survey is in the appendix.) Average response and standard deviation are included here at the end of the question. The term "Qi" refers to the ith question.

The following question required a response from (-1 None, 0 Some, +1 Extensive)

Q13 Is there a firmwide "pressure" to adopt the use of expert systems technologies into departments within your firm, including internal auditing (–.7/.49)?

The following question required an assessment of the number of EDP auditors. Subjects were required to "fill in the blank."

Q3a Please indicate the approximate number of employees in the EDP Audit Function (4.81/9.10).

The remainder of the questions required a choice of (–1 not true, 0, +1 true)

Q14a Budgetary pressures make it impossible to spend any resources on expert systems in internal auditing (–.22/.69).

Q14c Expert systems offer advantages in terms of reducing manpower needs over current manual methods (–.02/.61).

Q14d There is substantial uncertainty that expert systems can improve the audit process (–.15/.7).

Q14e Expert Systems developed to date have had very good success (–.12/.54).

Q14g There has been substantial flow of information from organizations, such as the IIA and the EDPAA regarding the use of expert systems in accounting and auditing (–.48/.63).

Q14h Suitable expert systems can be built for use in internal auditing using inexpensive (e.g., $300) expert system shells (–.067/.63).

Q5 To what extent are you employing expert systems technology as part of the internal audit function? (0 None, 1 Low, 2 Moderate, 3 High). (.4/.66). (Response of 1, 2, and 3 were aggregated together since it was assumed that a firm either adopted or did not adopt expert systems technology.)

Q14i Expert systems in internal audit improve the status of internal auditors. (.02/.69)

ANALYSIS OF RESULTS

The approach was to use a model designed to study the relationship between the status variable and the variables associated with the responses for each of the questions 1 through 9. A log linear model was used to investigate the resulting frequency tables using BMDP (Dixon et al. [1981]). The frequency tables, by percentage in groups, are summarized in the appendix.

The quality of the model was measured using the Pearson ratio chi-square test. The Pearson correlation coefficient for the model was used for determination of direction, and its t-value was used to measure its significance.

Results

The results substantiate each of the hypotheses developed above. The results are summarized in tables 7-1 and 7-2.

The status variable analyzed results from question Q14i. The other variables that were analyzed were the categorical responses to the other questions. The results generated by the log linear model were used to substantiate the hypotheses.

Those results include the following. First, both the reference group responses (firmwide pressure and number of EDP auditors) were found to be positively and significantly related to the status variable.

Second, the budget variable was found to be unrelated to the status variable. It appears that the status and budget variables are unrelated in this data set.

Third, the benefits of expert systems were related to the status variable. Both the specific reduction of manpower and the general success of expert systems were also found to be strongly related to the status variable. Further, the existence of uncertainty of improvement using the technology was found to be negatively related to the status variable.

Each of the information flow variables also was related to the status variable. Finally, the adoption of the technology also was strongly related to the status variable.

Table 7-1

LOG LINEAR MODEL OF EXPERT SYSTEM ADOPTION AND STATUS

Variable	Correlation Coefficient	t-value	Significance
Reference Group Variables			
H1-Number of EDP	0.103	2.431	.01
H2-Pressure	0.161	3.396	.001
Monetary Reference			
H3-Budget	0.019	0.378	***
Benefits			
H4-Manpower	0.247	4.737	.0001
H5-Improvement Uncertainty	–0.234	–4.514	.0001
H6-Success	0.177	3.384	.001
Information Flow			
H7-Information Flow	0.196	3.838	.001
H8-Suitability	0.189	3.374	.001
Adoption of Technology			
H9-Adopt/Non Adopt	0.121	2.456	.01

*** Greater than .1

Summary and Extensions

This chapter has investigated the relationship between status and adoption of an information technology. In particular, the chapter studied adoption of expert systems by internal auditors.

