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PREDICTING INTENTION TO ADOPT INTERORGANIZATIONAL LINKAGES: AN INSTITUTIONAL PERSPECTIVE¹

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Abstract

This study used institutional theory as a lens to understand the factors that enable the adoption of interorganizational systems. It posits that mimetic, coercive, and normative pressures existing in an institutionalized environment could influence organizational predisposition toward an information technology-based interorganizational linkage. Survey-based research was carried out to test this theory. Following questionnaire development, validation, and pretest with a pilot study, data were collected from the CEO, the CFO, and the CIO to measure the institutional pressures they faced and their intentions to adopt financial electronic data interchange (FEDI). A firm-level structural model was developed based on the CEO's, the CFO's, and the CIO's data. LISREL and PLS were used for testing the measurement and structural models respectively. Results showed that all three institutional pressures—mimetic pressures, coercive pressures, and normative pressures—had a significant influence on organizational intention to adopt FEDI. Except for perceived extent of adoption among suppliers, all other subconstructs were significant in the model. These results provide strong support for institutional-based variables as predictors of adoption intention for interorganizational linkages. These findings indicate that organizations are embedded in institutional networks and call for greater attention to be directed at understanding

¹V. Sambamurthy was the accepting senior editor for this paper.

institutional pressures when investigating information technology innovations adoption.

Keywords: Financial electronic data interchange, interorganizational systems, institutional influences, mimetic pressures, coercive pressures, normative pressures

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Introduction

Information technology-based interorganizational linkages (IT-based IOL) captured widespread interest among information systems (IS) academics in the 1980s, partly because of the competitive advantage gained by organizations such as American Airlines and American Hospital Supply (Cash et al. 1992). IT-based IOL have, interestingly, become the center of attention again due to the increased focus on business-to-business (B2B) electronic commerce. *The Economist* (February 26, 2000) estimated that B2B transactions will account for more than 80 percent of the expected U.S. \$3 trillion electronic commerce market by 2003. While these figures give the impression that the B2B market is expanding fast, the fact remains that many small and medium sized organizations are still sitting on the sidelines. For example, the GIGA Information Group estimated that a mere 300,000 American businesses have adopted and used electronic data interchange (EDI) (Hapgood 2000). Thus, for IS researchers and practitioners, adoption of interorganizational linkages, while not new, is still an interesting topic worthy of further investigation.

Within the last two decades, several studies have been conducted to identify possible factors driving the adoption of IT-based IOL (e.g., Chwelos et al. 2001; O'Callagan et al. 1992; Premkumar et al. 1994; Teo et al. 1995). Much of this research has focused on the diffusion of innovations (DOI) perspective (Rogers 1995), looking at characteristics (or perceptions) of IT that either encourage or inhibit adoption, and on the organizational

innovativeness (OI) perspective (Wolfe 1994), examining the influence of organizational characteristics on innovation adoption decisions (e.g., Damanpour 1991; Premkumar and Ramamurthy 1995). Much of this literature assumed that innovation adoption is driven by a rationalistic and deterministic orientation guided by goals of technical efficiency.

However, because interactive IT-based IOL induce uncertainty related to network effects and reciprocal interdependence (Markus 1987), the decision to adopt may have more to do with the *institutional* environment in which a firm is situated than rational intra-organizational and technological criteria. Interactive innovations diffuse when others observe and imitate the early adopters to replicate their success or to avoid being perceived as laggards, or when they communicate with these early adopters and are persuaded, induced, or coerced to adopt (Contractor and Eisenberg 1990; Markus 1987). Since innovation adoption could be influenced by the need for legitimacy, for social and economic fitness in a wider social structure (Abrahamson 1991; Poole and Van de Ven 1989), this study draws upon institutional theory to identify and examine key institutional determinants of IT-based IOL adoption (DiMaggio and Powell 1983; Haunschild and Miner 1997; Meyer and Rowan 1977).

To test the predictions of the theory, data were collected from 222 Singapore-based organizations to investigate a set of institutional factors that influence the intent to adopt financial EDI (FEDI). FEDI, being *an interactive technological innovation that facilitates the electronic transmission of structured payment and remittance information between a corporate payer, corporate payee, and their respective banks* (O'Hanlon 1993), cannot be independently adopted by any organization. FEDI success depends on the willingness of an adopting organization's suppliers and customers to accede to electronic linkages, and on the universal acceptance of a common standard for FEDI transactions by banks, value-added networks, and businesses for enabling such linkages. Organizations that feel uncertain about adopting FEDI may look toward the behavior of institutional

actors for guidance and directions. Early adopters interested in minimizing the costs of maintaining multiple channels of collection and disbursement may also exercise their influence, directly or indirectly, through interorganizational networks to encourage diffusion among nonadopters. Moreover, organizational decision makers may pay greater attention to policies and guidelines pronounced by trade associations, industry-wide EDI councils, and standards bodies that have proliferated in the last decade. FEDI is hence a good test case for the application of institutional theories to investigate the various interorganizational forces at work. Given the growing recognition of institutional interdependence as an issue that could potentially shape the adoption and use of Internet technology or IT-based IOL (Orlikowski and Barley 2001), our focus on institutional-based theories adds a much needed perspective on the role of institutional variables in IT-based IOL adoption that is missing from much of the IT innovations adoption literature.

Institutional Perspectives on Adoption

The institutional approach to the study of organizations has led to significant insights regarding the importance of institutional environments to organizational structure and actions (e.g., Burns and Wholey 1993; Fligstein 1985; Goodstein 1994; Han 1994; Haunschild 1993; Haveman 1993; Tolbert 1985; Tolbert and Zucker 1983; Mezias 1990). However, to our knowledge, there has been no research on the predicted relationships between institutional variables and the adoption of IT-based IOL by organizations.

The institutional approach argues that in modern societies where organizations are typified as systems of rationally ordered rules and activities (Weber 1946), organizational practices and policies become readily accepted as legitimate and rational means to attain organizational goals (Meyer and Rowan 1977). This gives rise to widespread social conceptions of appropriate organizational forms and behaviors that constitute

the institutional environment of organizations. As organizations compete for resources, customers, political power, and economic and social fitness (Carroll and Delacroix 1982), institutional theories posit that organizations face pressures to conform to these shared notions of appropriate forms and behaviors, since violating them may call into question the organization's legitimacy and thus affect its ability to secure resources and social support (DiMaggio and Powell 1983; Tolbert 1985).

Schelling (1978) noted that organizations respond to an environment that consists of other organizations responding to their environment, which consists of organizations responding to an environment of organizations' responses. Organizations are thus subject to pressures to be isomorphic with their environment, which incorporates both interconnectedness and structural equivalence (Burt 1987). Interconnectedness refers to interorganizational relations characterized by the existence of transactions tying organizations to one another while structural equivalence refers to the occupying of a similar position in an interorganizational network. DiMaggio and Powell (1983) distinguished between three types of isomorphic pressures—*coercive*, *mimetic*, and *normative*—and suggested that coercive and normative pressures normally operate through interconnected relations while mimetic pressures act through structural equivalence.

Mimetic Pressures

Mimetic pressures may cause an organization to change over time to become more like other organizations in its environment (DiMaggio and Powell 1983). Mimetic pressures manifest themselves in two ways: the prevalence of a practice in the focal organization's industry and the perceived success of organizations within the focal organization's industry that have adopted the practice (Haveman 1993). An organization will imitate the actions of other structurally equivalent organizations because those organizations occupy a similar economic network position in the

same industry and, thus, share similar goals, produce similar commodities, share similar customers and suppliers, and experience similar constraints (Burt 1987).

Regardless of the technical value of a practice or innovation, an organization may model itself after other organizations to acquire status-conferring legitimacy or social fitness in a wider social structure (DiMaggio and Powell 1983). Faced with problems with uncertain solutions (or technologies), organizational decision makers may succumb to mimetic pressures from the environment to economize on search costs (Cyert and March 1963), to minimize experimentation costs (e.g., Levitt and March 1988), or to avoid risks that are borne by first-movers (Lieberman and Montgomery 1988). Evidence of mimetic change is found in many studies examining adoption of new forms and practices (e.g., Fligstein 1985; Haunschild and Miner 1997). Banker and Kauffman (1988) noted the prevalence of automated teller machines (ATM) network technology in the banking industry when its business value had yet to be established. Hence, it is highly possible that potential adopters of FEDI may monitor their environment closely and model themselves after similar organizations that have adopted FEDI.

H1: Greater mimetic pressures will lead to greater intent to adopt FEDI.

