

## **AIS/IS sophistication and inter-organizational complexities**

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### **ABSTRACT**

At best, implementations of technological changes occur in fits and starts (e.g., horse drawn carriages to automobiles). At worst, such implementations never gain traction—even when the new technologies are positively disruptive. With this in mind, the overall objective of this research is to gain insights regarding EDI implementations in small businesses. The results suggest that the level of AIS/IS sophistication is associated with owner/manager knowledge of EDI benefits. Additionally, the results suggest that, to some extent, owner/manager perceptions of forced (mandated) EDI implementations may be associated with the level of AIS/IS sophistication; admittedly, the results are difficult to interpret due, in part, to possible inter-organizational complexities. In summary, while this research is grounded in EDI implementations, the results of this research provide insights applicable to other current and future technological change environments.

Key Words: accounting information systems, information systems, inter-organization

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## INTRODUCTION

Order management systems are systems used by companies for order entry and processing. An order management system may include the use of electronic data interchange (EDI) for the “exchange of electronic business documents between economic trading partners, computer to computer, in a standard format” (Chan et al., 1995). Intuitively, EDI benefits are maximized when EDI applications are fully integrated (electronically) into the accounting information system (AIS), specifically, as well as the overall information system (IS), generally. In this regard, the overall objective of this research is to gain insights regarding EDI implementations in small businesses. Specifically, this research seeks to gain insights concerning owner/manager awareness of EDI benefits (versus risks) as well as owner/manager perceptions that EDI implementations were forced (mandated) by a trading partner. Consistent with the thoughts of Vasarhelyi (2012), the underlying focus of this research relates to the transmission, capture, processing, storage and accessing of the data underpinning the (external and/or internal) reporting process—not “the manipulations to be performed” with respect to the (external and/or internal) reporting process.

The remainder of this document is organized as follows. First, a brief contextual background is provided and the related hypotheses are developed. Second, critical elements of the data collection and scale development activities are addressed. Third, the results of the data analyses are reported. Finally, a summary of the implications and limitations of the results as well as possible avenues for future research is provided in terms of inter-organizational complexities.

## BACKGROUND AND HYPOTHESES

While the AIS as well as the IS may share some common data, both the AIS and the IS have their own rather unique domain (Steinbart, 2009). Generally speaking, the AIS tends to support transaction processing and (historical) performance analysis while the IS tends to support (current and/or future) operating and strategic decision making (Brecht and Martin, 1996). Arguably, while large companies typically have fairly well developed AIS/IS capabilities, such is not typically the case with small businesses; thus any electronic exchange of data has a relatively greater potential to drive AIS/IS sophistication in smaller businesses. Given that many (if not most) repetitive business transactions are initially captured in the AIS/IS via an order management system, EDI is a technology worthy of continued analysis. In essence, it is the disruptive nature of EDI with respect to small businesses that motivates this research.

In this regard, a computer growth stage model is employed to gain insights into the disruptive nature of EDI with respect to the level of AIS/IS sophistication in small businesses. Nolan (1979) developed a six stage model describing computer growth in large “for profit” companies; the six stages are: initiation, contagion, control, integration, data administration and maturity. In order to better address the characteristics of smaller “not for profit” organizations, Telem (1989) subsequently modified the Nolan (1979) six stage model into the following three stage model: initiation, contagion or maturity.

The basic premise underlying both of these models is that computer growth in an organization will progress from the initiation stage, where the primary objective is to increase the efficiency of operations through the use of computers, to a maturity stage, where the

objective is the effective use of information for decision making. In this regard, this research employs the same three stages as Telem (1989)—initiation, contagion, and maturity. However, in contrast to Telem (1989), this research focuses on computer growth in small “for profit” businesses (not small “not for profit” organizations). Additionally, while Telem (1989) theoretically develops a three stage model, this research evaluates several hypotheses grounded in a (similar) three stage model. Specifically, the hypotheses employ growth stage as the dependent variable; thus growth stage is the proxy for the level of AIS/IS sophistication in this research. Additionally, the hypotheses employ one of the following independent variables—perception EDI forced and awareness of EDI benefits.

