Interorganizational Information Systems: Exploring An Internet-Based Approach

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Information technology has become the de facto approach in making organizations’ operational, tactical, and strategic processes more efficient and effective. The Internet, with its unprecedented growth, is a promising platform to exchange information along the business channels. This study determines the critical factors to managers influencing their adoption decision of Internet-based interorganizational information systems (IBIS). The results of a field-based survey suggest that the factors that are significantly affecting the adoption decision of IBIS are pressures felt from trading partners, pressure felt from competitors, costs, reliability, security, scalability, complexity, support from upper management, and trust. A discussion of these factors and implications of results are presented.

In response to today’s competitive environment, information technology (IT) has become the de facto approach in making organizations’ operational, tactical, and strategic processes more efficient and effective. Furthermore, the competitive stakes have been raised and today’s opportunity areas often lie in establishing strategic alliances between trading partners in an organization’s supply chain. Accordingly, organizations are beginning to emphasize closer supplier-customer relationships in order to create more efficient operations. The time-critical nature of these communication challenges implies that IT solutions must be employed.

Increased intimacy in supplier-customer relationships creates the basis for the simplest form of supply chain. According to Handfield and Nichols (1999), "the supply chain encompasses all activities associated with the (bi-directional) flow and transformation of goods from the raw materials stage (extraction), through to the end user, as well as the associated information flows."

Interorganizational information systems (IOIS) provide organizations with capabilities to improve linkages between trading partners along the supply chain. Electronic Data Interchange (EDI) is a well-known, traditional form of IOIS. It permits organizations to generate electronic purchase orders, invoices, bills of lading, and a variety of other documents and send them instantly to trading partners anywhere in the world. The reduction in communications, labor, and material costs as well as the gain in competitive advantage are among the reported benefits of implementing an EDI environment (Hoogeweegen et al., 1998). However, there have been several reports regarding disadvantages in implementing EDI. First, the additional costs associated with the value added network (VAN) services typically fall in the range of $5,000 to $6,000 per month (Bartholomew, 1997). This in turn becomes an excessive hurdle for small companies wanting to adopt an EDI environment to communicate with business partners. Second, to avoid difficulties, establishing EDI between trading partners requires compatible hardware at both ends in order to have seamless processing (Haugen and Behling, 1995). Third, pre-agreed standards and protocols are required. Several common industry-specific standards are required to
establish EDI: TDCC (Transportation Data Coordination Committee) used in the transportation industry, UCS (Uniform Communication Standards) used in the grocery industry, and ANSI X.12 developed by the American National Standard Institute (Lim, 1995). Finally, because of the significant initial and operational investments, both the customer and the supplier are typically tied to a long-term contractual relationship. Although this may be beneficial for the health of doing business, it has some drawbacks. Over time, other suppliers may come up with higher quality, lower priced, and/or better services and products. In such cases, switching costs associated with establishing a new linkage may prevent companies from making otherwise prudent changes (Wilder, 1998).

Businesses are taking advantage of the information age and the array of benefits offered by the Internet. Online shopping is one of the fastest growing activities on the Internet. Sieglein (2000) reported that consumer shopping on the Internet reached $5.2 billion during the fourth quarter of 1999 and $5.3 billion during the first quarter of 2000. In the B2B arena, the Gartner Group predicts that the amount of B2B Internet trade is expected to increase from $145 billion in 1999 to $7.29 trillion worldwide by 2004 (King, 2000).

Companies are continually searching for alternatives to improve links of the supply chain and at the same time reduce associated expenses. Virtual value-added networks (VANs) or extranets are examples of ways to utilize the Internet to establish B2B communications. According to Pincince (1998), virtual VANs can work like traditional VANs, the only difference being the Internet-based nature of virtual VANs. Virtual VANs can be owned by any of the trading partners or a third party. Extranets are considered a special case where a company allows its trading partner to utilize the Internet to have access to its private network and internal applications. In this study, Internet-based B2B transactions or Internet-based interorganizational information systems (IBIS) represent examples of Internet utilization to communicate with trading partners. IBIS appeals to many businesses as an efficient way to link trading partners along the supply chain.