Sociological research on threshold models (Granovetter 1978; Krassa 1988) suggests that decisions to engage in a particular behavior depend on the perceived number of similar others in the environment that have already done likewise. Hence, if enough similar organizations do things in a certain way such that it gives rise to that particular course of action being legitimated or taken for granted throughout a sector, others will follow suit to avoid the embarrassment of being perceived as less innovative or responsive (Fligstein 1985; Goodstein 1994; March 1981). In the context of FEDI adoption, the greater the extent of adoption in a given sector, the more likely the potential adopters in that sector would adopt the innovation to avoid being perceived as

technologically less advanced and as less suitable trading partners than their competitors that have adopted. Hence, a corollary to H1 would be:

H1a: Greater extent of adoption of FEDI among its competitors will lead to greater intent to adopt FEDI.

Besides cue-taking from the collective action of similar others, organizations are particularly apt to imitate the behaviors of those whom they perceive as successful (Burns and Wholey 1993; DiMaggio and Powell 1983; Haunschild and Miner 1997). Organizations can learn vicariously, copying or avoiding certain organizational practices according to their perceived impact or outcomes (Levitt and March 1988; Miner and Haunschild 1995). Copying fruitful products or practices for *second-mover advantage* may allow an organization to unwittingly acquire some unexpected or unsought unique advantages (Lieberman and Montgomery 1988). Innovation profitability has been proposed as a key factor determining its rate of adoption (Rogers 1995). Mimicking behaviors of these successful organizations could also accrue an external referent of prestige (Perrow 1961).

Although there are no studies directly examining mimicry of IT practices, there is implied evidence that followers, out of competitive necessity, imitate pioneers that have successfully exploited IT, especially in the banking and airline industries (Clemons 1990; Copeland and McKenney 1988). Therefore, in the context of FEDI adoption, potential adopters will be more likely to adopt if they perceive that FEDI has conferred success on adopters. Hence, a corollary to H1 would be:

H1b: Greater perceived success of competitors that have adopted FEDI will lead to greater intent to adopt FEDI.

Coercive Pressures

Coercive pressures are defined as formal or informal pressures exerted on organizations by other organizations upon which they are dependent (DiMaggio and Powell 1983). Empirical

evidence suggests that coercive pressures on organizations may stem from a variety of sources including resource-dominant organizations, regulatory bodies, and parent corporations, and are built into exchange relationships. A dominant actor that controls scarce and important resources may demand that organizations dependent on it adopt structures or programs that serve its interests, and these resource-dependent organizations may comply with the demands to secure their own survival (Pfeffer and Salancik 1978). When an organization enters into an exchange relationship that runs counter to institutionalized patterns, the maintenance of the relationship would generally be difficult and require greater effort, or worse, be unsustainable. Thus, organizations characterized by an institutionalized dependency pattern are likely to exhibit similar structural features such as formal policies, organizational models, and programs. Indeed, institutional arguments on coercive pressures stem mainly from the resource-dependence perspective (DiMaggio 1988), and have received much empirical support in the institutional literature (e.g., Mezas 1990; Palmer et al. 1993). Hence, we hypothesize:

H2: Greater coercive pressures will lead to greater intent to adopt FEDI.

In the context of FEDI adoption, we believe coercive pressures stem mainly from dominant suppliers, dominant customers, and the parent corporation. Dependence on customers arises when organizations rely heavily on customers that account for much of their sales and customers that have alternative suppliers. Dependence on suppliers arises when organizations are unable to switch to alternative suppliers, thereby relying on existing suppliers that account for much of their purchases. Several IS researchers have argued the relevance and presented evidence of coercive isomorphism for EDI adoption (e.g., Chwelos et al. 2001; Hart and Saunders 1997; Webster 1995). Resource-dominant organizations that have adopted EDI, would attempt to influence their resource-dependent trading partners to adopt EDI so as to increase their own benefits of adoption.

For instance, General Motors was successful in "persuading" its car dealers to tender payment for the vehicles sold through ACH debit transfers (Knudson et al. 1994). In the context of FEDI adoption, organizations are thus likely to receive both formal and informal pressures from dominant supplier adopters that want to maximize their benefits of adoption through speedy cash collection and reduction of paperwork. Similarly, both General Motors and Ford Motor Company required that their suppliers use EDI in order to retain their business (Fallon 1988; Webster 1995). Hence, in the context of FEDI adoption, organizations may receive similar pressure from dominant customer adopters that want to reduce administrative disbursement costs and enhance systems efficiencies. In sum, organizations may imitate the adoption behavior of dominant suppliers and dominant customers that have adopted FEDI to acquire legitimacy or status, or to demonstrate their fitness to do business with these dominant organizations. Hence, we state two corollaries to H2:

H2a: Greater perceived dominance of its suppliers that have adopted FEDI will lead to greater intent to adopt FEDI.

H2b: Greater perceived dominance of its customers that have adopted FEDI will lead to greater intent to adopt FEDI.

Organizations may also receive coercive pressure from parent corporations in addition to resource-dominant trading partners. DiMaggio and Powell noted that subsidiaries are required to conform to practices and structures that are compatible with the policies of the parent corporation. Hence, parent corporations that have adopted FEDI are likely to exert pressure on subsidiaries to do likewise. Parent corporations with foreign subsidiaries may also require these subsidiaries to adopt FEDI in order to enhance system efficiencies and reduce bank and foreign currency conversion costs (Holland et al. 1994). Hence, a corollary of H2 would be that subsidiaries are likely to follow the behavior of parent corporations that have adopted FEDI.

H2c: Adoption of FEDI by parent corporation will lead to greater intent to adopt FEDI.

Normative Pressures

According to social contagion literature, a focal organization with direct or indirect ties to other organizations that have adopted an innovation is able to learn about that innovation and its associated benefits and costs, and is likely to be persuaded to behave similarly (Burt 1982). Sharing these norms through relational channels among members of a network facilitates consensus which in turn increases the strength of these norms and their potential influence on organizational behavior (Powell and DiMaggio 1991). These normative pressures manifest themselves through dyadic interorganizational channels of firm-supplier and firm-customer (Burt 1982) as well as through professional, trade, business, and other key organizations (Powell and DiMaggio 1991). Hence, in the context of FEDI adoption, normative pressures faced by an organization stand to be increased by a higher prevalence of adoption of FEDI among its suppliers and customers, and by its participation in professional, trade, or business organizations that sanction the adoption of FEDI. Hence, we hypothesize:

H3: Greater normative pressures will lead to greater intent to adopt FEDI.

If two actors have direct and frequent communication with each other, they are more likely to think alike or behave similarly (e.g., Burt 1982; Erickson 1988). From a potential adopter's perspective, the perceived value of adoption would increase to the extent that its contacts have adopted the innovation and communicated their reasoning (Davis 1991; Palmer et al. 1993). Huff and Munro (1985) reported that information gathered through interorganizational communication had been used to understand the implications of adopting new information systems products. Hence, as an organization perceives more of its contacts adopting an innovation, adop-

tion may come to be deemed normatively appropriate for the organization (Davis 1991). Some researchers have observed that a wide extent of use may also serve as a proxy indicator that a practice has technical value (Abrahamson and Rosenkopf 1993; Haunschild and Miner 1997). In the case of interactive technologies (such as electronic mail and EDI) that involve reciprocal interdependence (Markus 1987) and complementary innovations, frequency of use among an organization's suppliers and customers may directly create positive externalities and increase the technical value of that innovation for the adopting organization (Farrell and Saloner 1985). Bouchard (1993) confirmed this observation when she found that an organization's decision to adopt EDI was contingent on the number of trading partners that had adopted, and not dependent on its perception of EDI characteristics. Organizations contemplating FEDI adoption are likely to be influenced by the extent of adoption among their suppliers and customers with whom they have direct ties. Hence, two corollaries to H3 would be:

H3a: Greater extent of adoption of FEDI among its suppliers will lead to greater intent to adopt.

H3b: Greater extent of adoption of FEDI among its customers will lead to greater intent to adopt.

Dyadic communication channels are not the only conduits through which norms are diffused from organization to organization. Organizational decision makers turn to norms, standards, and solutions that are institutionalized in their business and professional circles (DiMaggio and Powell 1983). In practice, these standards of behavior are diffused by key institutions that provide forums for information exchange, set standards, provide education, conduct promotions, and evaluate success of practices in professional and trade magazines. Key institutions that could influence organizational behavior with respect to IT innovation adoption include government sanctioned bodies, standards bodies, and professional and industry associations (King et al. 1994). Participation in these associations may render events

(adoption of new technologies) that are otherwise distant more proximate and salient. Hence, a corollary to H3 would be that decision makers who participate in associations that promote and disseminate information on FEDI adoption are more likely to be positively inclined toward the innovation:

H3c: Participation in associations that promote and disseminate information on FEDI will lead to greater intent to adopt FEDI.

