The Influence of Organization Structure and Organizational Learning Factors on the Extent of EDI Implementation in U.S. Firms

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Electronic Data Interchange (EDI) is a widely used form of electronic commerce. Numerous strategic and tactical advantages have been attributed to the use of EDI. We develop and empirically test a theoretical model to explain the extent of EDI implementation in organizations. Factors considered include organization structural characteristics (size, centralization, and functional differentiation) and organization learning factors (technical expertise, level of EDI knowledge, and training availability). We use three dependent variables to assess the extent of EDI implementation (volume, diversity, and sophistication). We analyze 235 responses from a national survey of 1200 EDI users. Our analysis suggests the data provide some support for the model. The results indicate that organization size explains much of the extent of EDI implementation in organizations, suggesting that the extent of EDI implementation is partly a matter of resource availability and transaction volume. The level of technical and EDI knowledge also influences the extent of EDI implementation. Functional differentiation affects EDI diversity and EDI sophistication. Training availability influences EDI sophistication in organizations.
for example, by including product code translation tables to permit a buyer to place an order using its own product codes. We suggest that an organization’s structure and factors related to its EDI learning process influence the extent of EDI implementation in the organization.

The purpose of this study is to identify the organization structural characteristics and organizational learning factors that lead to greater levels of EDI implementation in organizations. We report on the results of an investigation into the factors that predict the differences in the extent of EDI implementation in organizations that are EDI users. This study considers organization structural characteristics that are suggested by organizational level diffusion of innovation theory, and factors related to organizational learning as suggested by other researchers who have extended classical diffusion theory to technological innovations (Attewell, 1992; Fichman, 1992). This research contributes to the literature on diffusion of information technologies and the literature on organizational level innovations. The study has implications for the implementation of EDI since it examines two types of factors related to the extent of EDI implementation in organizations.

Conceptual Framework

Researchers have studied the diffusion of information technologies using the diffusion of innovation theoretical framework (Hoffer and Alexander 1992; Rai 1990; Zmud 1982, 1983). Runge’s (1985) study of telecommunications-based information systems suggested that their use was consistent with the behavior suggested by innovation diffusion theory. Runge’s study helped motivate Grover (1990) to investigate factors related to the implementation of customer-based interorganizational systems. Grover’s research suggested that organizational level innovation diffusion theory is an appropriate framework for studying interorganizational systems, and he recommended that other researchers investigate other types of interorganizational systems. Premkumar, Ramamurthy, and Nilakanta (1994) examined EDI with regard to innovation characteristics and compatibility, factors suggested by classical innovation diffusion theory. This study continues the development of innovation diffusion theory by including organization structural characteristics from organizational level innovation diffusion theory and factors related to organizational learning. In the following section, we discuss the extent of EDI implementation.

Extent of EDI Implementation

Researchers employing diffusion of innovation theory recommend using measures such as the extent of implementation of an innovation to gain a richer understanding of the extent to which organizations have assimilated a new technology (Downs and Mohr, 1976; Tornatzky and Klein, 1982).

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
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<tr>
<td>EDI Volume</td>
<td>Extent to which a particular transaction type is handled by EDI.</td>
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<tr>
<td>EDI Diversity</td>
<td>How widespread the use of EDI is in the organization.</td>
</tr>
<tr>
<td>EDI Sophistication</td>
<td>Extent to which an organization utilizes the various features of EDI technology.</td>
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Table 1. Aspects of the Extent of EDI Implementation.

This approach has been used to examine other information technology innovations (Alexander, 1989; Grover, 1990; Rai 1990). We use the extent of EDI implementation to measure an organization’s use of EDI, the innovation we are investigating. The aspects of the extent of EDI implementation are summarized in Table 1.

Researchers examining EDI have described several ways to measure EDI usage. Emmelhainz (1990) described three levels of EDI usage depending on how many types of transactions are done via EDI and how many of each type of transaction are done using EDI, the number of trading partners involved, and the degree to which business processes have changed because of EDI. Massetti and Zmud (1996) examined four facets of the extent of EDI usage in organizations. This research examines the extent of EDI implementation in an organization. The extent of EDI implementation of an organization indicates its ability to succeed in the electronic marketplace.

This paper considers three aspects of the extent of EDI implementation: 1) volume, 2) diversity, and 3) sophistication. EDI volume represents the extent to which transactions are handled via EDI (as opposed to other methods). The volume for a particular type of transaction is the fraction of those transactions being done via EDI divided by the total number of transactions of that type. This study is done at the organizational level, so EDI volume represents the maximum volume among all the transaction types performed via EDI. This is similar to the notion of volume used by Massetti and Zmud (1996). EDI diversity refers to the number of different types of transactions that are handled through EDI in the organization. The number of different types of transactions being done using EDI indicates how widespread the usage of EDI is in the organization. This is similar to the facet diversity used by Massetti and Zmud (1996). The third aspect, EDI sophistication, is the extent to which an organization utilizes the various features of EDI technology. A firm that is doing paper-based EDI (that is, the data is electronically received, is printed to paper, and is then rekeyed into another system) is at a much lower level of sophistication than a firm that is transmitting and receiving transactions without rekeying them. These objective measures provide a good indication of an organization’s EDI use.
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