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A contingency model of perceived effectiveness in accounting information systems: Organizational coordination and control effects

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Abstract

A contingency model is advanced that examines sources of requirements for organizational coordination and control as they affect the extent of integration in an accounting information system. Requirements that are contingent on the degree of organizational formalization, information interdependence among functional areas, and dependence in interorganizational information sharing and electronic data interchange links, are examined. The congruence or fit of system integration with those requirements is a key concept that influences beliefs about system effectiveness. Results of the empirical study indicated that, as hypothesized, the fit between the accounting system design and the contingency factors resulted in a more successful system. Specifically, system fit was a significant factor that explained variations in perceived AIS effectiveness, as measured by decision makers' perceived satisfaction with the accuracy and monitoring effectiveness of output information. The effect of system fit on a second factor of perceived AIS effectiveness, as measured by decision-makers' satisfaction with the perceived quality of information content in system outputs, was only marginally significant. The study addresses an important area in accounting systems research that directly relates to the decision facilitation and control objectives of accounting information.

Keywords: Accounting information systems; Perceived information system effectiveness; Contingency theory; Interorganizational systems.

1. Introduction

A critical research issue in the fields of accounting and management decision-making concerns the fit of the accounting information system (AIS) with the organizational requirements for information communication and control. An AIS is defined here as a computer-based system that processes financial information and supports decision tasks in the context of coordination and control of organizational activities. Prior accounting research has examined different models of fit between an AIS and an organization's task technology, structure, and environment (Chenhall and Morris, 1986; Gordon and Miller, 1976; Gordon and Narayanan, 1984; Kim, 1988; Macintosh and Daft, 1987; Mia and Chenhall, 1994). Although these earlier models have provided useful directions for AIS research, they have not examined specific system design constructs in relation to system effectiveness. The present study adds to this body of literature by developing a specific system design construct, "AIS Integration," and by examining its functional relationship with perceived system effectiveness. AIS Integration, in turn, is hypothesized to be a function of a number of contingency constraints that create organizational coordination and control requirements. Sources of contingency con-

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straints on AIS design have been identified through a review of prior accounting studies. In addition, this study introduces constraints due to interorganizational interactions that have not been examined before in the accounting systems literature.

The approach in this study is consistent with the information-processing paradigm of organizational design (Daft and Lengel, 1986; Galbraith, 1973; Tushman and Nadler, 1978), which would suggest that AIS design represents a response to the requirements for organizational coordination and control (OCC). AIS integration refers to a particular design state where the system in its implemented form can provide output information that may be effectively used to address OCC problems and requirements. Contingent variables, such as (a) the degree of formalization in the structure of an organization (Hage and Aiken, 1969; Simons, 1987), (b) interdependencies in information requirements between functional areas within an organization (Govindarajan and Fisher, 1990; Thompson, 1967), and (c) dependencies due to interorganizational information sharing and electronic data interchange (EDI) links (Bakos, 1991; Srinivasan et al., 1994; Zaheer and Venkatraman, 1994), influence the extent to which organizations experience different levels of coordination and control problems. AIS integration can resolve difficulties in coordination and control that are created by these contingent variables.

The purpose of this study is to empirically examine the relationship between AIS integration and perceptions of system effectiveness. Specifically, it is hypothesized that to the extent that AIS design provides for system integration, as necessitated by the three contingent variables mentioned above, the system would be perceived as effective. This hypothesis is tested with data collected from firms in the United States using the survey research method. Results partially confirm the hypothesis that the degree of fit between AIS integration and the contingent variables predicts AIS effectiveness. There is stronger support for the hypothesis when AIS effectiveness is defined by decision-makers' satisfaction with the accuracy and monitoring effectiveness of output information than by the more traditional definition of satisfaction with quality of information content in system outputs.

The remainder of the article is organized as follows: In the next section, research that relates to individual components of the research model is reviewed. The theoretical framework is developed and the research hypothesis for the study is advanced. The research method for the study is presented next, followed by a presentation of the empirical findings. The article concludes with a discussion of the findings and with suggestions for future research.

2. Theoretical framework

The research model for the study is presented in Fig. 1. The model posits that perceptions of system effectiveness will depend on the fit between AIS Integration and the contingent factors of organizational formalization, information interdependence among functional areas within the organization, as well as interdependence with other organizations. These contingencies are likely to create requirements for integrated information that are necessary for the satisfaction of coordination and control needs within an organization. The contingency formulation that is assumed in this article is that the design of an AIS will be adapted to respond to contingencies in expectation that the system will meet the information requirements of its users and thus be perceived as effective. The model discussion is organized around its major components, starting with a general discussion of the use of a contingency framework for AIS design.

2.1. Contingency framework for AIS design and effectiveness

The research issues that are central to the organizational literature relate to the design of internally consistent organizational mechanisms that will ensure managerial and economic effectiveness (Galbraith, 1995; Zimmerman, 1995). Accounting information systems are considered important organizational mechanisms that are critical for effective decision management and control in organizations (Jensen, 1983; Zimmerman, 1995). Differences in requirements for organizational coordination and control across organizations, therefore, as indicated by such contingencies as organizational context and structure, are likely to result in differences in accounting systems (Jensen, 1983, 325). As Otley states, "Accounting systems are an important part of the fabric of organisational life and need to be evaluated in their wider managerial, organisational and environmental context" (1980, 422). The contingency theory of organizational design (Daft and Lengel, 1986; Galbraith, 1973; Tushman and Nadler, 1978) can therefore suggest relevant models for the effective design of AISs.