The Impact of Perceived Innovation Complexity

Perceived innovation complexity, the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers 1995), has been widely recognized as an inhibitor to adoption (Grover 1993; Tornatzky and Klein 1982). However, its role in the relationship between institutional pressures and innovation adoption has hardly been explored. Organization learning theories assume that, at any given moment, organizations possess some bundle of knowledge and skills that are related to their current operational and managerial processes (Fichman and Kemerer 1997). A complex innovation thus increases the bundle of knowledge and skills an organization has to acquire in order to assimilate that innovation effectively (Rogers 1995). The heightened knowledge gap between what is required and what an organization has currently creates a higher sense of uncertainty about that innovation for the organization. Theories and empirical studies of uncertainty (e.g., DiMaggio and Powell 1983; Festinger 1954; Haunschild and Miner 1997) posit that when technologies are poorly understood, mimetic pressures are likely to be strengthened, unlike coercive and normative pressures. Organizational decision makers may base their own decisions about a complex innovation on its pattern of use and its effects on similar others to economize on search and experimentation costs, and to reduce associated risks. DiMaggio and Powell suggest that the

greater the uncertainty between the means and the ends, the greater the extent to which an organization will model itself after organizations that it perceives to be similar and successful. Hence, we hypothesize:

H4: Mimetic pressures will have a more significant impact on intention to adopt FEDI when perceived complexity is higher than when it is lower.²

Control Variables

Prior research on organizational innovation studies and feedback from informed participants suggests a number of additional factors be included because of their potential influence on organizational adoption intention:

1. Organization size has been found to have a positive influence on adoption behavior (Rogers 1995). Large organizations are more likely to adopt FEDI than small organizations because they possess the resources and the skills necessary to assimilate that innovation effectively, and they possess the economies of scale in transactions to leverage their investment in FEDI (O'Hanlon 1993). Organization size is used in many innovation studies as a surrogate measure for total resources, slack resources, and organization structure (see Rogers 1995).
2. IT department size represents the technical resources an organization possesses to effectively assimilate an innovation (e.g., Damanpour 1991). Technical resources have been found to be extremely important in adoption of technological innovations (e.g., Zmud 1984) because the larger the department size, the broader the technological knowledge base of the organization for introducing and deploying information system innovations.

²We thank the editors and the reviewers for the suggestion to incorporate this hypothesis.

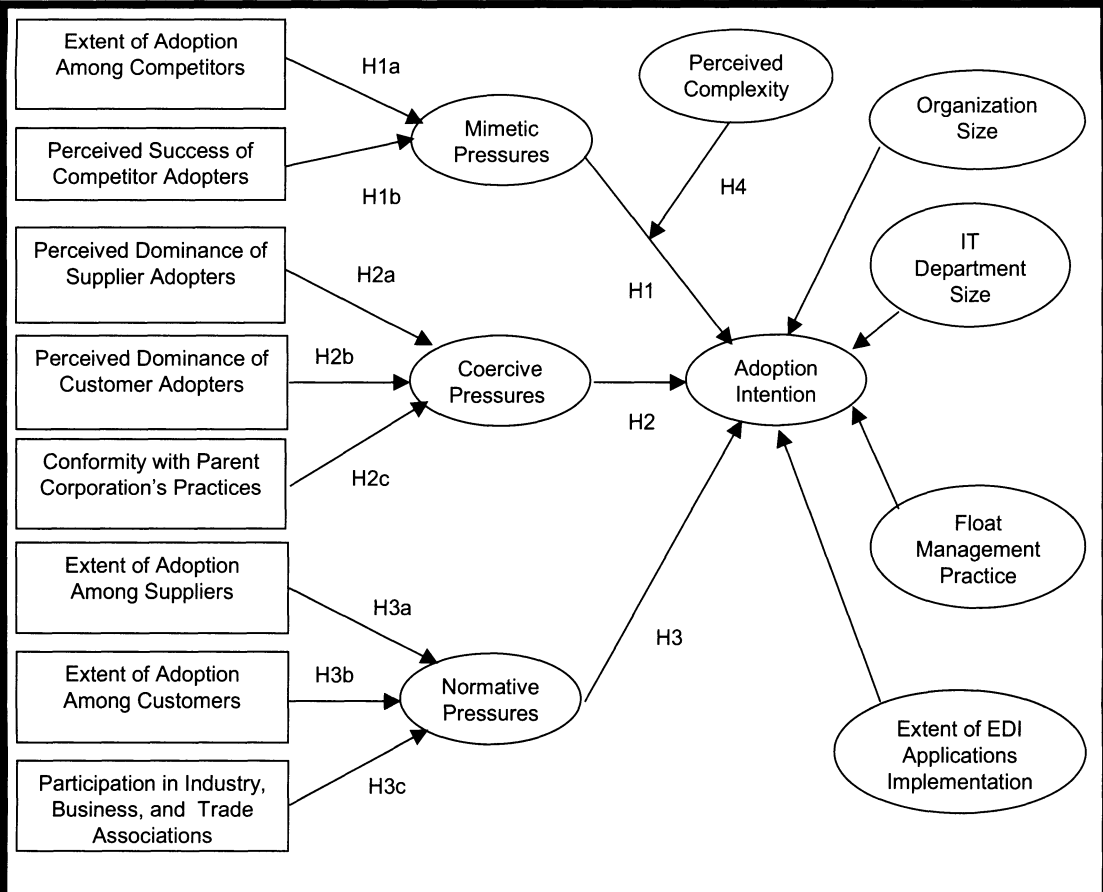


Figure 1. The Research Model

3. The extent of EDI applications implementation (for preorder, procurement, logistics, and invoicing activities) in the organization could have a positive effect on adoption intention. First, implementing these upstream EDI solutions may provide complementarity benefits toward adopting FEDI (O'Hanlon 1993). Second, the experience gained through these implementations could provide greater confidence to the decision makers to assimilate FEDI more effectively, which would in turn influences their intentions toward FEDI.
4. Float management practice is cited as a hindrance to adopting FEDI because of the

potential loss in float gains and the business processes changes required for adopting FEDI by key organizational informants.

Figure 1 depicts the research model.

Research Method

The survey method was used to test the model because it provides a basis for establishing generalizability, allows replicability, and has statistical power. First, a literature search was carried out within the domain of the constructs to

generate sample items. Short interviews with 15 finance managers were next conducted to assess their face validity followed by a process of conceptual validation. A *pilot study* involving 105 top-level executives (CEO, CIO, CFO) of listed firms was then conducted to assess the reliability and validity of these constructs. Finally, we drew our sample from Dun and Bradstreet (Singapore), which lists the name and contact information of 1,107 key businesses from a broad spectrum of industries operating in Singapore. After omitting the banks and the pilot study participants from the list, the survey instrument was administered to the CEO, the CFO, and the CIO of the remaining 1,021 organizations. The instrument was further validated by assessing the measurement model using confirmatory factor analyses (LISREL 8.51).

Scale Development, Conceptual Validation, and Pilot Study

Empirical literature on institutional-based theories examined for validated measures of mimetic, coercive, and normative pressures showed that most of the measures developed were too idiosyncratic for use in our context. Moreover, studies on the adoption of interactive technologies that incorporated these measures had operationalized them at an individual level within organizations instead of at an organizational level within interorganizational networks (e.g., Rice and Aydin 1991). Hence, conceptual definitions from the literature were employed to develop the questionnaire items.

Mimetic Pressures

The mimetic pressures construct was operationalized as a formative, emergent construct formed from two subconstructs: the extent of adoption by competitors (*Co-adp*) and the perceived success of adoption by competitors (*Co-suc*). The theoretical rationale is that extent of adoption by competitors is not necessarily

correlated with the perceived success of adoption by competitors. For instance, a lone adopter of an innovation may be perceived as highly successful in adopting that innovation.

As in Palmer et al. (1993), the former subconstruct was measured as the *perceived* extent of existing (at the point of survey) adoption by competitors in the primary industry to which an organization belongs. Primary industry was defined as the sector that accounts for most of an organization's sales. Perceived instead of actual extent of adoption was used because no consolidated archival data exist on FEDI adoption and managers decide based more on their perceptions than on their actual understanding of the real world (Nutt 1984). A seven-point scale was used to gauge the *perceived* extent of adoption by competitors, with 1 reflecting zero extent and 7 reflecting 100 percent extent. The latter subconstruct was operationalized by asking respondents to indicate on a seven-point scale the extent to which competitors that have adopted FEDI had benefitted greatly, and had been perceived favorably by others in their industry, supplier industry, and customer industry.

