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Organizational Coordination and Performance in Hospital Accounting Information Systems: An Empirical Investigation

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ABSTRACT: This paper describes a field study of 28 hospital accounting information systems (HAIS) development groups designed to address the issue of "fit" between organizational context and the effective design of management accounting systems (MAS). Hypotheses are developed for studying the interaction effects of contextual and MAS design variables on performance. The findings indicate that the match between HAIS task predictability and coordination modes is significantly associated with good performance as measured by user information satisfaction.

THE issue of "fit" between organizational context and the effective design of management accounting systems (MAS) has been of interest to many scholars [Bruns and Waterhouse, 1975; Chenhall and Morris, 1986; Gordon and Miller, 1976; Merchant, 1981; Otley, 1980; and Waterhouse and Tiessen, 1978], but the results to date have been difficult to integrate and often conflicting.

Since there is an increasing emphasis in research on contingency theory and organizational performance [Daft and MacIntosh, 1981; Fry, 1982; and Otley, 1980], several studies have included performance in their research design [Argote, 1982; Chenhall and Morris, 1986; Fry and Slocum, 1984; Hayes, 1977; and Schoonhoven, 1981]. However, the weakness common to the studies using organizational performance as a dependent variable is a lack of control over confounding variables that may have affected performance. Confounding variables may not be included in research designs because of the difficulties in identifying and measuring those variables. However, without neutralizing the effects of as many of the rival hypotheses as possible, it is hard to determine how changes in the MAS design

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variables cause variations in performance.

Another problem with the existing literature involves the various levels of analysis used [Alexander and Randolph, 1985; Fry, 1982; Fry and Slocum, 1984; and Merchant, 1981]. Studies of organizational context and structure have been conducted at the organization, subunit, and individual levels, with no attempt to control for the possible effects of variation in levels [Fry, 1982]. Matching the level of analysis in these studies is critical for identifying appropriate contingent factors for the MAS design variable [Pfeffer, 1982]. For example, Merchant [1981] criticized previous studies on budgeting behavior for lower levels of analysis (individual level), when he studied budgeting in the corporate context. This limitation has led to conflicting results and an inability to interpret results across studies. This paper reports the findings of an empirical study directed at examining these specific shortcomings.

This study has three primary purposes. First, it attempts to extend existing work on contingency theory by examining whether the match between technology and coordination modes of hospital accounting information systems (HAIS) development groups leads to higher performance, when the effects of confounding variables are controlled. Second, the study examines the contingency relation at the work group level (i.e., HAIS development group), at which decisions regarding changes in technology are made [Fry and Slocum, 1984; Pfeffer, 1982; and Van de Ven, Delbecq, and Koenig, 1976]. Third, it considers multiple contingencies, three technology dimensions and work group size, to investigate which of the various elements of contextual factors is important for the effective design of HAIS group coordination modes.

Independent Variables

Technology

Organizational contextual variables, thought to be critical for the functioning of organizations, include environmental uncertainty [Lawrence and Lorsch, 1969; Duncan, 1972], organizational size [Child, 1975; Galbraith, 1973], and technology [Perrow, 1967; Thompson, 1967; and Woodward, 1965].

In small departments, technology has been found to have a significant effect on organizational structure because personnel in small departments are located close to the technical activities of that unit [Hrebiniak, 1974; Van de Ven et al., 1976; and Kmetz, 1977/1978]. Pfeffer [1982] provides the theoretical underpinnings of the technology-structure relation:

> . . . technology . . . affects the skills and discretion of the work force and, thus, the control that must be employed; different structural arrangements . . . imply different types of control structures and procedures; and, therefore, technology is linked to structure through its requirements for procedures to control work. . . . [pp. 152–154]

Various authors have posited a variety of technology typologies, but three dimensions are basic to all, and they depict what is meant by "the technology construct" [Fry and Slocum, 1984]. These dimensions are task predictability, problem analyzability, and task interdependence.

Task predictability, also called "task variety," denotes the number of exceptions in the work, or the frequency of unexpected and novel events that occur in the conversion process [Perrow, 1970]. *Problem analyzability* denotes the degree to which one can analyze the unexpected events [Perrow, 1970]. Objective or computational procedures usually are followed to resolve analyzable exceptions. For unanalyzable exceptions, individuals may have to spend time thinking about what to do, relying on accumulated experience, intuition, and judgment. *Task interdependence* denotes the extent to which unit personnel depend upon one another to perform their individual jobs [Thompson, 1967]. Task interdependence can be further categorized as pooled, sequential, reciprocal, or team.