This study attempts to extend prior models and address criticisms of specific applications. First, it expands the scope in defining organizational context to also include effects due to interorganizational interactions. The examination of multiple contingencies that may have a joint influence on system design and performance can improve the explanatory ability of a research model (Gresov, 1989). Second, this study addresses, in part, criticisms of specific appli-

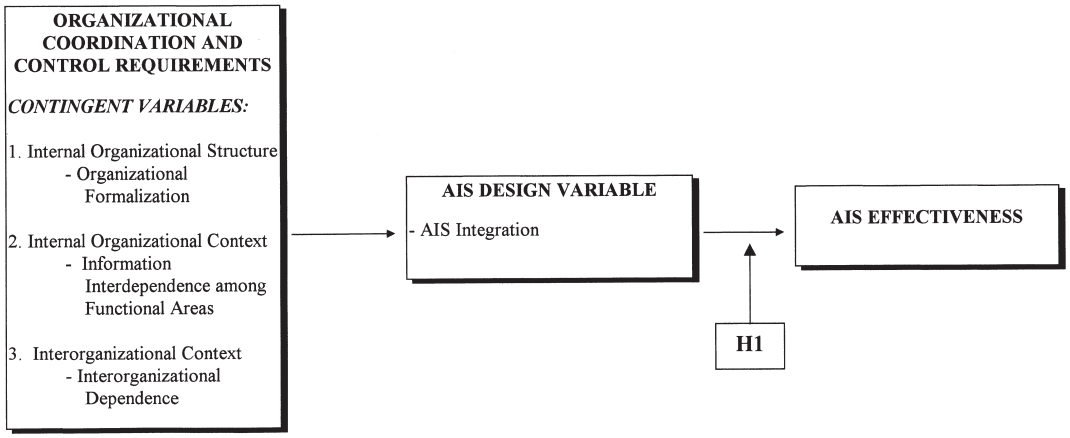

Fig. 1. Research model for the study.

cations of contingency theory models. Past applications had overlooked the link between system design and performance and were criticized for the lack of attention to such a relationship (Otley, 1980; Schoonhoven, 1981). This study partially addresses this criticism by examining the critical path between system design and perceived effectiveness; however, it only defines AIS effectiveness in terms of perceptions about system characteristics, and does not examine specific performance outcomes. The relationship between AIS integration and effectiveness, however, still represents an important specific application of a contingency theory model for AIS design.

2.2. Contingent variables

The problem of defining the informational structure of the firm has been dealt with in the early accounting literature. Prakash and Rappaport (1975) have defined the elements of the firm in terms of the following five interacting processes: planning process, decision-making process, implementation through observation process, data structuring process, and performance evaluation process. The role of accounting information is to tie those elements in a common informational structure. The need to minimize redundancies, promote increased consistency among data elements used in different functional areas within the organization, enhance data organization, and promote a cross-functional view within the organization (Cook and Eining, 1993), can create coordination requirements for the sharing of scarce resources (Govindarajan and Fisher, 1990) as well as control requirements for the centralized monitoring of decisions and actions (Simons, 1987). AIS design should therefore be adapted to meet such requirements. The need to deal with inefficiencies, reduce fragmentation in services, and increase control in interorganizational resource-sharing (Rogers and Whetten, 1982) can also have a significant effect on the degree of operating complexity of an AIS and necessitate important changes in AIS design.

The following contingent factors, therefore, motivate AIS integration: (a) interdependencies in information requirements between functional areas within an organization (Govindarajan and Fisher, 1990; Thompson, 1967), (b) the degree of formalization in the structure of an organization (Hage and Aiken, 1969; Simons, 1987), and (c) dependencies due to interorganizational information sharing and electronic data interchange (EDI) links (Bakos, 1991; Srinivasan et al., 1994; Zaheer and Venkatraman, 1994).

Interdependence denotes the extent to which different organizational segments within a subunit depend on one another to carry out their tasks (Thompson, 1967). Interdependence can occur at any level, including the individual, departmental, or functional subunit, or organizational level (Fry, 1982). Prior research in management accounting has examined this variable as an aspect of task technology both within business subunits (Chenhall and Morris, 1986; Kim, 1988) and among subunits (Govindarajan and Fisher, 1990; Hayes, 1977; Macintosh and Daft, 1987). Task interdependence within subunits was also reported to have a significant association with system integration, that is, the provision of information that integrated the effects of decisions from different functional areas (Chenhall and Morris, 1986).

Following Prakash and Rappaport's (1975) conceptualization of an information structure as a set of

interacting activities that share information for the execution of organizational tasks, interdependence is defined in this study as the "required information sharing" that takes place among different organizational functions in carrying out their tasks. This definition is consistent with Gresov's (1989) definition of work-unit dependence as the extent to which information or resources from outside sources are required as necessary inputs for a work process. It is also consistent with the concept of resource sharing that was developed by Gupta and Govindarajan (1988) and Govindarajan and Fisher (1990).

Organizational formalization refers to the extent to which an organization uses rules and procedures to prescribe behavior (Fredrickson, 1986; Hage and Aiken, 1969). A more formalized organization, or one where many rules exist, will tend to be associated with tight control where rules and control procedures are embedded within organizational routines and systems, and there is an increased need for the monitoring of organizational actions on an ongoing basis. In such situations, the AIS becomes a tool for control and must provide integrated information at the organizational level in order to support control requirements.

The introduction of information sharing systems that cross-organizational boundaries (Bakos, 1991) can also significantly increase the degree of complexity in the operating environment of an AIS and necessitate important changes in AIS design in order to integrate interorganizational information (Barrett and Konsynski, 1982). Interorganizational systems (IOS) facilitate communication between two or more organizations by providing a highly efficient and error-free electronic information link (Bakos, 1991). These benefits of electronic integration may, however, create dependencies between two different organizations that rely on each other for the procurement of resources.