Coercive Pressures

Drawing on Pfeffer and Salancik (1978) and on DiMaggio and Powell (1983), we operationalized coercive pressures as a formative, emergent construct formed from three subconstructs: perceived dominance of supplier adopters (*Dom-su*), perceived dominance of customer adopters (*Dom-cu*), and conformity with parent corporation's practices (*Par-adp*). The coercive pressures construct was operationalized this way because these three constructs do not necessarily correlate with one another and an organization may experience varying or contrasting levels of dependence on these dominant actors.

Perceived dominance of supplier adopters was measured by asking respondents to indicate whether their organization's well-being depended

on these supplier adopters, whether they could switch to alternative suppliers, whether it was critical to maintain good relationships with these supplier adopters, and whether these supplier adopters represent the core suppliers in their industry. Questions used to gauge perceived dominance of supplier adopters were also used to measure perceived dominance of customer adopters by simply replacing *supplier* with *customer*. Conformity with the parent corporation's practices was measured by a surrogate binary variable indicating whether the parent corporation had adopted FEDI (1 = adopted, 0 = not adopted). Organizations are likely to face greater conformity pressures when their parent corporations have adopted FEDI.

Normative Pressures

Normative pressures could arise from members of dyadic relational channels and multilateral organizations such as professional, trade, and industry organizations. Hence, as argued for the cases of mimetic and coercive constructs, we operationalized the normative pressures construct as a formative, emergent construct formed by three subconstructs: the extent of existing FEDI adoption by an organization's suppliers (*Su-adp*) and customers (*Cu-adp*), and participation in professional, trade, and business bodies that promote and disseminate information on FEDI adoption (*Member*). The first two constructs were measured and coded in the same way as the extent of existing adoption by competitors. Normative influence from institutional members was gauged by asking whether or not the respondents were members of any professional, trade, or business associations that endorse FEDI (1 = yes, 0 = no) because organizations are apt to act collectively when they are members of these associations.

Perceived Innovation Complexity

Perceived innovation complexity was measured by asking respondents to indicate the level of

difficulty in (1) understanding FEDI from a business perspective, (2) understanding FEDI from a technical perspective, (3) using FEDI, (4) using FEDI to maintain an audit trail, (5) using FEDI to trace and resolve transactional errors, and (6) using FEDI to understand and visualize the whole process of cash disbursement and collection. Predisposition toward FEDI may differ according to the perceived innovation complexity of the decision makers.

Intention to Adopt

Based on Azjen and Fishbein (1980), we measured intention to adopt FEDI as a reflective construct by asking respondents to indicate whether (1) they were contemplating FEDI adoption or (2) they were likely to adopt it within a year. These questions incorporate actions (contemplating to adopt, likely to adopt), target (FEDI), context (organization), and time (within a year) which are essential elements of intention and behavior. All items in the questionnaire were anchored on appropriately labeled seven-point scales (see Appendix A).

Control Variables

Organization size was measured using the total number of employees of the organization. IT department size was measured by the total number of IT personnel. Because their data were skewed, natural logarithms of organization size and IT department size were used in the data analyses. Existence of EDI applications implementation was measured by asking the respondents to indicate if they had implemented EDI for preorder, procurement, logistics, and invoicing processes. A five-point scale was created out of these responses. Existence of float management practice was determined by a binary variable indicating if the organization practiced float management (1 = yes, 0 = no).

Conceptual Validation and Pilot Study

A process of conceptual validation was next carried out for the theoretical constructs with multiple indicators (intention to adopt, dominant suppliers, dominant customers, perceived success of competitors that have adopted FEDI, innovation complexity). As in Moore and Benbasat (1991), four rounds of sorting the questions were performed, each involving four judges who were information systems faculty members or graduate students. There were no major problems, thus indicating that the constructs possess adequate conceptual validity. A *pilot study* involving the CEO, the CFO, and the CIO of 158 publicly listed organizations was conducted using the improved questionnaire. Cronbach's alpha computations and factor analyses (Kerlinger 1986) were performed based on the 105 responses received from the executives and confirmed the stability and validity of these constructs in the survey instrument.³

The Survey

The definition and description of FEDI were included in the survey instrument to improve the validity of the responses. A package containing a cover letter stating the study objective, a copy of the questionnaire (including one adopter and one nonadopter version), and a prepaid reply envelope was sent to each CEO, CFO, and CIO of 1,021 organizations listed in Dun and Bradstreet Directory (Singapore) with complete information. Banks and organizations that participated in the short interviews and the pilot study were left out of the study. The CEO, the CFO, and the CIO were selected as the key people making FEDI adoption decisions. Moreover, as boundary-spanning personnel (Tushman and Scanlan 1981) and opinion leaders (Rogers 1995), they were likely to be recipients of diverse information, and would thus be most cognizant of their environment.

Viewpoints of different individuals are particularly important in the institutional context because they are entrenched simultaneously in both similar and different web of values, norms, rules, beliefs and taken-for-granted assumptions (e.g., inter-organizational web versus professional web).

Respondents were instructed to complete the appropriate version of the questionnaire, depending on whether they were adopters or not. Of the 3,063 questionnaires sent out, 396 (132 organizations) could not be delivered by the postal service at the stated addresses. A check with the business telephone directory confirmed that 78 organizations had changed addresses. The remaining 54 could not be located. Additional parcels were sent to 234 respondents at their new addresses and to 41 respondents who had misplaced theirs. Follow-up calls were made to increase the response rate.

The 583 individual returns received were scrutinized for data reliability. First, the accuracy of certain questionnaire items (e.g., questions on adopter/nonadopter, extent of adoption, parent corporation adoption status) were verified by comparing responses from respondents in the same organization and organizations that belong to the same Standard Industry Classification (SIC) sectors. In cases where conflicting answers were provided, phone calls were made to the respondents to clarify and understand their rationale for their answers. Second, as completion of questionnaires has been known to be delegated to secretaries or junior people with no decision making responsibilities, we confirmed that our target respondents contributed to completing the questionnaire by making phone calls to each respondent (under the guise of thanking them personally) to ascertain if he/she was aware of the survey and to clarify certain of their answers.

As a result of this scrutiny, 35 questionnaires were discarded. The remaining 548 were segregated according to nonadopters and adopters of FEDI. In all, 160 CEOs, 177 CFOs, and 155 CIOs from 222 nonadopting organizations, and 15 CEOs, 26 CFOs, and 15 CIOs from 30 adopting organi-

³Please see Teo (1998) for detailed results of the conceptual validation and pilot study.

zations replied. Response rates at the individual and organizational levels were 26.2 percent and 26.0 percent respectively. This response rate is considered reasonable because the survey was unsolicited and it involved senior management. Only responses from nonadopting organizations were used for data analyses in order to have predictive value on adoption intention, and to avoid the respondent-recall problem and the problem of correlating today's variables with yesterday's innovativeness. There were no significant differences in sales turnover and number of employees between organizations that responded and those that failed to respond.⁴

Data Analyses and Results

Analysis Strategy

Because we were interested in the effects of institutional variables on organizational adoption intention toward FEDI, a firm-level model was developed and tested. Firm-level data were derived by averaging the scores of each item for all respondents from each organization. There were three individuals' responses from 124 organizations, dual responses of CEO's and CFO's, CEO's and CIO's, and CFO's and CIO's from 7, 6, and 9 organizations respectively, and single response of CEO's, CFO's, and CIO's from 23, 37, and 16 organizations respectively. Using a single model fitted with pooled data does not introduce any adoption bias since multiple one-way analyses of variance of all exogenous constructs and the adoption intention for CEO, CFO, and CIO showed no significant differences. Table 1 provides a profile of these nonadopting organizations. Tables 2 and 3 show the descriptive statistics and the intercorrelations of the study variables respectively.

⁴Sales turnover and number of employees were chosen as the criteria for a response bias test because they were available for both respondents and non-respondents, and because they reflected the ability of organizations, given their willingness, to adopt FEDI.

Structural equation modeling (SEM) was adopted for data analyses. In this study, LISREL was used to perform confirmatory factor analysis of the measurement items that were used to capture the dimensions of the subconstructs. Using LISREL for confirmatory factor analyses provides a more rigorous assessment of the fit between the collected data and the theoretical factor structure, and satisfies the minimum requirements of assessing the measurement properties of unidimensionality, convergent validity, and discriminant validity (Bagozzi 1980).