Status plays an important role in the "exchange theory" investigation of human behaviors. In exchange theory an actor increases their status, with respect to a reference group, when they make contributions to the group. Status is seen as a means of recognition of contributions to the group. Information technology can provide a number of contributions to the firms and groups within firms. As a result,

Table 7-2

LOG LINEAR MODEL OF EXPERT SYSTEM ADOPTION AND STATUS*

Variable	Pearson Chi-Square	Significance/Degree of Freedom
Reference Group Variables		
H1-Number of EDP	8.826	.07 / 4
H2-Pressure	13.59	.01 / 4
Monetary Reference		
H3-Budget	0.570	.97 / 4
Benefits		
H4-Manpower	39.126	.00 / 4
H5-Improvement	29.951	.00 / 4
H6-Success	18.815	.01 / 4
Information Flow		
H7-Information Flow	18.243	.00 / 4
H8-Suitability	38.415	.00 / 4
Adoption of Technology		
H9-Adopt/Non Adopt	5.959	.05 / 2

* See Dixon et al. [1981] for detail on this approach.

exchange theory was used as the basis of the generation of the hypotheses and questionnaire questions.

The resulting questionnaire was sent to over 3000 internal department heads. A response rate of about 30% was obtained in the single mailing of questionnaires.

The results were consistent with the exchange theory-based hypotheses. The number of EDP auditors, the existence of firmwide pressure, benefits of manpower reduction, and the success of expert systems (in general) were all positively related to the status of internal auditors resulting from the adoption of expert systems. Budgetary pressures were not found to be related to the status associated with

the adoption of expert systems. The existence of uncertainty in improvement resulting from the use of expert systems was negatively related to the status associated with the adoption of expert systems. Finally, status and adoption of the technology were strongly related.

The approach in this chapter could be generalized to other groups and other information or artificial intelligence technologies. In particular, the more general hypothesis, that the adoption of information technologies is done to improve status could be studied using other technologies, in other environments.

Appendix
Frequency Table Percentages

This appendix presents the frequency tables (in percentage form), analyzed using the log linear model presented in BMDP (Dixon et al. [1981]). In each case "status" (-1, 0, +1) is one of the two variables.

Status vs. Pressure

Scale	–1	0	1	Total
–1	19.5	36.2	15.3	70.9
0	3.2	15.5	9.1	27.8
+1	0.2	0.7	0.2	1.2
Total	22.9	52.5	24.6	100.0

Status vs. Number of EDP Auditors

Scale	–1	0	1	Total
Under 10	21.9	45.1	21.7	88.7
10 to 25	1.0	5.2	1.5	7.6
Over 25	0.0	2.2	1.5	3.7
Total	22.9	52.5	24.61	00.0

Status vs. Budget

Scale	–1	0	1	Total
–1	9.1	19.0	9.4	37.4
0	10.8	25.4	11.6	47.8
+1	3.0	8.1	3.7	14.8
Total	22.9	52.5	24.6	100.0

Status vs. Manpower

Scale	–1	0	1	Total
–1	6.4	9.4	3.7	19.5
0	15.0	36.0	11.8	62.8
+1	1.5	7.1	9.1	17.7
Total	22.9	52.5	24.6	100.0

Status vs. Uncertainty of Improvement

Scale	–1	0	1	Total
–1	5.2	15.8	12.3	33.3
0	10.3	28.8	9.44	8.5
+1	7.4	7.9	3.0	18.2
Total	22.9	52.5	24.6	100.0

Status vs. Uncertainty of Improvement

Scale	−1	0	1	Total
−1	5.2	15.8	12.3	33.3
0	10.3	28.8	9.4	48.5
+1	7.4	7.9	3.0	18.2
Total	22.9	52.5	24.6	100.0

Status vs. Success

Scale	−1	0	1	Total
−1	6.7	11.6	3.4	21.7
0	14.8	37.7	16.5	69.0
+1	1.5	3.2	4.7	9.4
Total	22.9	52.5	24.6	100.0

Status vs. Information Flow

Scale	−1	0	1	Total
−1	15.3	30.5	10.1	55.9
0	6.7	19.2	11.1	36.9
+1	1.0	2.7	3.4	7.1
Total	22.9	52.5	24.6	100.0

Status vs. Suitability

Scale	−1	0	1	Total
−1	8.6	10.6	4.4	23.6
0	10.3	36.7	12.3	59.2
+1	3.9	5.2	7.9	17.0
Total	22.9	52.5	24.6	100.0

Status vs. Adoption

Scale	−1	0	1	Total
Nonadopt	17.5	36	14.8	68.2
Adopt	5.4	16.5	9.9	31.8
Total	22.9	52.5	24.6	100.0

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