Coordination Modes

Coordination involves integrating the various organizational activities to achieve organizational objectives. Coordination is needed due to the interdependent nature of the activities that organization members perform. Coordination can be achieved through a variety of means (e.g., administrative vs. interpersonal), and several typologies of coordination methods have been advanced [Bruns and Waterhouse, 1975; Merchant, 1981; Thompson, 1967; and Van de Ven et al., 1976]. The one that is used in this study is the categorization of coordination modes into either impersonal or personal, as proposed by Van de Ven et al. [1976]. They assert that the basic distinction between impersonal and personal coordination is that with the personal mode human input is required to make task adjustments. In impersonal coordination, various organizational activities are integrated by using preestablished plans, schedules, formalized rules, and policies and procedures, which do not require human input. Impersonal coordination modes are discussed in the literature with many different labels, including "administrative control" [Bruns and Waterhouse, 1975; Merchant, 1981], "formal controls" [Child, 1975], and "output controls" [Ouchi, 1977]. In personal coordination, human input may take the form of individual intervention or group meetings. An individual or a group serves as the mechanism for making mutual task adjustments through vertical or horizontal channels of communication or through committee meetings.

Dependent Variable: HAIS Effectiveness

Measuring the effectiveness of information systems (IS) is a perplexing issue that has generated much debate and subsequent research over the years. Although ideally one would like to evaluate the IS effectiveness based on its degree of support for decision making and its resultant productivity benefits, measurement is a difficult task because of the difficulties of tracing and measuring the intermediate effects of MAS. Thus, information systems researchers have developed surrogate measures for IS effectiveness. Examples of these surrogate measures include user information satisfaction [Ives, Olson, and Baroudi, 1983; Jenkins and Ricketts, 1979], system usage [Mann and Watson, 1984; Srinivasan, 1985], and information value [Gallagher, 1974].

User information satisfaction (UIS), measuring users' satisfaction with information quality, is generally recognized as one of the most important indicators of IS effectiveness [Ives et al., 1983; Srinivasan, 1985; Swanson, 1974; and Zmud, 1979]. UIS measures satisfaction of organization members who actually use the IS output to meet their organizational responsibilities. An underlying reasoning of measuring UIS as a surrogate for IS effectiveness is that a direct relation between information quality and individual decision making performance is believed to exist. In general, there is some empirical support for this relation [Porat and Haas, 1969; Streufert, 1973]. Also, a direct link has been identified between organizational goal achievement and the quality of individual decision making [Huber, 1980]. Therefore, users' satisfaction with information quality, a major output of IS, is considered to be a meaningful surrogate for IS effectiveness and is used in this study.

Hypotheses

Building upon an understanding of technology and coordination modes, we can explore the best "matches" between these two variables in terms of HAIS development group performance. When the structural contingency theory asserts that there is a relation between technology and structure which predicts a third variable (performance), it is stating that an *interaction* exists between technology and structure [Arnold, 1982; Schoonhoven, 1981]. Thus, a series of interaction hypotheses are developed between individual technology and coordination modes.

Task Predictability

As the frequency of unexpected events increases, it becomes increasingly difficult for an HAIS development group to specify rules, policies, and procedures in advance. If there are few exceptions, system development personnel can learn and apply the prespecified plan of action for each exception. Alternatively, when a less frequently observed event arises, the programmer can consult with a senior systems analyst to determine the appropriate prespecified response. As the number of unexpected events increases, however, there are more situations in which reliance on standardized procedures is inappropriate and less effective. In the extreme case, a high level of uncertainty may require that mutual adjustments be accomplished by group judgments [Van de Ven and Delbecq, 1974]. Accordingly, the following hypotheses are proposed:

H1: Impersonal means of coordination will make a greater contribution to UIS under conditions of high task predictability than under conditions of low task predictability.

H2: Personal means of coordination will make a greater contribution to UIS under conditions of low task predictability than under conditions of high task predictability.