Resource dependencies emerge from asymmetries in the control of critical resources (Pfeffer and Salancik, 1978). Pfeffer and Salancik's model of resource dependence posits that the following factors are critical in determining the dependence of one organization on another: (a) the importance of the resource, or the extent to which the organization requires it for continued operation and survival, and (b) the extent to which the organization has discretion over the resource allocation and use (Pfeffer and Salancik, 1978, 45). In cases where resource dependence is present and significant, the integration of interorganizational information, processed through EDI systems, with internal accounting systems can provide significant benefits to the organization in terms of improved coordination and control of internal activities.

2.3. AIS Effectiveness

Past research in information systems has defined system effectiveness in terms of "user information satisfaction" or perceptions of system users about the extent to which the information system available to them meets their information requirements (Ives et al., 1983, 785). Given the lack of objective, systematic indicators of information systems effectiveness that might suggest the potential impact of a system on organizational performance, user information satisfaction has been generally accepted as a surrogate for utility in decision-making.

A semantically similar concept of "information usefulness" has also been extensively examined in the accounting literature (Chenhall and Morris, 1986; Chong, 1996; Fisher, 1996;Gordon and Narayanan, 1984; Gul and Chia, 1994; Kim, 1988; Larcker, 1981; Mia and Chenhall, 1994). Accounting information, in general, has been categorized into two primary types: (a) decision-influencing information that is mainly used for organizational control and (b) decision-facilitating information that is mainly used for organizational coordination (Demski and Feltham, 1976; Kren, 1992). The whole set of "information usefulness" studies in accounting draws on a common base of information concepts that were originally developed to capture report users' reactions to qualitative characteristics of accounting information.

AIS effectiveness, therefore, is defined in this study in terms of the perceptions of decision-makers that the output information available to them through transaction processing, management reporting, and budgeting systems meets their requirements for organizational coordination and control.

2.4. The relationship between AIS integration and AIS effectiveness

AIS integration has been defined above as a system design state that influences the ability of the system to provide output information that can be effectively used to respond to OCC requirements. At the conceptual level, therefore, AIS integration is related to AIS effectiveness.

Increased system integration has been suggested to improve communications both within (Huber, 1990) and across organizations (Malone et al., 1987). Huber (1990) argues that improved coordination due to system integration can improve the quality of decision-making. The relationship between the use of integrated systems and user evaluations of "task-technology fit," that is, the degree to which a technology assists an individual in performing his or her portfolio of tasks, has been empirically demonstrated by

Goodhue (1995). Electronic integration among interorganizational (EDI systems) and internal information systems has also been reported to have a significant association with a perceptual measure of user information satisfaction (Premkumar et al., 1994), and an objective measure of shipment discrepancy reduction in the automotive industry (Srinivasan et al., 1994). In conclusion, system integration is shown to be an important construct in past research. Accounting systems are primarily influenced by contextual factors that affect accounting processes for transaction processing, reporting, process monitoring, and performance evaluation. As a result, this study examines the effect of contextual influences on AIS integration and on its relationship with system effectiveness.

The congruence of AIS integration with the contingent variables implies that an interaction exists between the two sets of concepts (Drazin and Van de Ven, 1985). An interaction hypothesis is advanced that predicts the effect of system-context fit on AIS effectiveness. Following Venkatraman's (1989) argument, "fit" in this study is conceptualized in terms of how strongly the relationship between AIS integration and AIS effectiveness is affected by the presence or absence of the contingent variables. The three contingent variables, therefore, jointly influence the relationship between AIS integration and AIS effectiveness. The following research hypothesis is advanced:

> H1: The fit of AIS integration with organizational coordination and control requirements, as defined by the joint effect of information interdependence among functional areas, organizational formalization, and interorganizational dependence, will have a positive association with perceptions of AIS effectiveness.

3. Research method

3.1. Sample and data collection

A cross-sectional sample of 600 organizations was randomly selected from the *Phillips Business Information 1995 EDI Yellow Pages Directory (Phillips Business Information, 1995).* Due to the nature of EDI technology, financial institutions were excluded from the sample. The information about each organization selected from this directory was individually cross-validated with information from the *Company Profiles Online Database* (1995; an online database of more than 100,000 public and private organizations in the United States). Each selected organization was mailed one copy of the research instrument for completion by the financial controller or chief financial officer. The research instrument was evaluated by expert panels, including faculty members and an individual from the target population (Dillman, 1978, 155–158). The revised instrument and a cover letter were mailed to the specific individual who was listed as a financial controller or chief financial officer of each firm in the sample. A postcard reminder was sent and nonrespondents were followed up with two additional mailings.

The final response rate from all mailings was 22 percent. Table 1 presents the sample characteristics.

Tests for nonresponse bias were performed to determine (a) whether the distribution of the 600 organizations in the response ($n = 120$) or nonresponse ($n = 480$) categories was independent of available demographic characteristics (industrial classification, gross revenue, and number of employees), and (b) whether early and late respondents provided significantly different responses. Chi-square tests indicated no significant differences in the three demographic characteristics. The Hotelling's T^2 statistic also indicated no significant differences in the multivariate means of early versus late respondents.

3.2. Measurement of research variables

3.2.1. AIS effectiveness (AIS-EFF)

The question of effectiveness has plagued the referent literature of organizational analysis. Earlier taxonomies of cumulative research on the issue seem to converge on a conceptualization that incorporates multiple dimensions of effectiveness (Cameron, 1986; Lewin and Minton, 1986; Quinn and Rohrbaugh, 1983). Research in information systems has also provided similar taxonomies and has suggested that system effectiveness can be viewed through a number of different perspectives (DeLone and McLean, 1992; Kim, 1989). In prior studies examining multiple indicators of accounting system effectiveness (Ives et al., 1983; Kim, 1988; Seddon and Yip, 1992), a decision-maker's satisfaction with the perceived quality of information outputs provided by the system has been suggested as an important concept of effectiveness. This study, therefore, measures AIS effectiveness using a number of items that relate to the satisfaction of system users with the quality of information outputs.