Research Objectives

To understand the business applications of the Internet, researchers have studied the factors influencing the adoption of the Internet in the workplace (Tan and Teo, 1998; Vadapalli and Ramamurthy, 1997) and in small business (Poon and Swatman, 1998). Adopting an IBIS will involve several factors that must be considered by managers. Identifying the most critical factors affecting the adoption decision would provide managers with a more focused list of factors that need their consideration in adoption decisions relating to IBIS. However, no study has been identified that sought to determine the factors affecting the adoption of the Internet technology to establish interorganizational information systems. The present study seeks to fill this void.

Research Methodology and Research Design

Several research efforts in the area of IOIS have addressed the adoption and impact of new technology in organizations (e.g., Grover and Goslar, 1993; Iacovou et al. 1995; Premkumar and Ramamurthy, 1995). Few research studies were identified that focus on business adoption and use of the Internet (for exceptions to this, see Vadapalli and Ramamurthy, 1997). The present study focuses on the critical factors influencing adoption decisions derived from the closely related literature mentioned above in areas such as telecommunications, EDI, and the
Internet. In addition, there have been reported concerns about several technical factors when it comes to establishing an IBIS. Network reliability (Dunlap, 2000), security concerns (Stijini and Gunton, 2000), operation scalability (Tan and Teo, 1998), and operations complexity (Dykeman, 1997) are issues of concern that are unique to the environment of conducting electronic commerce (EC) over the Internet and can influence the adoption decision of IBIS. Consequently, the present study includes these factors.

A set of questionnaires was developed from a pool of survey instruments that have been tested and used in the above-mentioned areas. New survey items were developed to address issues related to the Internet that have not been tested previously. Members of the Council of Logistics Management (CLM) in the United States were chosen to be the subject pool for this research because of their understanding of the major issues affecting interorganizational operations and supply chain management. A total of 420 questionnaires were directed to members drawn at random from all members of CLM. Among all returned questionnaires, 115 were found to be complete and usable, which represented a response rate of 27.3%. Surveys were returned from members working at companies that operate in different geographic locations and that represent different roles in their respective supply chains (e.g., suppliers, customers, or intermediates). These characteristics help in providing more generalizable results.

A factor analysis was conducted both to assess the construct validity of the survey measures and to determine the underlying factors influencing the adoption decision of IBIS. The factors identified by the factors analysis are: (1) Pressure from trading partners, (2) pressure from competition, (3) costs, (4) reliability, (5) security, (6) scalability, (7) complexity, (8) top management support, and (9) trust. Each of these will be discussed in the following section.

**Discussion of Findings**

The results of the study support many of the findings of previous research in IOIS:

**Pressure from Trading Partners.** Pressure from trading partners, also known as channel power, has been studied intensively. Williams (1994) defined channel power as “the influence one channel member has over another channel member.” IOIS research found a significant relationship between channel power and the adoption of IOIS such as EDI (Iacovou et al., 1995). This study extends the significance of pressure from trading partners when establishing IBIS.

**Pressure from Competition.** Pressure from competition represents the second factor that is consistent with previous IOIS literature. Competitive pressure can affect the adoption of IOIS (Banerjee and Golhar, 1994).

**Cost.** The cost to establish Internet communications can represent tremendous savings to organizations. Organizations establish an EC environment with their trading partners over the Internet thus eliminating the high costs associated with the value-added networks in traditional EDI environments. This finding supports previous findings that the lower the costs and the higher the benefits, the better the adoption of IOIS (see: Premkumar et al., 1994). Furthermore, Scala and McGrath (1995) found that one of the major disadvantages of implementing EDI is that it requires high initial capital investments. Accordingly, IBIS emerged as an economically viable alternative to create electronic links with trading partners. First, in an Internet-based environment, trading partners eliminate the use of intermediaries and
the associated high costs of subscribing to the VAN. Moreover, Internet-based systems require less investment in hardware and software to establish communication with trading partners than those needed in EDI.