Problem Analyzability

If problems encountered are analyzable, most of the task activities can be standardized and programmed [Litwak, 1961; Perrow, 1970; and Hall, 1972]. However, if problems are not well understood, then during the process of task execution learning takes place, which leads to changes in role allocation, schedules, and priorities [Galbraith, 1973; Perrow, 1967]. Thus, it becomes increasingly difficult to specify rules and procedures to be followed in advance as problem analyzability decreases. Instead, personal means of coordination, which involve on-the-spot sharing of information among system development personnel, are an effective way of dealing with unanalyzable problems. Hence the following hypotheses:

H3: Impersonal means of coordination will make a greater contribution to UIS under conditions of high problem analyzability than under conditions of low problem analyzability.

H4: Personal means of coordination will make a greater contribution to UIS under conditions of low problem analyzability than under conditions of high problem analyzability.

Task Interdependence

The coordination mechanism also varies depending on the level of task interdependence; pooled, sequential, reciprocal, or team. At the pooled level, the little coordination that is necessary when problems arise can be efficiently handled by categorization of problems. At the sequential level, a high degree of mechanization can be utilized to help the coordination process proceed according to plan. However, as task interdependence increases to reciprocal and team levels, it becomes increasingly difficult for an HAIS to specify in advance the behaviors to be followed by organizational members. Personal contact between unit members and group modes will be necessary to make mutual adjustments. The above discussion leads to the following hypotheses:

H5: Impersonal means of coordination will make a greater contribution to UIS under conditions of low task interdependence than under conditions of high task interdependence.

H6: Personal means of coordination will make a greater contribution to UIS under conditions of high task interdependence than under conditions of low task interdependence.

Group Size and Coordination

In addition to technology, the size of the group, defined as the total number of persons employed in a work unit, has been found to be a factor confounding the effect of coordination mode on work unit performance [Hare, 1962; Van de Ven, 1975; Van de Ven et al., 1976]. In general, the growth in group size increases structural differentiation, and subsequently produces a trade-off between high complexity and low coordination burden within work units because activities within a group tend to become more homogeneous [Van de Ven et al., 1976]. To summarize the previous research findings about the relation between group size and coordination modes, as size increases: (1) more mechanical methods are used to control the behaviors of participants in reaching a solution [Hare, 1962]; (2) face-to-face techniques of leadership behavior give way to more impersonal techniques of coordination [Van de Ven, 1975]; (3) group size appears to have an impersonalizing effect on coordination [Van de Ven et al., 1976]. These research findings suggest the following hypothesis:

H7: The impersonal mode of coordination will make a greater contribution to UIS when the group size is larger than when the group size is smaller.

Confounding Variables

In order to identify the confounding variables that may affect HAIS performance, reference is made to the IS research framework provided by Ives et al. [1980]. The confounding variables examined in this study, as well as their operational measures, appear in Table 1.

IS Environment

The Ives et al. [1980] framework describes IS in terms of its interfaces with an external environment, the organizational environment, and three information system environments (user, development, and operations). The effect of the external environment was held constant by selecting a specific type of organization: not-for-profit hospitals.

TABLE 1
CONFOUNDING VARIABLES[a]

	Threats	How Controlled
Environmental Factors	External	Control over the industry effect since organizations in the same industry are usually exposed to the similar environmental demands
	Organizational	Organizational rank (RANK)[b] of IS director and group size (SIZE)
	User	Matching the management level of primary users
	Development	User involvement (UINV) in IS development and evaluation
	Operations	Top management support (TOP) and coordination modes (independent variables)
Technical Quality of HAIS		Classify the HAIS into six different stages, using Nolan's stage hypotheses (STAGE1-STAGE6):
	IS Content	Data Base Management Systems and data communications
	Timing of presentation	On-line vs. Batch systems

[a] Adapted from Ives, Hamilton, and Davis [1980].
[b] Abbreviations in parentheses are variable names used in statistical analyses.