A previously validated instrument (Doll and Torkzateh, 1988) was used to measure user satisfaction (a surrogate measure for AIS effectiveness). The instrument encompasses five related sets of information concepts: information content, accuracy, format, ease of use, and timeliness. This instrument, hereafter called the "UIS" scale, includes twelve items and has been shown to exhibit adequate construct validity (Doll et al., 1994), as well as test-retest reliability (Hendrickson

et al., 1994; Torkzateh and Doll, 1991). The twelve items were measured as in Doll and Torkzateh (1988), that is, using a 5-point *almost never* to *almost always* Likert scale. In addition to these twelve items, two additional items were included in the instrument in order to measure user perceptions about the monitoring effectiveness of the system.

The Committee of Sponsoring Organizations of the Treadway Commission (1992) suggests the importance of ongoing monitoring as an indicator of effective accounting and internal control systems. Ongoing monitoring is built into the normal, recurring operating activities of the organization and is generally assumed to be more effective than periodic evaluation. The following two items were therefore developed: For the AIS overall, (a) control reports are provided frequently on a systematic, regular basis, for example, daily, weekly reports; (b) all in all, our AIS provides information useful for the ongoing monitoring of decisions and actions. The first item was used by Simons (1987) as a measure of management control. The second item was developed in this study and measured the overall effectiveness of the AIS in supporting ongoing monitoring requirements. Both items were measured on a 7-point, *strongly agree* to *strongly disagree* Likert scale. Panel A of Table 2 presents all items used to measure AIS effectiveness.

3.2.2. AIS integration (AIS-INT)

At the operational level, AIS integration is defined in terms of the following two characteristics: (a) the degree of integration in internal AIS applications (Davenport, 1998; Davis et al., 1998; Scapens et al., 1998) and (b) the degree of integration between the interorganizational EDI systems and the internal AIS applications (Cathey, 1991; Kogan et al., 1997; Mazurkiewicz, 1994; Splettstoesser, 1997). The importance of these characteristics has been repeatedly emphasized in the accounting professional literature that is cited in the above references. Accounting sys-

Table 1
Sample characteristics

Response Rate		
Original random sample from EDI Directory		600
Less:		
Undelivered questionnaires	19	
Declined response due to time pressures	13	
Declined response because of non-use of EDI system	10	(42)
Effective sample size		558
Number of completed questionnaires received		120
Response rate		22%
Useable responses (exclude 10 unuseable questionnaires because of no significant EDI use)		110
Effective response rate		20%
Type Of Industries Represented By Responding Firms		
a. Manufacturing		60
b. Wholesale and Retail Trade		28
c. Transport and Electric/Gas Utilities		15
d. Miscellaneous		17
Total		120
Size of Responding Firms		
Average number of employees in responding firms: 3,524 employees (*S.D.* = 5,730 employees).		
Average revenue (gross sales), $669 million (*S.D.* = $1,054 million).		
Characteristics of Responding Individuals		
Most frequent organizational titles of respondents:		
a. Financial controller		45
b. Information systems manager		40
c. Chief financial officer		28
Average time of employment of respondents in their organizations:	10.04 years (*S.D.* = 7.50)	
Length of Use of Information Systems		
Average time period of use of AISs in responding organizations:	16.06 years (*S.D.* = 7.95)	
Average time period of use of EDI systems in sales area:	4.83 years (*S.D.* = 5.11)	
Average time period of use of EDI systems in purchasing area:	2.67 years (*S.D.* = 3.71)	

tems are primarily influenced by contextual factors that affect accounting processes for transaction processing, reporting, internal control, process monitoring, and performance evaluation. These characteristics can capture the range of potential contextual influences.

The integration of AIS applications was measured by the extent of standardization in coding schemes and by the extent to which application systems adhere to standard coding schemes. These two items were developed in this study and were based on the operational concept of data integration, which refers to "the use of common field definitions and codes across different parts of the organization" (Goodhue et al., 1992, 294). Another six items were used to measure the extent of integration of the AIS with information provided by EDI systems, one item for each of the following organizational areas: accounting, procurement, shipping/distribution, reporting/budgeting, payments (financial EDI), and production planning (similar scales were used by Premkumar et al., 1994). All items used to measure AIS Integration are shown in Panel B of Table 2. Responses on all items were measured on a 5-point scale with *none* to *very large extent* endpoints.

3.2.3. Information interdependence (INF-DEP)

Information interdependence is defined as the extent of required information sharing between pairs of organizational functions that are supported by AIS applications. Applications in an AIS were identified by a large-scale study in the United States to relate to the following four areas: (a) accounting, (b) procurement, (c) shipping/distribution, and (d) reporting/budgeting (Deloitte and Touche LLP and Hyperion Software, 1995). These areas encompass a set of interacting activities that share financial information processed by an AIS. The resulting six pairs are presented on Panel C of Table 2. Responses were measured on a 5-point scale with *none* to *very large extent* endpoint.

Prior accounting studies have used a single item to measure task interdependence (e.g., Kim, 1988) or a dichotomous measure of workflow interdependence (e.g., Chenhall and Morris, 1986). This study further advances the approach of Govindarajan and Fisher (1990), where interdependence was measured as the extent of "resource sharing" among organizational subunits. The present approach directly relates interdependence to requirements for organizational coordination and control that are relevant to the design of an AIS.

3.2.4. Organ

An existing scale that was developed by Hage and Aiken (1969) was employed in order to measure organizational formalization. The scale measures the extent of use of formal policies and procedures in the organization, the monitoring of compliance to established policies and procedures, and the existence of penalties in case procedures are not followed. The scale items are shown in Panel D of Table 2.