PLS, as implemented in PLS Graph version 2.91.03.04, was chosen and used for hypotheses testing primarily because it allows latent constructs to be modeled as either formative or reflective indicators. Reflective indicators *reflect* an unmeasured latent construct that is deemed to exist before it is measured, and are invoked to account for the observed variances and covariances. Formative indicators are used to form a superordinate construct (used as categorization and measurement devices for complex phenomena) where the individual indicators are weighted according to their relative importance in forming the construct (Chin 1998, Law et al. 1998). Formative indicators are also invoked to minimize residuals in the structural relationships.

In this model, the three exogenous constructs—mimetic, coercive, and normative pressures—were operationalized as formative, emergent constructs formed from first-order reflective subconstructs. PLS has an added advantage over LISREL in that it follows a components-based strategy and thus does not depend on having multivariate normal distributions, interval scales, or a large sample size (Fornell and Bookstein 1982). While LISREL's emphasis is on overall model fit, making it "closer to the model, more confirmatory, and more model analytic," PLS is more prediction-oriented and seeks to maximize the variance explained in constructs, thus making it "closer to data, more exploratory, and more data analytic" (Barclay et al. 1995). Given the prediction-oriented nature of this study and the use of non-interval scales, PLS was the preferred technique for testing the structural model.

Table 1. Profile of Potential Adopting Organizations that Responded

Demographic/Control Variables	Category	Frequency (n = 222)	Percent
Industry:	Manufacturing	113	(50.9%)
	Services	62	(27.9%)
	Trading/Commerce	47	(21.2%)
Annual Sales: (US\$ million)	< \$10	29	(13.1%)
	\$10 – 19.99	51	(22.9%)
	\$20 – 39.99	47	(21.1%)
	\$40 – 69.99	39	(17.6%)
	\$70 – 149.99	29	(13.1%)
	> \$150	25	(11.3%)
	Missing	2	(0.9%)
Number of Employees:	< 100	69	(31.1%)
	100 – 399	88	(39.6%)
	400 – 699	28	(12.6%)
	700 – 999	12	(5.4%)
	> 1000	23	(10.4%)
	Missing	2	(0.9%)
Number of IT Employees:	≤ 10	172	(77.4%)
	11 – 50	38	(17.1%)
	51 – 100	4	(1.8%)
	> 100	6	(2.7%)
Existence of EDI Applications for:	Preorder Activities	23	(10.4%)
	Procurement Activities	88	(39.6%)
	Logistics Activities	27	(12.2%)
	Invoicing Activities	37	(16.7%)
Existence of Float Management Practice:	Yes	62	(27.9%)
	No	160	(72.1%)

Table 2. Descriptive Statistics of Variables		
Study Variables	Mean	Std Dev
Subconstructs		
Extent of Adoption by Competitors (Co-adp)	3.70	1.27
Perceived Success of Competitors that have adopted FEDI (Co-suc)	3.76	1.07
Perceived Dominance of Suppliers that have adopted FEDI (Dom-su)	3.38	1.22
Perceived Dominance of Customers that have adopted FEDI (Dom-cu)	3.77	1.32
Conformity with Parent Corporation's Practices (Par-adp)	.11	.29
Extent of Adoption by Suppliers (Su-adp)	2.92	1.27
Extent of Adoption by Customers (Cu-adp)	3.41	1.32
Participation in Industry, Trade or Professional Bodies that sanctioned FEDI (Member)	.50	.49
Perceived Complexity of Using FEDI (P-cplx)	4.44	1.04
Control Variables		
Extent of EDI Applications Implementations (EDI-Appl)	0.53	.98
Size of Information Technology Department (IT-size)	2.37	8.12
Firm Size (Firm-size)	489	1091
Float Management Practice (Float)	.28	.45
Endogenous Construct		
Adoption Intention	3.22	1.29

Evaluating the Measurement Model

Four multiple-items constructs—perceived success of competitors that have adopted FEDI, perceived dominance of suppliers that have adopted FEDI, perceived dominance of customers that have adopted FEDI, and perceived innovation complexity—were subject to confirmatory factor analyses using LISREL 8.51. The validity of the constructs was assessed in terms of unidimensionality, convergent validity, internal consistency, and discriminant validity. All other constructs in the model were operationalized through single indicators.

Unidimensionality and convergent validity ensures that all items measure a single underlying construct (Bagozzi and Fornell 1982). The initial model structure of the four multiple-items constructs comprised of 18 items was found to have poor model fit (see Table 5). Following an iterative procedure of changing one item in each step and the modification indices provided by

LISREL (Jöreskog 1993), refinements to this model were made by eliminating three of the perceived innovation complexity indicators (see Appendix A for the items marked for deletion) with low loadings or high cross loadings.

The final model comprised of 15 items showed significant improvement (see Tables 4 and 5). As is evident, all except one indicator loading were about the criterion of .707 and significant (Hair et al. 1998). The errant indicator, Dom-su03, which has a loading of .67, has no cross-loading problem, was significant, and did not contribute to problems of convergent validity and internal consistency, was retained. The model fit indices (Table 5) also provide adequate evidence of the unidimensionality of the items. Except for the RMSEA index, which was slightly higher than the criterion of .08, all indices, particularly the important robust indices of Comparative Fit Index (CFI) (Bentler 1990) and Tucker-Lewis Index (TLI) (Tucker and Lewis 1973), were above their criterion levels.

Table 3. Intercorrelations Among Study Variables													
Variables	Co-adp	Co-suc	Dom-su	Dom-cu	Par-adp	Su-adp	Cu-adp	Member	P-cplx	EDI-appl	IT-size	Firm-size	Intent
Co-adp	1.000												
Co-suc	0.562	1.000											
Dom-su	0.340	0.496	1.000										
Dom-cu	0.316	0.538	0.676	1.000									
Par-adp	0.104	0.065	-0.008	-0.047	1.000								
Su-adp	0.822	0.526	0.442	0.381	0.026	1.000							
Cu-adp	0.687	0.460	0.239	0.376	0.000	0.643	1.000						
Member	0.237	0.134	0.071	0.078	0.076	0.230	0.143	1.000					
P-cplx	-0.120	0.173	0.119	0.056	-0.002	-0.109	-0.114	0.163	1.000				
EDI-appl	0.040	-0.087	-0.052	-0.061	0.124	0.036	0.064	-0.009	-0.214	1.000			
IT-size	0.070	-0.052	0.021	-0.026	0.120	0.082	0.038	0.186	-0.125	0.108	1.000		
Firm-size	0.070	0.007	0.022	-0.008	0.048	0.119	0.067	0.190	-0.122	0.070	0.573	1.000	
Float	-0.110	-0.022	0.043	0.007	0.008	0.004	-0.067	-0.085	0.035	-0.118	0.256	0.230	1.000
Intent	0.329	0.308	0.168	0.146	0.220	0.290	0.280	0.466	-0.255	0.015	0.177	0.157	0.067
													1.000

Table 4. Operationalization of Multiple-Item Subconstructs: Evidence of Unidimensionality		
Construct Items	Standardized Parameter Estimate	t-value
Perceived Success of Competitors that have adopted FEDI (Co-suc)		
Co-suc01	0.86	14.18
Co-suc02	0.97	17.35
Co-suc03	0.88	14.68
Co-suc04	0.91	15.67
Perceived Dominance of Suppliers that have adopted FEDI (Dom-su)		
Dom-su01	0.94	16.24
Dom-su02	0.94	16.11
Dom-su03	0.67	9.73
Dom-su04	0.73	11.02
Perceived Dominance of Customers that have adopted FEDI (Dom-cu)		
Dom-cu01	0.93	16.10
Dom-cu02	0.88	14.57
Dom-cu03	0.79	12.40
Dom-cu04	0.85	13.81
Perceived Complexity of Using FEDI (P-cplx)		
P-cplx01	0.93	15.33
P-cplx01	0.86	13.00
P-cplx01	0.81	12.54

Table 5. Goodness of Fit Indices for the Measurement Model			
Goodness of Fit Indices	Initial Model	Revised Model	Desired Levels
χ^2	537.93	215.14	Smaller
df	129	84	—
χ^2/df	4.17	2.56	< 3.0
GFI	.74	.88	> .90
AGFI	.66	.80	> .80
Standardized RMR	.08	.05	< .05
RMSEA	.13	.085	.05 – .08
NFI	.81	.90	> .90
CFI	.85	.94	> .90
TLI	.82	.92	> .90
Number of Latent Variables	4	4	—
Total Number of Items	18	15	—

Table 6. Assessment of Internal Consistency and Convergent Validity

Dimensions	Number of Items	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Perceived success of competitor adopters that have adopted FEDI	4	.944	.948	.821
Perceived dominance of supplier adopters that have adopted FEDI	4	.800	.896	.687
Perceived dominance of customer adopter that have adopted FEDI	4	.927	.921	.746
Perceived complexity of using FEDI	3	.901	.901	.753

The internal consistency of each dimension was assessed by computing the Cronbach's alpha, composite reliability, and the average variance extracted (Hair et al. 1998). Table 6 presents the results along these dimensions. All Cronbach's alpha and composite reliabilities exceeded Nunnally's (1978) criterion of .70 while the average variances extracted for these constructs were all above the recommended threshold of .50 (Hair et al. 1998).