Regarding organizational environment, the organizational rank (RANK) of the responsible IS executive was selected since empirical research findings clearly support the relations between the rank and IS success [Ein-Dor and Segev, 1982; Olson and Chervany, 1980; and Hammond, 1974]. Ein-Dor and Segev [1978] summarized the previous research findings as follows:

> . . . the likelihood of MIS success declines rapidly the lower the rank of the executive to whom the MIS chief reports, and is virtually negligible more than two levels below the chief officer of the particular organization which the MIS serves. [p. 1074]

The user environment is the environment surrounding and including primary users. Primary users consist of decision makers who use the IS outputs for their decisions. Gorry and Scott Morton [1971] argue that the attributes of required information (e.g., accuracy) vary depending on Anthony's [1965] levels of managerial activity and Simon's [1960] relative degree of structure in the decisions being made. Thus, it may be important to account for differences in information requirements among users.

Regarding primary users of hospital information systems (HIS), Ball and Boyle [1980] concluded in their survey of HIS that the HIS currently emphasizes business-oriented applications:

> In general, they transmit orders, capture a day's charges, prepare the census . . . and frequently allow inquiry into patient financial records on the accounting computer. . . . [p. 16]

Their study indicated that the primary users of HAIS were administrative personnel, and the typical hospital business office accommodated these personnel. Thus, the business office manager was selected as an appropriate user for the HAIS performance evaluation and, thus, different information needs were mitigated.

Concerning the IS development environment, user involvement (UINV) in the development process has been identified as a critical factor to IS success. Based on an extensive literature review, Ives and Olson [1984] summarized that user involvement in IS development improves the chance of IS success by providing a more accurate user information needs, by improving user understanding of the system, by leading to system ownership by users, and by committing users to the system. Thus, user involvement is incorporated.

Concerning the information system operations environment, top management support (TOP) for IS has been identified as a critical factor for IS effectiveness [Maish, 1979; Martin, 1983; and Swanson, 1974].

Technical Quality of HAIS

Ives et al. [1980] also suggest that technical quality of an information system is an important factor for IS effectiveness. Technical quality of an IS can be described in terms of its content (data and decision model) and its time dimension (processing delay and on-line versus off-line).

The model used here for measuring technical quality of an IS was developed by Nolan [1979]. In his descriptive "stage model" of computing evolution in organizations, Nolan developed a "technology benchmark test" to evaluate the technical quality of an IS. The test incorporates IS content, a dimension of technical quality, measuring the usage of data base management systems and data communications. To incorporate timing of presentation, the test measures the usage of on-line versus batch processing. Based on the technology benchmark test, an HAIS is classified into one of the six different stages in Nolan's model, ranging from STAGE1 (the least sophisticated) to STAGE6 (the most sophisticated).

In summary, the confounding variables included in the research design are: organizational rank of HAIS director (RANK), top management support (TOP), user involvement (UINV), and technical quality of HAIS (STAGE1 through STAGE6).

Research Method

Using questionnaires, a field survey of HAIS development groups was conducted. The HAIS development function includes the analysis, design, and programming of new applications, and the maintenance of existing applications. Application areas include various administrative tasks such as diagnostic related groups (DRGs), general ledger, accounts payable, payroll, admissions and discharges, materials management, and patient billing.

The Sample

Questionnaires were sent to 91 hospitals that were members of a private national association of HIS.[1] The research objectives required that, in each hospital, the information come from both the HAIS group and HAIS users. Business office managers were chosen to receive the user questionnaire based on the work of Ball and Boyle [1980]. To

[1] One important characteristic of the member hospitals was that most hospitals were using in-house developed HIS as opposed to vendor-provided software packages.

help ensure a fair evaluation of HAIS performance, the business office managers were contacted independently of the HAIS directors.[2]

HAIS directors were asked to complete the questionnaire concerning the confounding variables. HAIS directors were also asked to select randomly five system development personnel and to distribute an HAIS Employee Questionnaire to each of them. HAIS development personnel were asked to complete the questionnaire regarding both their task characteristics and the coordination modes within the HAIS department. The completed questionnaires were directly mailed to the researcher.

Of the 91 hospitals originally contacted, usable responses were received from 28 hospitals for a response rate of 31 percent.[3] Thus, those 28 hospitals comprised the final research sample. To assess nonresponse bias, differences in *UIS* between the hospitals in which the data were collected from *both* groups and the hospitals in which *only the business office manager* responded were tested. There were no significant differences. Hospital size, measured by the number of patient beds, ranged from medium to large: 11 hospitals between 150 and 400 beds, ten between 500 and 850 beds, and seven over 1,000 beds. There were no statistically significant differences in *UIS* among these groups.