3.2.5. Interorganizational dependence.

The two dimensions from Pfeffer and Salancik's (1978) resource dependence model were used as measures of interorganizational dependence. The first dimension of resource importance (RES-IMP) was measured by two items, shown on Panel E of Table 2, that elicit responses about the extent of use of EDI systems. These two items were developed by Premkumar et al. (1994). The second dimension of discretion over resource access and use (RES-ACC) was measured by the next three items in Panel E of Table 2. The items measured the extent to which a common EDI communication standard was followed, or whether a proprietary format was required for communication. The use of firm specific, proprietary formats result in EDI systems that are specific to a particular trading partner. A number of industries, as for example, in the automotive industry, have already established their own communication formats in order to avoid problems with proprietary systems. The third item measured the ease with which alternative EDI links can be established, which also depends to a large extent on the use of common communication formats.

3.3. The model

The research hypothesis was tested using a deviation score approach (Drazin and Van de Ven, 1985). The deviation score approach examines the extent of departure, or lack of fit, from an ideal linear relationship between context and design variables (Drazin and Van de Ven, 1985, 519). In the single ideal relationship, lack-of-fit is equal to zero. For simplicity in model development, therefore, the ideal relationship is assumed linear so that the ideal estimate for lack-of-fit can not take a nonzero value due to the selection of model form from many alternatives (for example, from different curvilinear forms of the relationship). The degree of fit or departure from the ideal relationship will be measured by the absolute value of the residuals of the regression of AIS integration on the three contingent variables. The lower the degree of departure, the higher the degree of system fit and the higher the performance or AIS effectiveness. At a second step in the analysis, therefore, AIS effectiveness will be regressed on system fit. The main effects of the variables determining system fit will also be controlled for in the model.

Table 2
Response scales

Panel A: AIS Effectiveness
User Information Satisfaction (UIS) Items:[a]
For the AIS overall:
a. do you think the output is presented in a useful format?
b. are you satisfied with the accuracy of the system?
c. is the information clear?
d. is the system accurate?
e. does the system provide sufficient information?
f. does the system provide up-to-date information?
g. do you get the information you need in time?
h. does the system provide the precise information you need?
i. does the information content meet your needs?
j. does the system provide reports that seem to be just about exactly what you need?
k. is the system user friendly?
l. is the system easy to use?
Perceived Monitoring Effectiveness Items[b]
For the AIS overall:
a. control reports are provided frequently on a systematic, regular basis, e.g., daily, weekly reports.
b. all in all, our AIS provides information useful for the ongoing monitoring of decisions and actions.
Panel B: Scale Measuring AIS Integration (AIS-INT)
Extent of standardization of your AIS:
a. standardization in coding schemes across functional databases.
b. application systems adhere to standard coding schemes.
Extent to which EDI information is integrated with internal application systems in the following areas:
c. Accounting.
d. Procurement.
e. Shipping/Distribution.
f. Reporting/Budgeting.
g. Payments (financial EDI).
h. Production planning.
Panel C: Scale Measuring Information Interdependence (INF-DEP)[c]
Extent of required information sharing between the following pairs of organizational functions for the execution of organizational tasks:
a. Accounting and Procurement.
b. Accounting and Shipping/Distribution.
c. Accounting and Reporting/Budgeting.
d. Procurement and Shipping/Distribution.
e. Procurement and Reporting/Budgeting.
f. Shipping/Distribution and Reporting/Budgeting.
Panel D: Scale Measuring Organizational Formalization (FORMAL)[d]
In my organization:
a. whatever situation arises, we have policies and procedures to follow in dealing with it.
b. when rules and procedures exist here, they are usually written.
c. the employees here are monitored for compliance with established procedures.
d. there are strong penalties for failure to comply with established procedures.
e. the rules are ignored and informal agreements reached to handle some situations.

(*continued on next page*)

4. Results

4.1. Factorial structure of new scales not validated in prior research

New items were developed in this study to measure the constructs of resource accessibility (RES-ACC), information dependence (INF-DEP), AIS integration (AIS-INT) and the two items of user perceptions about the monitoring effectiveness of the system. Exploratory principal component analysis on RES-ACC and INF-DEP resulted in satisfactory single-factor structures. The high correlation ($r = .70$; $p \leqslant .0001$) between the two items of perceived monitoring effectiveness and the twelve-item UIS scale

Table 2
(*continued*)

Panel E: Scale Measuring Interorganizational Dependence[e]
Resource Importance (RES-IMP) Dimension
Extent of use of EDI systems:
a. total external partners (that could be electronically linked) that are linked by EDI.
b. total external documents (convertible to EDI) that are converted to EDI.
Resource Accessibility And Use (RES-ACC) Dimension[f]
Concerning the EDI system used in my organization:
a. our industry employs a common EDI communication standard.
b. our major EDI partners require use of their in-house proprietary EDI formats.
c. establishment of EDI links with alternative partners is easy to do.

[a] Source: Doll & Torkzateh (1988); responses were measured on 5-point scale with *almost never* and *almost always* endpoints.

[b] Responses were measured on 7-point scale with *strongly disagree* and *strongly agree* endpoints.

[c] Responses were measured on 5-point scale with *none* and *very large extent* endpoints.

[d] Source: Hage & Aiken (1969); responses were measured on 7-point scale with *strongly disagree* and *strongly agree* endpoints; item (e) was reverse-scored.

[e] Source: Premkumar, Ramamurthy, & Nilakanta (1994); responses were measured on 5-point scale with *none* and *very large extent* endpoints.

[f] Responses were measured on 7-point scale with *strongly disagree* and *strongly agree* endpoints; items (a) and (c) were reverse-scored.

necessitated the examination of the factorial structure of all fourteen items within the same factor model. Principal component analysis with varimax rotation resulted in two interpretable factors, as determined by the screen test, Bartlett's χ^2 test on the number of factors, and the eigenvalue-greater-than-one rule (Gorsuch, 1983). The two factors explained 65 percent of the total variance. The first factor included high loadings from ten items in the UIS scale. The two "accuracy" items from the original UIS scale loaded heavily on the second factor, which also included the two items of perceived monitoring effectiveness. As a result, two factors of AIS effectiveness were used in the analysis, one factor that included items relating to user satisfaction with the quality of information outputs, hereafter called the UIS factor, and a second factor that included four items relating to user perceptions about the accuracy of information outputs and about the monitoring effectiveness of the system. This factor is hereafter called the PME factor for perceived monitoring effectiveness.