Discriminant validity reflects the extent to which the measures for each construct are distinctly different from each other, and is generally assessed by testing whether the correlations between pairs of constructs are significantly different from unity (Anderson 1987). For each pair of constructs, the correlation between a referent construct and another construct was unconstrained in one model but was set to unity in another model. Constraining the correlation between pairs of constructs to be unity suggests that all of the items measure the same construct. Discriminant validity is established if the χ^2 -value of the unconstrained model is significantly lower than that of the constrained model. Table 7 provides strong evidence of discriminant validity. Additionally, as evident in Table 3, the correlations between all pairs of constructs are also below the threshold value of .90 (Bagozzi et al. 1991) reflecting that the constructs are distinct.

Testing the Structural Model

Following confirmation of good psychometric properties in the measurement model, PLS was used to assess the firm-level structural model. A bootstrapping procedure generating 250 random samples of size of 200 was used to estimate the significance of the path coefficients and the weights of the dimensions of constructs. Hypotheses and corollaries testing were performed by examining the size, the sign, and the significance of the path coefficients and the weights of the dimensions of the constructs respectively. Since PLS does not generate an overall goodness of fit index, one primarily assesses predictive validity by examining the R^2 and the structural paths. All statistical tests were assessed at 5 percent level of significance using one-tailed t-tests because our hypotheses and corollaries were unidirectional in nature.

Tables 8 and 9 and Figure 2 present the results of the PLS data analyses. Following Fichman and Kemerer (1997), we estimated three models: the full model, the theoretical model, and the control model. These three models were estimated to provide a basis for assessing the true impact of the theoretical variables and to rule out alternative explanations. A comparison between the full model and the control model shows that the full model explains a substantive incremental variance of (36.6 – 2.7) 33.9 percent. In contrast, the incremental variance derived by comparing the full

Table 7. Assessment of Discriminant Validity			
Dimensions	Constrained Model	Unconstrained Model	$\Delta \chi^2$
	χ^2 (df)	χ^2 (df)	
Perceived success of competitor adopters that have adopted FEDI with			
Perceived dominance of supplier adopters that have adopted FEDI	508.50 (20)	37.13 (19)	471.37*
Perceived dominance of customer adopter that have adopted FEDI	642.93 (20)	37.33 (19)	605.60*
Perceived complexity of using FEDI	1006.28 (35)	359.81 (34)	646.47*
Perceived dominance of supplier adopters that have adopted FEDI with			
Perceived dominance of customer adopters that have adopted FEDI	359.92 (20)	106.44 (19)	253.48*
Perceived complexity of using FEDI	935.62 (35)	391.83 (34)	543.79*
Perceived dominance of customer adopters that have adopted FEDI with			
Perceived complexity of using FEDI	964.78 (35)	368.22 (34)	596.56*

*All differences in χ^2 are significant at $p < .05$.

Table 8. Results of PLS Analysis: Path Coefficients			
Constructs	Path Coefficients		
	Full Model	Theoretical Model	Control Model
Mimetic Pressures	.083*	.090*	
Coercive Pressures	.156**	.162**	
Normative Pressures	.479**	.468**	
Firm Size	.01		.078
Size of IT Department	.007		.049
Extent of EDI Applications Implementations	.019		.022
Float Management Practice	.107		.096
Variance Explained in Adoption Intention (R^2)	36.6%	33.2%	2.7%

*Significant at 5% level of significance.

**Significant at 1% level of significance.

Table 9. Results of PLS Analysis: Weights of Dimensions of Constructs

	Weights	
	Full Model	Theoretical Model
Dimensions of Mimetic Pressures		
Extent of Adoption by Competitors (Co-adp)	.720**	.722**
Perceived Success of Competitors that have adopted FEDI (Co-suc)	.399**	.397**
Dimensions of Coercive Pressures		
Perceived Dominance of Suppliers that have adopted FEDI (Dom-su)	.302*	.301*
Perceived Dominance of Customers that have adopted FEDI (Dom-cu)	.343*	.346*
Conformity with Parent Corporation's Practices (Par-adp)	.825**	.822**
Dimensions of Normative Pressures		
Extent of Adoption by Suppliers (Su-adp)	0.139	.140
Extent of Adoption by Customers (Cu-adp)	.347**	.346**
Participation in Industry, Trade or Professional Bodies that sanctioned FEDI (Member)	.816**	.814**

*Significant at 5% level of significance.

**Significant at 1% level of significance.

model and the theoretical model amounts to a mere 3.4 percent. These results suggest that our theoretical model is substantive enough to explain a large proportion of the variance in organizational predisposition toward FEDI.

Table 8 lists the path coefficients of the formative constructs and the control variables and Table 9 shows the weights of the subconstructs respectively. Examining the theoretical model and the full model reveals that all three hypotheses involving mimetic pressures, coercive pressures, and normative pressures were significant. All of the respective corollaries, except for H3a (extent of adoption by suppliers), were also supported, indicating strong support for the role of institutional pressures in technological innovation adoption. Overall, normative pressures had the strongest effect on organizational

adoption intention toward FEDI, followed by coercive and mimetic pressures.

H4 was assessed by performing PLS analyses on two subsets of the data, obtained by splitting the original dataset based on the median of perceived complexity of using FEDI. Tables 10 and 11 report the results of the PLS analyses. As posited by uncertainty theories (e.g., Festinger 1954), mimetic pressures were significant when decision makers perceived the innovation to be highly complex and not significant otherwise. Interestingly, when decision makers perceived FEDI to be highly complex, they attended more to the effects of FEDI on other competitor adopters than to the extent of adoption among their competitors. Coercive and normative pressures had a significant effect regardless of the perceived complexity of using FEDI.