Measures

Operationalizations of the dependent and independent variables are summarized in Table 2.

User information satisfaction (UIS) was used to measure HAIS performance. Among many UIS measures, the Jenkins and Ricketts [1979] measure was adapted to measure users' satisfaction with information quality. Seven information attributes of information quality are accuracy, amount of information, format, understandability, usefulness for identifying and resolving problems, and usefulness for selecting among alternative courses of action. Users were asked to circle a number between one and seven that indicated their degree of agreement with each item as a description of each information attribute. The responses to the questions were averaged to achieve an overall HAIS performance score. The Cronbach alpha coefficient was .87.

Technology and coordination modes of HAIS development group were measured on semantic differential scales that indicated HAIS employees' degree of agreement on a description of the work done in their unit and of the work group coordination modes, respectively. The respondents' scores were averaged to obtain organizational scores.

With respect to technology, the two questionnaire scales developed by

[2] One concern about the independent evaluation, raised by an anonymous reviewer, was that the business office manager could be the immediate supervisor of the HIS director. The direct data about this matter were not collected when the study was conducted. However, indirect data, i.e., organizational rank of HAIS director, were collected. In 23 hospitals out of 28 in the sample, the HAIS director was ranked one or two levels below the CEO. For these hospitals, it is assumed that the business office manager may not be the immediate supervisor of the HAIS director. For the five hospitals where the HAIS director was ranked three or more levels below the CEO, the HAIS director was contacted to find out the hierarchical relation with the business office manager. *No HAIS director* was under the supervision of the business office manager.

[3] The response rates were:

	HAIS Department		
	Response	*Nonresponse*	*Total*
Business Office			
Response	28* (31%)	33 (36%)	61 (67%)
Nonresponse	12 (13%)	18 (20%)	30 (33%)
Total	40 (44%)	51 (56%)	91 (100%)

* Number of hospitals

TABLE 2
OPERATIONALIZATION OF THE VARIABLES

	Dependent Variable	*Independent Variables*
Theoretical Construct	HAIS development group performance	Match between coordination and organizational context such as technology and group size
Operational Definitions	Constituent satisfaction with information quality [User Information Satisfaction[a] (UIS)[b]]	Coordination includes personal (PER) and impersonal (IMPER) coordination modes.[c] Technology includes predictability (PRED), analyzability (ANAL), and interdependence (INTER) of HAIS tasks.[d] Group size (SIZE) is defined as the total number employed in the work unit.
Operational Measures	Seven information attributes measured are (1) accuracy, (2) format, (3) understandability, (4) amount of information, (5) usefulness for identifying and (6) resolving problems, and (7) usefulness for selecting among alternative courses of action.	Task characteristics and coordination modes of HAIS development group are measured on semantic differential scales that indicate HAIS employees' degree of agreement on a description of the work done in their unit and of the group coordination modes, respectively.

[a] Adapted from Jenkins and Ricketts [1979].
[b] Abbreviations in parentheses are variable names used in statistical analyses.
[c] Adapted from Van de Ven et al. [1976].
[d] Adapted from Perrow [1970].

Withey et al. [1983], using a seven-point scale ranging from strongly disagree to strongly agree, were used to measure task predictability (PRED) and problem analyzability (ANAL). The alpha coefficient was .88 for the task predictability and .87 for the problem analyzability. For task interdependence (INTER), the question developed by Mohr [1971] was used. HAIS employees circled a number from one to ten in response to the question. Coordination modes were measured with the questions Van de Ven et al. developed in 1976. Employees were asked to circle a number between one and seven that indicated their degree of agreement with each item as a description of group coordination modes. The alpha coefficient was .74 for the impersonal coordination modes (IMPER) and .83 for the personal coordination modes (PER).

HAIS development group size (SIZE) was measured as the total number employed in the work unit.

RESULTS

Zero-order Correlation Among Variables

Table 3 presents descriptive statistics for the independent and dependent variables, including the zero-order correlations.