The AIS integration scale (AIS-INT) measures different aspects or characteristics of an AIS. As a result, the collection of those items listed on Panel B of Table 2 are not assumed to measure a latent construct of AIS integration with error, but rather are assumed to measure different aspects of AIS integration (Gordon and Smith, 1992). The use of factor analysis in the case of AIS-INT was therefore not considered appropriate.

Table 3 presents descriptive statistics for all the variables measured in this study. Table 4 presents the results on the Cronbach α coefficient of internal consistency for each scale as well as the Pearson product-moment correlation coefficients among the research variables.

4.2. Construct validity and reliability of measures

The validity of measures was evaluated by confirmatory factor analysis (CFA). Maximum likelihood estimates of the CFA model were obtained using the LISREL 7 program. A series of *ad hoc* tests were employed, as recommended by Anderson and Gerbing (1988) and Bagozzi et al. (1991). The estimated mea-

Table 3
Descriptive statistics ($N = 110$)

Scale	Number of scale items	*M*	*S.D.*	Range of Observations	
				Minimum	Maximum
UIS	10	3.56	0.68	2.3	5
PME	4	5.58	0.98	2.6	7
AIS-INT	8	2.14	0.88	1	5
INF-DEP	6	3.59	0.98	1	5
FORMAL	5	4.03	1.28	1	7
RES-IMP	2	2.84	0.85	1.50	5
RES-ACC	3	3.19	1.43	1	7

UIS = user information satisfaction; PME = perceived monitoring effectiveness; AIS-INT = AIS integration; INF-DEP = information dependence; FORMAL = organizational formalization; RES-IMP = resource importance; RES-ACC = resource accessibility.

surement model for the four contingent variables (i.e., INF-DEP, FORMAL, RES-IMP, and RES-ACC) had a χ^2 fit ($df = 99$) of 172.78 and a noncentralized normed fit index of .91, which exceeds the threshold of .90 recommended by Bagozzi et al. (1991) for good fit. The value of the root mean square residual (RMSR) was .085, where values less than .10 indicate good fit.

Three tests of convergent validity were assessed. First, the *t*-values of all standardized loadings were statistically significant ($p < .001$). Second, composite reliabilities, which are analogous to Cronbach α coefficients, were above .80 for three of the latent constructs (INF-DEP, FORMAL, and RES-IMP), exceeding the .70 threshold for adequate internal scale consistency set by Nunnally (1978, 245–246). For RES-ACC, composite reliability was at .62, a result that might be allowed for a new scale although an indicator of the need for future improvement. Third, the variance extracted estimate for each latent variable, which represents the amount of variance accounted for by the factor in relation to the variance due to random measurement error, with the exception of RES-ACC, was greater than the level of .50 recommended by Fornell and Larcker (1981). For RES-ACC, the estimate was at .40, also an indicator of the need for future improvement.

Two additional tests were performed to assess the discriminating validity of the four latent constructs. In the first test, a 95 percent confidence interval around the correlation estimate between each pair of factors did not contain the value of one. In the second test, the estimated correlation parameter between two constructs was constrained to a value of one and a χ^2 difference test was performed on the values obtained for the constrained and unconstrained models. In all six comparisons, the χ^2 values were significantly higher ($p < .001$), supporting the discriminating validity of the four scales. In conclusion, with the exception of the RES-ACC scale, all other latent constructs exhibited adequate levels of reliability and construct validity. Due to the poor reliability and weak construct validity of the RES-ACC scale, the three individual items that comprised the scale were used in hypothesis testing instead of the summated measure.

4.3. Test of common method bias

To test for common method bias, the fit of a single-factor model for the independent and dependent variables (the common methods hypothesis), was compared to the fit of a six-factor model in which the items measuring INF-DEP, FORMAL, RES-IMP, RES-ACC, UIS, and PME, were the six factors. The six-factor model ($\chi^2_{(391)} = 817.7$; RMSR = .089) provided a significantly better fit to the data than the one-factor model ($\chi^2_{(406)} = 2050.4$; RMSR = .149), thus offering evidence that common-method variance was not a significant concern.

4.4. Results on hypothesis testing

The first step in the deviation score analysis involves the estimation of the linear relationship between AIS-INT and the contingent variables, that is, INF-DEP, FORMAL, RES-IMP, and the three items of RES-ACC, that is, RES-ACC1, RES-ACC2, and RES-ACC3. The absolute value of the residuals from this model represents the extent of system fit. Table 5 presents the results of the regression of AIS-INT on the four contingent variables.

The research hypothesis was tested by estimating regression models of UIS and PME on SYSTEM

Table 4
Pearson product-moment correlations and Cronbach a coefficients

Variables	1	2	3	4	5	6	7
UIS	.936						
PME	.71**	.801					
AIS-INT	.30**	.192*	.786				
INF-DEP	.31**	.33**	.33**	.902			
FORMAL	.40**	.41**	.31**	.30**	.829		
RES-IMP	.07	−.07	.47**	.19*	.16	.823	
RES-ACC	−.29**	−.21*	−.23*	−.20*	−.25**	−.42**	.644

UIS = used information satisfaction; PME = perceived monitoring effectiveness; AIS-INT = AIS integration; INF-DEP = information dependence; FORMAL = organizational formalization; RES-IMP = resource importance; RES-ACC = resource accessibility.