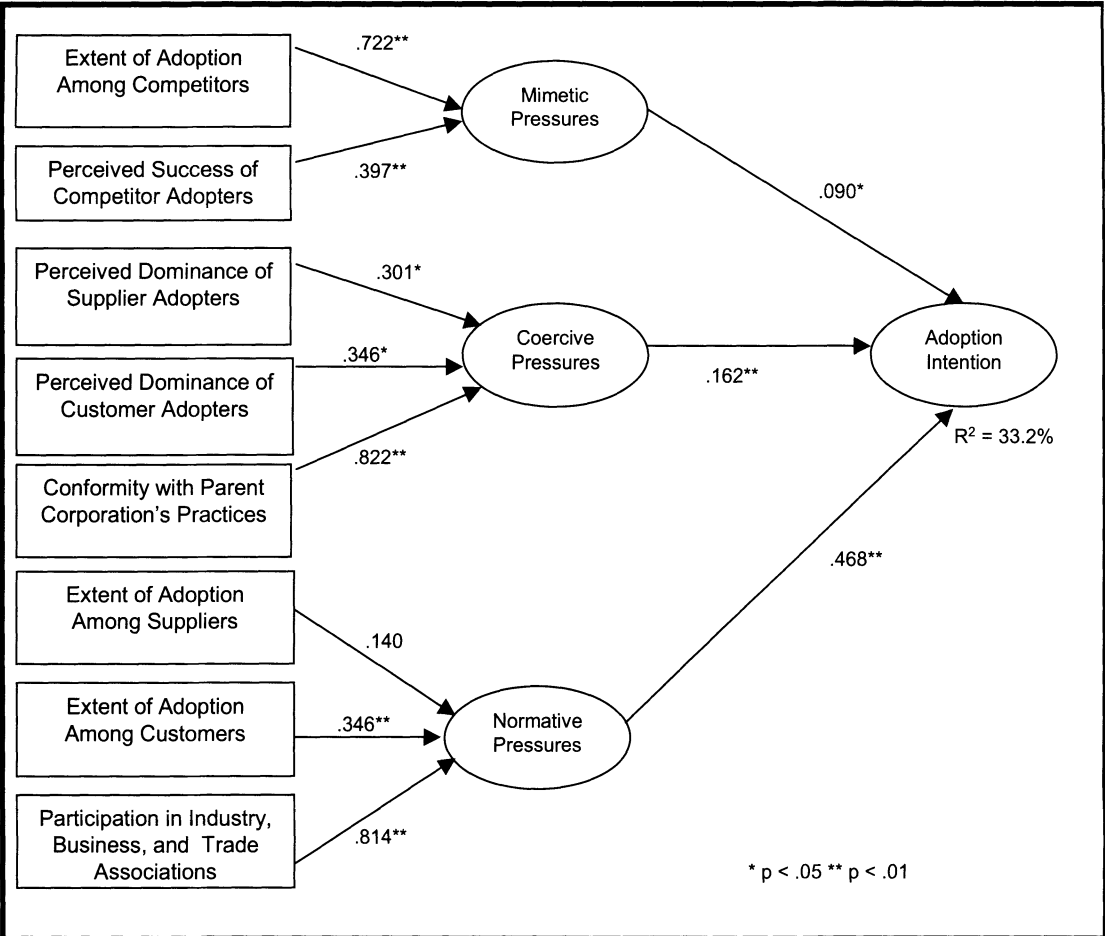


Figure 2. Results of PLS Analyses for Theoretical Model

Table 10. Results of PLS Analysis: Path Coefficients of Constructs for Low and High Perceived Complexity of Using FEDI

Constructs	Path Coefficients	
	Low Perceived Complexity of Using FEDI	High Perceived Complexity of Using FEDI
Mimetic Pressures	.047	.099*
Coercive Pressures	.227**	.150*
Normative Pressures	.485**	.415**
Variance Explained in Adoption Intention (R ²)	36.9%	32.1%

*Significant at 5% level of significance.

**Significant at 1% level of significance .

Table 11. Results of PLS Analysis: Weights of Dimensions of Constructs for Low and High Perceived Complexity of Using FEDI

	Weights	
	Low Perceived Complexity of Using FEDI	High Perceived Complexity of Using FEDI
Dimensions of Mimetic Pressures		
Extent of Adoption by Competitors (Co-adp)	.694**	.323
Perceived Success of Competitors that have adopted FEDI (Co-suc)	.348	.760**
Dimensions of Coercive Pressures		
Perceived Dominance of Suppliers that have adopted FEDI (Dom-su)	.091	.301*
Perceived Dominance of Customers that have adopted FEDI (Dom-cu)	.540*	.099
Conformity with Parent Corporation's Practices (Par-adp)	.809**	.466**
Dimensions of Normative Pressures		
Perceived Extent of Adoption by Suppliers (Su-adp)	.194	.132
Perceived Extent of Adoption by Customers (Cu-adp)	.291*	.394**
Participation in Industry, Trade or Professional Bodies that sanctioned FEDI (Member)	.819**	.785**

*Significant at 5% level of significance.

**Significant at 1% level of significance.

Discussion and Implications

Discussion of Findings

This study constitutes the first systematic tests of a fundamental linkage between institutional theory and adoption of IT-based IOL, an area that has not been comprehensively examined by previous studies of interorganizational IT innovation adoption in an integrative fashion. Consistent with institutional-based theories, our evidence indicates that all three institutional influences—mimetic pressures, coercive pressures, and normative pressures—can be clearly distinguished conceptually and empirically in terms of their

influence on organizational predisposition toward an IT-based IOL. Furthermore, as described in Teo et al. (2001), when institutional forces are examined as a whole, and their influence is evaluated within a larger set of factors that include *organizational readiness* to adopt FEDI and *attitudes toward adopting* FEDI, institutional factors still exhibit a significant and high influence on intentions to adopt. Overall, there is strong empirical support for institutional-based variables as predictors of adoption intentions for interorganizational linkages. This is in line with arguments and evidence that organizations may simultaneously use both social and technical indicators as guides to actions, even in a single domain such as FEDI adoption (Powell and DiMaggio 1991).

Among the social indicators, normative pressures exhibit the strongest influence on organizational predisposition toward FEDI. Norms espoused by the business and professional circles played a particularly major role in influencing organizational decision makers' inclinations to adopt FEDI, possibly because these business and professional associations provide an arena in which highly visible organizations supportive of FEDI adoption efforts are given strong recognition and substantive influence (DiMaggio and Powell 1983). Also, the unique context (Singapore) in which this research was conducted may help explain the importance organizational decision makers attached to normative pressures from these institutions. Operating in a collectivistic and paternalistic culture where the citizenry looks toward leading institutions for guidance and leadership on strategic issues, Singapore managers may tend to make organizational choices that are only endorsed and consistent with views espoused by government-sponsored and/or collective associations such as industry-wide EDI councils. This may especially be the case for IT/EDI innovation adoption where, traditionally, the government of Singapore and leading institutions have played an extremely proactive role in promoting the use of IT in general, and EDI in particular, to spur the economy and productivity growth (Gurbaxani et al. 1990; King and Konsynski 1990; Sisodia 1992). TradeNet, a well-established EDI system in Singapore, is an example where promotions by the government and trade associations were instrumental in accelerating widespread adoption among traders (Neo 1994). This may help explain why mimetic and coercive pressures do not have as significant an impact on adoption intention toward FEDI. Although this explanation may render our results not generalizable to North American situations (cf Chwelos et al. 2001),⁵ we

believe that our findings may still be applicable to adoption of EDI systems in similar environments such as the newly industrializing and developing countries. Given that organizations are embedded in social networks (Granovetter 1985), it would be credible to suggest that diffusion of FEDI in North America stands to be improved by the greater involvement of key institutions.

Norms arising from the greater extent of adoption among customers exert a strong influence on organizational decision makers' propensities to adopt FEDI than those from the extent of adoption among suppliers. This result suggests that organizational decision makers may be generally more customer-oriented and thus more attuned to the needs of customers than suppliers.

With respect to coercive pressures, our results suggest that organizational decision makers have a greater tendency to comply with the policies and the practices of their parent corporation than their trading partners, probably because their performance and tenure are subject to evaluation by the parent corporation's executives. This finding extends the empirical literature on EDI adoption and previous institutional studies, which tend to neglect the role parent corporations play in influencing adoption behavior, and have thus far restricted their attention to trading partners or regulatory bodies as dominant organizations imposing preferences on those dependent on it for resources or legitimization (e.g., Hart and Saunders 1997; Mezas 1990).

Our study adds to the growing evidence of mimetic influence on organizational actions by confirming its applicability to IT innovations adoption. This result is consistent with studies that reported the importance of competitive pressures in shaping EDI/technological innovation adoption behavior (e.g., Chwelos et al. 2001; Premkumar and Ramamurthy 1995). More importantly, we add a linkage between innovation diffusion theory and institutional and uncertainty theories by showing that mimetic influence was enhanced when the technological innovation is perceived to be complex by organizational decision makers.

⁵Canada, where the Chwelos study sample was collected, is larger and more dispersed and has 10 separate provincial institutional authorities that influenced the organizations in that sample, whereas Singapore is much smaller with one-tenth of the population and one central institutional authority that is highly influential.

Limitations and Future Research

Since this study was conducted in Singapore, it may limit the generalizability of our results to Singapore-based organizations and those in similar institutional contexts. Caution must therefore be exercised when generalizing these findings to organizations operating in different institutional and cultural environments. This generalizability may not be as severe as believed because Singapore, being a cosmopolitan city, attracted a number of multinational companies that are represented in our sample and have management with experience in other foreign institutional contexts to the extent local norms may not have a significant influence. Notwithstanding this limitation, we believe our research contributed to overall IS research by validating and assessing the applicability of innovation and institutional theories in an Asia Pacific context. The more studies of a cross-country/cross-cultural nature are conducted, the better informed we will be concerning the applicability of innovation theories under different political, institutional, economic, and cultural conditions.

Second, our operationalization of participation in professional and business bodies that endorsed FEDI may be potentially biased because organizations may also be exposed to negative information (e.g., adoption risks) through their participation in these bodies (Ravichandran 2001). A two tier questioning format—asking if respondents were participants of these bodies and the type of information (positive or negative) received from these bodies—may have been more appropriate. Notwithstanding this limitation, our study is one of the few that examines the importance of pro-innovation business and professional bodies in the diffusion of innovations. Future research could replicate the importance of these bodies and explore the impact of different roles (e.g., standards-setting, information dissemination, resources aggregation, arbitration) of these bodies on adoption of an interactive innovation that may be potentially useful for the entire industry.