**Technical Issues.** The final four factors deal with technical issues that are important to organizations with respect to IBIS: reliability, security, scalability, and complexity. Internet server systems integrators agree that *reliability* is the most critical technical issue in conducting EC over the Internet (Dunlap, 2000). In fact, bandwidth and reliability are routinely mentioned in the literature to be among the main factors affecting Internet communications between trading partners. Reliability can be defined as the ability of a company to rely on the transfer of "mission critical" applications over the Internet (Pincince, 1998). The fact that the Internet is a network of networks of computers force many organizations to think twice before adopting IBIS to communicate with trading partners. Most of the risks when dealing with the Internet are due to the existence of outdated web servers or applications that were not carefully installed initially (Levitt and Smith, 2000). Today, business communication requires increased bandwidth to accommodate the transfer of large multimedia files such as video and audio files. Accordingly, bandwidth, or more generally, reliability becomes a concern to many organizations -- especially with the current communications conditions inherent with the Internet.

**Security** represents a major concern to companies practicing EC. The concerns regarding security are most typically characterized in terms of confidentiality and fraud (Supply Management, 1997). In a recent survey conducted by the UK's Department of Trade and Industry revealed that, from 1997 to 1999, more than 60% of companies in the UK have suffered security breaches (Stijins and Gunton, 2000). By placing strategic data such as financial reports and manufacturing schedules online, companies open themselves to potentially damaging security breaches. With control over a computer or router, a hacker can easily access critical information on the system. Not surprisingly, the results suggest that IBIS adoption may hinge on security-related issues since IBIS can expose sensitive information for potential hackers to steal, alter, or make the systems malfunction. Identifying the identity of the message is not the main issue when it comes to security -- confirming purchasing authority and other attributes is the real concern (Giarraputo and Moore, 2000). Furthermore, companies along the supply chain are concerned about information gathered and/or mined by trading partners as well as the intent behind the use of the collected data (D'Amico, 2000).

**Scalability** is an organization's ability to easily modify the systems supporting an EC environment as business requirements and relationships change (these modifications are typically increases in system size, scope, and/or function). Because of the low initial investment and operational costs, the Internet provides organizations with the capabilities to expand its EC environment without significant investments (Tan and Teo, 1998) or specific technical expertise.

**Complexity** refers to the ease of adoption of the Internet standards, which allow organizations to contact any other organization anywhere in the world. Most research efforts discussing EDI have indicated that the existence of several communication standards between trading partners is a major obstacle in adopting EDI (Scala and McGrath, 1993). Accordingly, IBIS is thought of as a less complex system and a viable option that provides organizations with one communication standard.

**Top Management Support.** The last two major factors of concern relating to IBIS adoption are top management support and trust. The result of
this study with respect to top management support is in line with previous IOIS literature (e.g., Crook and Kumar, 1998; Premkumar and Ramamurthy, 1995). Accordingly, this specific finding in the present study extends the findings of IOIS literature with regard to the importance of top management support in the area of IBIS adoption.

**Trust.** IOIS literature has extensively researched trust between trading partners and confirmed its importance in cooperative relationships (e.g. Mohr and Spekman, 1991; Williams et al., 1998). In general, a trusting relationship with a trading partner is a critical factor for the success of that relationship. The results here emphasize the importance of having a trusting relationship in an IBIS implementation. Furthermore, the fact that organizations have to give trading partners access to their internal applications mandates greater trust between each party. Given that IBIS environment takes full advantage of the features provided by the Internet, it goes far beyond EDI in terms of business communications to coordinate the entire purchasing cycle, from product information to customer support. Therefore, a trusting relationship between trading partners is a major factor in creating an IBIS-based environment.

**Conclusions**

According to Soliman (2000), IBIS research reduces the gap between academic research and practitioners’ concerns since it addresses a timely issue of utilizing the Internet to establish communications along business channels. The recent growth of the Internet has been nothing short of phenomenal. Similarly, most organizations are looking for ways to optimize their supply chains as a means to create competitive advantage. Consequently, many organizations are reengineering their business processes in order to take full advantage of this new communication medium. To that end, this study addresses the timely issue of utilizing the Internet to establish IBIS and examine practitioners' concerns about the issues surrounding the adoption of these new systems. From a practical perspective, the findings presented here, although exploratory in nature, do suggest that supply chain managers should and will be considering IBIS implementations with increased frequency. When viewed as a system, the supply chain and the solutions needed to optimize it will require that the factors uncovered here be considered in order to achieve supply chain success.
References


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