As Table 3 shows, the impersonal mode of coordination was highly correlated with task predictability and problem analyzability. That is, as task predictability and problem analyzability increased, the use of such impersonal

TABLE 3
PRODUCT-MOMENT CORRELATIONS AMONG VARIABLES

	Mean	Standard Deviation	Cronbach's Alpha	Variable Number 1	2	3	4	5	6
Performance									
1. User Information Satisfaction (UIS)	5.03	.91	.87						
Technology									
2. Predictability (PRED)	3.22	.77	.88	.31					
3. Analyzability (ANAL)	4.06	.79	.87	.30	.42*				
4. Interdependence (INTER)	3.00	.86	N/A	.33	.18	.20			
Group Size									
5. (SIZE)	14.65	11.45	N/A	−.09	.45*	.06	.22		
Coordination									
6. Impersonal (IMPER)	5.02	.78	.74	.35	.53**	.67**	.21	.15	
7. Personal (PER)	4.57	.65	.83	.36	.37	.28	.00	.19	.58**

$N=28$ Hospitals
* $p<.05$
** $p<.01$

TABLE 4
REGRESSION ANALYSES OF COORDINATION MODES ON TECHNOLOGY AND GROUP SIZE

Contingent Variable	Coordination Modes: Impersonal (IMPER) β	F-statistic	Probability	Personal (PER) β	F-statistic	Probability
Technology						
Predictability (PRED)	.479	9.89	.004	−.418	8.52	.007
Analyzability (ANAL)	.676	21.05	.000	.225	1.54	.225
Interdependence (INTER)	−.214	1.22	.279	.137	.57	.455
Group Size						
Group Size (SIZE)	2.223	.61	.441		N/A	

coordination means as formalized rules, schedules, and pre-established plans increased. Group size correlated highly with task predictability.

Hypotheses Testing

The hypotheses were tested using a deviation-score approach [Dewar and Werbel, 1979; Fry and Slocum, 1984]. Proponents of this approach have analyzed the impact of deviations in structure from an ideal context-structure model, in which congruency is defined as adherence to a linear relation between dimensions of context and structure [Drazin and Van de Ven, 1985]. Also, multicollinearity is less of a problem in this approach than in the standard multiple regression procedure using multiplicative interaction terms.[4]

It has been pointed out that in order to statistically test the significance of an interaction term, lower order main effects must be removed from any higher order interaction effects [Cohen, 1978]. Thus, a regression model was developed for each hypothesis; each regression includes the confounding variables discussed earlier and all the lower order terms plus the deviation score.

A three-step procedure was followed for the deviation-score test.

1. Deviation scores were constructed by regressing each coordination mode ($X1$) on each task characteristic and group size ($X2$). For example:

$$X2 = a + b^{*}X1 + e$$

2. Residuals were calculated from the best-fitting least-square lines. The absolute values of these residuals were used as deviation scores (low

[4] With standard multiple regression model using multiplicative interaction terms that combines elements of independent variables in the model, the possibility of multicollinearity exists [Blalock, 1979]. Regression coefficients are unreliable [Neter and Wasserman, 1974] and a depressed regression coefficient could lead to a rejection of the interaction model [Althauser, 1971]. This was the case in this study. For example, the correlation between SIZE and IMPER*SIZE was .975 and the correlation between ANAL and ANAL*IMPER was .936. Thus, testing the statistical significance of the regression coefficient of the interaction term is inappropriate.

TABLE 5
MULTIPLE REGRESSION RESULTS FOR H1 AND H2 CONCERNING TASK PREDICTABILITY (PRED)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (1): H1		*Model (2): H2*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.44*	.30	−.49**	.29
2. PRED	−.13	.22	−.04	.23
3. IMPER	.48**	.19		
4. PER			.33*	.18
5. TOP	.17*	.08	.14	.08
6. UINV	.09	.11	.06	.11
7. RANK	−.63***	.15	−.59***	.15
8. STAGE2	.04	.39	.28	.40
9. STAGE3	.45	.45	.37	.47
10. STAGE4	−.18	.40	−.26	.42
11. STAGE5	−.27	.39	−.25	.41
R^2	.70		.67	
Adjusted R^2	.53		.48	
F-statistic (model)	4.03***		3.52**	
$P(F)$	.005		.011	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1.
[2] Absolute values of technology-coordination regression residuals

scores, good fit; high scores, poor fit). For example:

$$\hat{X}2 = a + b^*X1$$
$$\text{Misfit} = |X2 - \hat{X}2|$$

3. The negative regression coefficient for the deviation score (i.e., the greater the deviation, the lower the performance), reflects its contribution to a regression equation on HAIS performance.[5] For example:

$$UIS = a + b1^*|X2-\hat{X}2| + b2^*X1 + b3^*X2 + b4^*TOP + b5^*UNIV + b6^*RANK + b7^*STAGE2 + b8^*STAGE3 + b9^*STAGE4 + b10^*STAGE5 + e$$