Entries on the diagonal are Cronbach α coefficients of internal scale consistency.

* Significant at the .05 level; ** Significant at the .01 level.

Table 5
Estimated regression model of AIS integration on contingent variables

Independent variable	Parameter estimate (*t*-statistic)	Standardized coefficient
Intercept	−0.29 (−0.57)	
INF-DEP	0.19 (2.36**)	0.21
FORMAL	0.13 (2.15**)	0.19
RES-IMP	0.42 (4.43***)	0.41
RES-ACC1	−0.02 (−0.35)	−0.04
RES-ACC2	0.04 (0.93)	0.09
RES-ACC3	−0.01 (−0.25)	−0.02

INF-DEP = information dependence; FORMAL = organizational formalization; RES-IMP = resource importance; RES-ACC = resource accessibility.

$F_{(6,103)} = 8.39$***; Model $R^2 = 0.33$; Model Adjusted $R^2 = 0.29$.

* Significant at the 0.10 level; ** Significant at the 0.05 level; *** Significant at the 0.01 level.

Table 6
Estimated regression model of AIS effectiveness on system fit

Independent variable	Parameter estimate (*t*-statistic)	Standardized coefficient
Panel A: Regression of UIS on System Fit[a]		
System Fit	−0.30 (−1.70*)	−0.16
Intercept	3.08 (7.77***)	
INF-DEP	0.11 (1.70*)	0.16
FORMAL	0.14 (2.85***)	0.26
RES-IMP	−0.14 (−1.73*)	−0.18
RES-ACC1	−0.03 (−0.90)	−0.10
RES-ACC2	−0.01 (−0.30)	−0.03
RES-ACC3	−0.06 (−1.55)	−0.14
AIS-INT	0.18 (2.22**)	0.23
Panel B: Regression of PME on System Fit[b]		
Intercept	4.92 (8.79***)	
System fit	−0.40 (−3.22***)	−0.30
INF-DEP	0.25 (2.72***)	0.25
FORMAL	0.22 (3.18***)	0.29
RES-IMP	−0.33 (−2.84***)	−0.26
RES-ACC1	−0.10 (−1.88*)	−0.20
RES-ACC2	0.03 (0.66)	0.07
RES-ACC3	−0.03 (−0.63)	−0.06
AIS-INT	0.16 (1.44)	0.15

[a] $F_{(8,101)} = 5.10$***; Model $R^2 = 0.29$; Model Adjusted $R^2 = 0.23$.

[b] $F_{(8,101)} = 5.78$***; Model $R^2 = 0.31$; Model Adjusted $R^2 = 0.26$.

INF-DEP = information dependence; FORMAL = organizational formalization; RES-IMP = resource importance; RES-ACC = resource accessibility; AIS-INT = AIS integration.

* Significant at the 0.10 level; ** Significant at the 0.05 level; *** Significant at the 0.01 level.

FIT, that is, the absolute value of the residuals from the previous regression of AIS-INT on the contingent variables. The variables determining system fit were also included in the regression in order to partial out their main effects from the effect of the fit variable (see, for example, Kim's (1988) approach). Two regression models were estimated in order to test the research hypothesis. Goodness-of-fit tests were also performed on the error terms of both regression models estimated (Neter et al., 1985, 122–123). In both cases, no significant deviations from normality were indicated. Panel A of Table 6 presents the results of regression models estimated for UIS and Panel B of Table 6 presents the results for PME, the second dependent variable.

The research hypothesis predicts that the degree of fit of AIS integration (AIS-INT) with the joint effect of information interdependence (INF-DEP) among functional areas, organizational formalization (FORMAL), and interorganizational dependence (RES-IMP, RES-ACC1, RES-ACC2, RES-ACC3), will be positively associated with UIS and PME, the two factors of AIS effectiveness. The hypothesis was partially supported by the data. As can be seen from Panel A of Table 6, the estimated coefficient of system fit was marginally significant ($t_{(101)} = -1.70$, $p < .10$) in the regression of UIS on system fit. In the regression of PME on system fit, however, the estimated coefficient of system fit was highly significant ($t_{(101)} = -3.22$, $p < .01$). This result is shown in Panel B of Table 6 and provides strong support for the hypothesis advanced earlier in the study. In both regression models, the direction of the effects was as expected. The coefficient of system fit is negative, indicating that, as expected, a lower deviation in the relationship between AIS-INT and the joint effect of the contingent variables is associated with a higher level of UIS and PME, that is, AIS effectiveness.

Additional tests were performed to avoid the risk that the hypothesis was tested on the same sample that was used to estimate system fit. These results were found to be robust in a random split of the sample where half of the responses ($n = 55$) were used for estimation purposes and a hold out sample ($n = 55$) was used for hypothesis testing. The results were also found to be robust in a median split of the sample, where the estimation sample was formed by those responses with scores on UIS and PME that were above the median score ($n = 24$). In a further test, organizational size (defined as the logarithm of

the number of employees) was entered into the estimation equation with no significant changes to the results.

5. Discussion, limitations, and conclusions

This study examined the relationship between the degree of fit between organizational requirements for coordination and control with the design of an AIS and perceptions of effectiveness about the system. Contingency theory served as the basis for the development of the hypothesis in the study. The results of the study indicated that internal dependence due to (a) required information sharing across organizational functions, (b) organizational formalization, and (c) interorganizational dependence in terms of both resource importance and accessibility, had a significant effect upon the requirements for organizational coordination and control that should be met by the design of the system. The fit between AIS design and those requirements significantly contributed to perceptions of monitoring effectiveness and to perceptions about the accuracy of information outputs. System fit, however, failed to exhibit a strong effect on user information satisfaction, that is, on the perceived quality of information content available in system outputs.