Third, our results provide no empirical support for the perceived extent of existing adoption of

suppliers. If we argue intuitively that organizations are reluctant to adopt FEDI to minimize float loss to suppliers, we would expect the control variable, float management practice, to have a significant effect on organizational predisposition in our sample. However, this is not the case. Given the small number of companies that practiced float management in our sample, these variables need to be tested more thoroughly in future studies.

Fourth, although float management may not be a concern among our sample of respondents, there is a possibility that the effect of extent of adoption among suppliers and customers on organizational predisposition may be mediated by perceived usefulness, since the adopting organization can derive positive network effects from the extent of adoption among their trading partners. Hence, it may be worthwhile to examine the causal pathways of social processes on adoption in future studies. Fifth, our study was conducted in the early stage of FEDI adoption in Singapore. Based on our sample of respondents, only about 11 percent are adopters of FEDI. Care must be taken when generalizing our results to innovations that are in a different stage of adoption. Future research should test the applicability of these constructs for innovations that are in a different adoption stage.

Finally, while much of the IT innovation literature has incorporated diffusion of innovation and organizational theories, prior work incorporating institutional-based theories in the interorganizational context has been found lacking. It would be interesting to examine the cumulative as well as the individual impact of these theoretical perspectives on IT innovation adoption.

Implications for Theory and Practice

From an institutional theory perspective, our study extends its applicability to a technological innovation adoption context. Moreover, contrary to many institutional studies examining innovations that are well diffused (Meyer and Rowan 1977), our study implies that institutional theories may also be

applicable to innovations in the early stage of diffusion.

Within the diffusion framework (see Rogers 1995, p. 207), this study provides several contributions. First, it attends to the organizational and environmental levels of analysis, as called for by many researchers (e.g., Contractor and Eisenberg 1990; Rogers 1995), and elaborates the theoretical linkages between the nature of exchange relationships (e.g., structural equivalence versus relational proximity) and the adoption intention of organizational decision makers. Second, in addition to considering dyadic relationships, we also explicitly examined and established the role of multilateral, central organizations such as industry associations in organizational predisposition toward an IT-based IOL. Hence, this study goes beyond the usual communication channels (e.g., mass media versus interpersonal) explored in previous innovation studies. Third, compared to many studies, our results derive credibility and validity from the use of multiple members of top management as our respondents. Investments in costly technological innovations with organization- and interorganization-wide implications would not have been possible without their acquiescence (collective decision). Finally, it overcomes the *post-diction* criticism by focusing on adoption intention of potential adopters to build a model that is predictive in nature. While the post-diction approach has some merits, it limits our opportunities to draw immediate and practical implications for technology vendors, mediating institutions (e.g., EDI council), and adopters.

This study provides several practical implications for technology vendors, mediating institutions, and adopters. Our results suggest that technology vendors should work closely with government-sponsored IT councils, EDI standards bodies, and industry, trade, and professional associations (e.g., Data Processing Management Association) on promotional programs because these institutions possess the credibility to influence organizational decisions on IT-based IOL adoption. Technology vendors should target the parent corporation and its subsidiaries simultaneously because they are likely to adopt at the same time

(or soon after one another) to maintain a pattern of consistent and compatible relationships.

Our results also seem to suggest that technology vendors should focus their attention on dyadic links between a focal organization and its customers when promoting FEDI. Members of these dyadic relationships, interconnected with one another in terms of exchange transactions, are likely to adopt together to maximize their gains from using the interactive innovation. Given the strong influence of important customers, it would appear logical to target the most upstream organizations within a value chain as much as possible. Their influence could then trickle down to the remainder of the value chain.

Another important implication arising from our results is that technology vendors should highlight not only numbers of adoption among an organization's competitors but also name reference sites that have successfully adopted the technology when encouraging adoption among potential adopters. This strategy serves the purpose of reducing managerial uncertainty pertaining to the technological innovation. When decision makers of potential adopters perceive FEDI to be difficult to understand and use, technology vendors should provide and emphasize more information about competitors' successful adoption of FEDI to enhance and produce vicarious learning among potential adopters (Haunschild and Miner 1997).

For interactive interorganizational technologies, adopters other than technology vendors and mediating institutions would have self-interest in promoting diffusion among potential adopters (Markus 1987). Since early adopters of interactive innovation stand to gain from an increase in adoption among their trading partners, they should actively seek to participate in industry-wide IT/EDI councils to contribute their expertise, share their experience, and allow potential adopters to learn vicariously from their experience. Additionally, early adopters should work with technology vendors or consulting companies to help develop promotion programs that could address the concerns of those potential adopters.

Concluding Comments

This research enhances our understanding of how mimetic, coercive, and normative pressures existing in an institutionalized environment could contextualize and shape organizational adoption intention toward IT-based IOL. Overall, the results serve as a reminder that organizations are embedded in institutional networks. Diffusion practitioners should note that organizational actions are affected by actions at the level of the institutional environment, and should move upstream in the adoption process to work closely with key institutions and to capitalize on the imitative tendencies of organizations by providing visible and credible social and technical information.

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Appendix A

Measurement Items for Key Research Variables

Perceived Extent of Adoption by Competitors (Co-adp):

1 - None has adopted; 7 - All have adopted; Don't know

What is the extent of FEDI adoption by your firm's competitors currently?

Perceived Success of Competitors that have adopted FEDI (Co-suc):

1-Strongly Disagree; 7-Strongly Agree

My main competitors that have adopted FEDI:

have benefitted greatly (**Co-suc01**).

are perceived favorably by others in the same industry (**Co-suc02**).

are perceived favorably by suppliers (**Co-suc03**).

are perceived favorably by customers (**Co-suc04**).

Perceived Dominance of Suppliers that have adopted FEDI (Dom-su):

1-Strongly Disagree; 7-Strongly Agree; NA

With regard to my main suppliers that have adopted FEDI:

my firm's well-being depends on their resources (**Dom-su01**).

my firm cannot easily switch away from them (**Dom-su02**).

my firm MUST maintain good relationships with them (**Dom-su03**).

they are the core suppliers in a concentrated industry (**Dom-su04**).

Perceived Dominance of Customers that have adopted FEDI (Dom-cu):

1-Strongly Disagree; 7-Strongly Agree; NA

With regard to my main customers that have adopted FEDI:

my firm's well-being depends on their purchases (**Dom-cu01**).

my firm cannot introduce switching costs to them (**Dom-cu02**).

my firm MUST maintain good relationships with them (**Dom-cu03**).

they are the largest customers in the industry (**Dom-cu04**).

Conformity with Parent Corporation's Practices (Par-adp):

(Yes; No; NA)

Has your parent company adopted FEDI?

Perceived Extent of Adoption by Suppliers (Su-adp):

1 - None has adopted; 7 - All have adopted; Don't know

What is the extent of FEDI adoption by your firm's suppliers currently?

Perceived Extent of Adoption by Customers (Cu-adp):

1 - None has adopted; 7 - All have adopted; Don't know

What is the extent of FEDI adoption by your firm's customers currently?

Participation in Industry, Trade or Professional Bodies (Member):

(Yes; No)

Do you participate in any industry, trade or professional bodies where you have been exposed to FEDI promotion and information?

Perceived Complexity of Using FEDI (P-cplx):

1 - *Very Easy*; 7 - *Very difficult*

FEDI is conceptually difficult to understand from a business perspective (**P-cplx01**).

FEDI is conceptually difficult to understand from a technical perspective (**P-cplx02**).

Using FEDI is difficult (**P-cplx03**)

Using FEDI is difficult to maintain an audit trail (**P-cplx04**)*

Using FEDI is difficult to trace and resolve transactional errors (**P-cplx05**)*

Using FEDI is difficult to understand and visualize the whole process of cash disbursement and collection (**P-cplx06**)*

Intention to Adopt FEDI (Intent):

1 - *Strongly disagree*; 7 *Strongly agree*

I am contemplating to adopt FEDI in a year's time (Intent01).

I am likely to adopt FEDI in a year's time (Intent02).

Extent of EDI Applications Implementation (EDI-Appl):

(Tick where appropriate)

Has your firm implemented any EDI applications/messages in the following processes?

Preorder []; Procurement []; Logistics []; Invoicing [].

Firm Size (Firm-size): Derived from secondary sources (Ministry of Labor)

Size of Information Technology Department (IT-size)

What is the current number of IT professionals in your firm? _____

Float Management Practice (Float)

Does your firm practice float management currently? (Yes, No)

* *Marked for deletion.*