One-tailed tests were used since all of the hypotheses specified the direction of the expected relations. Regression analyses of coordination modes on the contingent variables (technology and group size) are presented in Table 4.

The regression results of testing the interaction hypothesis between task predictability and impersonal coordination modes (H1) appear in Table 5. As hypothesized, the regression results indicated that the coefficient of the residual was significantly different from zero ($t = -1.46$, $p < .10$). The negative sign of the coefficient indicates that the greater

[5] STAGE1 was not included in regression equations because no one hospital in the sample belonged to this category.

TABLE 6
MULTIPLE REGRESSION RESULTS FOR H3 AND H4 CONCERNING PROBLEM ANALYZABILITY (ANAL)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (3): H3		*Model (4): H4*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.50	.44	−.17	.32
2. ANAL	−.13	.25	.21	.17
3. IMPER	.51*	.26		
4. PER			.25	.17
5. TOP	.16*	.08	.19*	.09
6. UINV	.08	.10	.08	.11
7. RANK	−59***	.17	−.52***	.17
8. STAGE2	−.17	.43	.13	.40
9. STAGE3	.10	.46	.26	.45
10. STAGE4	−.20	.41	−.15	.43
11. STAGE5	−.34	.41	−.26	.42
R^2	.69		.66	
Adjusted R^2	.51		.46	
F-statistic (model)	3.75***		3.28**	
$P(F)$	.008		.015	

N=28
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1.
[2] Absolute values of technology-coordination regression residuals

the deviation, the lower the performance. Thus, the congruency between task predictability and impersonal mode of coordination was significantly associated with performance of the system development group in the hypothesized direction.

Results for the interaction hypothesis between task predictability and personal coordination modes (H2) also appear in Table 5. Results indicated that the coefficient of the residual was significantly different from zero ($t=-1.84$, $p<.05$), as hypothesized. Thus, the congruency between task predictability and personal mode of coordination significantly influenced the performance of the system development function in the hypothesized direction when confounding variables are controlled.

In order to test the interaction effects between other contextual factors (ANAL, INTER, and SIZE) and the two coordination modes (IMPER and PER), H3 through H7, five regressions were estimated using UIS as the dependent variable. Contrary to expectations, no significant interaction effects were observed. Thus, H3 through H7 were not supported. Results are presented in Tables 6, 7, and 8.

DISCUSSION

The results suggest that the congruency between task predictability and coordination modes of HAIS develop-

TABLE 7
MULTIPLE REGRESSION RESULTS FOR H5 AND H6 CONCERNING TASK INTERDEPENDENCE (INTER)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Impersonal Coordination		*Personal Coordination*	
	Model (5): H5		*Model (6): H6*	
Independent Variables[1]	B-*Value*	*Standard Error*	B-*Value*	*Standard Error*
1. Misfit[2]	−.27	.42	−.40	.34
2. INTER	−.15	.21	.02	.21
3. IMPER	.43**	.18		
4. PER			.33*	.16
5. TOP	.18*	.09	.12	.09
6. UINV	.08	.10	.07	.11
7. RANK	−.61***	.16	−.56***	.12
8. STAGE2	−.18	.43	.02	.43
9. STAGE3	.17	.45	.36	.46
10. STAGE4	−.20	.47	.01	.48
11. STAGE5	−.34	.42	−.27	.43
R^2	.68		.66	
Adjusted R^2	.49		.46	
F-statistic (model)	3.65***		3.30**	
$P(F)$	.009		.014	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1
[2] Absolute values of technology-coordination regression residuals

ment group significantly affected HAIS user information satisfaction. This implies that the appropriateness of various coordination modes depends on task predictability. When HAIS development tasks are predictable, the use of impersonal means of coordination, such as rules, plans, and policies, is most appropriate. These coordination methods are both less expensive than personal coordination methods and appear to be more associated with constituent satisfaction. Also, the use of personal means of coordination appears to be appropriate in HAIS development groups experiencing low task predictability.