The overall results are consistent with the theoretical perspectives underlying the concepts examined in the study. The theory of resource dependence (Pfeffer and Salancik, 1978) explains the behavior of organizations in cases where one organization is dependent upon another for critical resources. As interorganizational EDI links become more prevalent and organizations depend on them for their survival, the requirements to coordinate and control internal activities become more intense if continuous flow of resources is to be ensured. The more extensive the use of EDI and the more dependent organizations are on firm-specific communication formats, the greater the dependence and the need for internal coordination. The fit of the system with those requirements has been shown to contribute to satisfaction with the accuracy of system-generated information, as well as with satisfaction with monitoring effectiveness. Decisions and actions giving rise to costs at the different stages of the ordering, delivery, receiving, inspection, storing, and payment processes can be more effectively controlled through the use of integrated systems. Such benefits could reduce the total cost of ownership of raw materials and provide strategic advantages to the organization (Cooper and Kaplan, 1991).

The results of the study are also consistent with information processing theory (Daft and Lengel, 1986; Galbraith, 1973; Tushman and Nadler, 1978), which posits that, in the face of uncertainty, organizations will incorporate information-processing capacities in their structures in order to match information processing requirements. Interdependent processes among functional areas can create requirements for information sharing and the design of integrated AISs that will satisfy such requirements. Adherence to rules and procedures may lead to an increased need for ongoing evaluations and these results have shown that, in such cases, AIS design must be responsive to those requirements in order for the system to be perceived as effective. The design of integrated systems, therefore, as a response to such requirements, may satisfy the need for improved accuracy in information sharing and continuous monitoring, and thus result in more effective systems.

The lack of significant results between system fit and the concept of "user information satisfaction" might be due to the choice of the research instrument used to measure UIS. Doll and Torkzateh's (1988) instrument was chosen because of evidence of its superior psychometric validity in the specific context of accounting information systems (Seddon and Yip, 1992). More recent conceptualizations of the system effectiveness construct advance a concept of "task/technology fit," that is, information systems will have a positive impact on performance only when there is a correspondence between their functionality and the task requirements of users (Goodhue, 1995). The Doll and Torkzateh (1988) instrument might have provided too limited a measurement for an overall evaluation of system functionality. It has provided user evaluations for a wide range of information characteristics, but a different focus might have been necessary. For example, a measure of system functionality might focus on the level of support that is provided to users in carrying out their managerial functions of planning, investigating, coordinating, and evaluating, as they have been specified in the traditional management literature (Mahoney et al., 1965) or in any management accounting text (e.g., Hilton, 1997).

Like all studies, the current study also has its limitations due to the methodology employed. For example, the study measured all research variables at a single point in time and used co relational analysis. This approach limits statements about causation. Use of summated responses to questionnaire items that appear on the same instrument always entails some risks. Responses could be biased because of the common method used for the collection of all data. Though care was taken to extensively validate these data through psychometric analyses, which have not indicated any violations of scale validity, this criti-

cism of the survey method can never be completely ignored and should be taken into account. Nonresponse has been a problem in the data collection phase of this study. Nevertheless, all tests for nonresponse bias have provided satisfactory results.

Despite the above limitations, this study has contributed useful results for both professionals and researchers in AIS. Professionals can utilize the scales for AIS integration and AIS effectiveness that were examined in this study in order to measure and evaluate the level of satisfaction with an existing system. This evaluation could also be performed within the context of a post-implementation review, where the objective might be to identify areas of concern that should be addressed in future system development projects. The importance of using standardized scales in a post-implementation evaluation context is that they promote learning about the system. This effect is often difficult to measure, even though it represents a major purpose for post-implementation reviews (Chenhall and Morris, 1993; Miller and Dunn, 1997). For researchers, the concepts developed here, particularly the concept of system integration and its fit with contingent variables, offer empirically observable indicators that could be examined in a post-implementation context. The relationship between the evaluation of post-implementation perceptions of effectiveness and firm performance has not been examined in past empirical research, despite its importance to professionals in the field. Although this study has also not investigated this important relationship, it provides some insights into this complex question. Any future research effort addressing this relationship must consider the issue of using AIS evaluation scales that were validated in different contexts in order to isolate the effect of system learning on a firm's operating performance. The complexity of this issue is manifested by the fact that firm performance could not only be defined in different ways, but it could also be influenced by other factors confounding the effects of interest. These concepts could also be incorporated in research models that examine the effect of contingencies relating to internal cost structure and interorganizational cooperation through just-in-time exchanges on the implementation of cost management systems. The results of this study have demonstrated the feasibility as well as the necessity of examining multiple contingencies in future research models of AIS design.

There are also a number of other useful directions for future research. First, the study has relied on qualitative or perceptual measures of AIS effectiveness. Future research could examine the effects of accounting system design choices on quantifiable measures of firm performance, such as operational measures of performance (e.g., inventory turns) as well as profitability measures (e.g., return on assets employed). Second, the measurement of interorganizational variables needs to be refined and further developed. Finally, future research could also further refine the concept of organizational coordination and control and directly define and measure different types of costs that relate to such requirements. Consequently, the relationship between system fit and AIS effectiveness could be made more explicit and could incorporate direct types of costs that could be reduced, eliminated, or displaced through the use of appropriate accounting information systems.

In conclusion, the central issue of system integration that was examined in this study has been demonstrated to be an important concern, both empirically as well as conceptually. The respondents to this study have indicated their reliance on the measure of system integration in forming their opinions about the effectiveness of an AIS. This study is one of a very few studies to empirically examine the concept of AIS integration and its relationship with perceptions of AIS effectiveness. At the conceptual level, AIS integration successfully captures the effect of specific contextual influences on AIS design. The concept of AIS integration as a specific state of system design, therefore, is validly related to an organization's specific context, as this may be determined by interorganizational agreements, internal teamwork, or cross-functional decision-making units. This study only represents the start of a series of research investigations into these important issues that are faced by current businesses.

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