Contrary to expectations, the congruency between various coordination modes and such contextual factors as problem analyzability and task interdependence were not significantly associated with UIS. One possible explanation is that the data may not have enough variation to test these interaction hypotheses. Considering the lengthy history of HAIS, one would expect to find most of them at the "maintenance" stage in the system development life cycle. In the maintenance stage, projects may be simple enough to allow one person to handle identification of errors and proposed enhancements, analysis, performing changes, and testing, and, thus, only require low level of task interdependence. Also, as an HAIS accumulates experience with the system, un-

TABLE 8
MULTIPLE REGRESSION RESULTS FOR H7 CONCERNING GROUP SIZE (SIZE)
DEPENDENT VARIABLE IS USER INFORMATION SATISFACTION (UIS)

	Group Size (SIZE)	
	Model (7): H7	
Independent Variables[1]	B-*Value*	*Standard Error*
1. Misfit[2]	.00	.03
2. SIZE	−.00	.01
3. IMPER	.41**	.18
5. TOP	.18*	.09
6. UINV	.07	.11
7. RANK	−.61***	.17
8. STAGE2	−.00	.43
9. STAGE3	.24	.46
10. STAGE4	−.09	.45
11. STAGE5	−.21	.41
R^2	.67	
Adjusted R^2	.47	
F-statistic (model)	3.40**	
$P(F)$	.013	

$N=28$
* $p<.10$
** $p<.05$
*** $p<.01$
[1] Definitions appear in Table 1
[2] Absolute value of technology-coordination regression residuals

analyzable exceptions may become analyzable through the learning process. If most hospitals in the sample are at the maintenance stage of HAIS, there may not be enough variation in INTER and ANAL to test the interaction hypotheses. In order to assess this possibility, the data on HAIS development technology were reexamined. It was found that only low to moderate interdependence in the sample, with 20 out of 28 indicating low. Regarding problem analyzability, moderate to high analyzability was observed, with 22 HAIS indicating moderate. Thus, inadequate variation in the data may explain the insignificant interactions.

Some specific results about confounding variables are worth noting. The negative relation between the organizational rank of the HAIS director and performance supports a proposition that the higher the organizational rank of the responsible IS executive, the higher the IS performance. Also supported is the proposition that top management support for IS functioning is necessary for IS success. The results regarding the technical sophistication of IS tend to support previous research findings [Cheney and Dickson, 1982] in that IS performance is not influenced much by technical sophistication. For the HAIS practitioner, the current results suggest the need to worry less about how sophisticated the system is, and worry more about how HAIS employees are managed and how organizational support for HAIS can be achieved.

Conclusion

This study examined the relation between (1) various coordination modes and three technology dimensions and group size as contextual factors, and (2) the impact of that relation on the functioning of HAIS development groups. The approach to testing structural contingency theory used here has several advantages over previous approaches. First, the effect of confounding variables was controlled to rule out alternative explanations. Second, the study examines the contingency relation at the work group level, i.e., HAIS development group, where technology can best be applied. Further, independent user evaluation of HAIS performance minimized the problem of respondent source bias.

Regarding different research approaches, Drazin and Van de Ven [1985] classified three approaches to "fit" in structural contingency theory—the selection, interaction, and systems approaches. This study used the interaction approach which defines "fit" as the interaction of pairs of organizational context-structure factors. In the selection approach, "fit" is a premise underlying a congruence between context and structure. In the systems approach, "fit" is the internal consistency of multiple contingencies and multiple structural characteristics. Different approaches and a different sample might help refine understanding of the context-structure relation in MAS design and make further improvements in MAS management.

Finally, this study used UIS as a surrogate measure for MAS performance. However, Srinivasan [1985], examining the relations between UIS and IS usage as surrogate measures of system performance, found that the two are not always positively associated. He suggested that researchers be careful about using surrogate measures of IS performance and specifying clearly the exact nature of the dependent variables. This study utilized UIS as a surrogate measure for IS performance and, thus, the results may hold only in the limited context of UIS.

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