Walton (1994) suggests that EDI makes data transmission more efficient (i.e., reduces paper and postage expenses as well as minimizes delays associated with data entry errors) which, in turn, supports shorter order cycles (thus allowing businesses to be more responsive to customer needs). Given these benefits, if an owner/manager has a high awareness of EDI benefits, then that owner/manager will be more likely to take advantage of EDI benefits; in turn, if an owner/manager is more likely to take advantage of EDI benefits, then the level of AIS/IS sophistication is expected to be at the contagion or maturity stage. This growth stage expectation is formalized in the following hypothesis.

H1a: AIS/IS sophistication at businesses where owner/managers have a high awareness of EDI benefits will be at the contagion or maturity stage of the growth model.

In contrast, if an owner/manager has a low awareness of EDI benefits, then that owner/manager will be less likely to take advantage of EDI benefits; in turn, if an owner/manager is less likely to take advantage of EDI benefits, then the level of AIS/IS sophistication is expected to be at the initiation stage. This growth stage expectation is formalized in the following hypothesis.

H1b: AIS/IS sophistication at businesses where owner/managers have a low awareness of EDI benefits will be at the initiation stage of the growth model.

In addition to awareness of EDI benefits, the level of AIS/IS sophistication may also be associated with owner/manager perceptions that EDI implementations were forced (mandated) by a trading partner. In this regard, when an owner/manager adopts EDI only to placate a trading partner, some researchers have speculated that the “placating” owner/manager may resent the situation (Udo and Pickett, 1994; Premkumar et al., 1994; Wang and Seidmann, 1995); in turn, a high perception EDI forced may inhibit that owner/manager from gaining an awareness of EDI benefits that will enable that owner/manager to exploit the technology to its full extent. Thus, in this situation, the level of AIS/IS sophistication is expected to remain at the initiation stage. This growth stage expectation is formalized in the following hypothesis.

H2a: AIS/IS sophistication at companies where owner/managers have a high perception that EDI was forced on the business will be at the initiation stage of the growth model.

In contrast, an owner/manager may view a request by a trading partner to adopt EDI as an opportunity to improve the overall operations of the company. Instead of reacting negatively, that owner/manager may become increasingly aware of EDI benefits. This increased awareness may, in turn, be positively associated with the level of AIS/IS sophistication. Thus, in this situation, the level of AIS/IS sophistication is expected to be at the contagion or maturity stage. This growth stage expectation is formalized in the following hypothesis.

H2b: AIS/IS sophistication at companies where owner/managers have a low perception that EDI was forced on the business will be at the contagion or maturity stage of the growth model.

## **DATA COLLECTION AND SCALE DEVELOPMENT**

To test the hypotheses, data were gathered from agricultural equipment dealers (throughout the United States) using a survey instrument. Of the 882 surveys mailed to the agricultural equipment dealers, 189 useable surveys were received (representing a 21.4 percent response rate). A summary of the data (factors) for both independent composite variables (i.e., awareness of EDI benefits and perception EDI forced) as well as a summary of the data (factors) for the dependent variable (i.e., growth stage) are provided in the Appendix (i.e., Table One and Table Two, respectively).

With respect to the 189 useable surveys, the results of a preliminary analysis suggest the possibility of response bias relative to both independent composite variables. Specifically, there is evidence to suggest that early respondents are often associated with higher levels of perception EDI forced; fortunately, the results of a supplemental regression analysis procedure do not suggest that this association is influential with respect to the overall reliability of the measure. Additionally, there is evidence to suggest that (both early as well as late) respondents are not as aware of EDI risks (versus EDI benefits); this finding is consistent with the scale development results documented in the following paragraph.

To assess scale reliability, Cronbach's alpha scores are computed for each group of factors comprising a composite variable (Vogt, 1993). While the results suggest that the factors used to determine these composite variables consistently measure the elements of interest, the results also suggest that owner/managers are not as familiar with EDI risks as they are EDI benefits. In turn, while the results of a sensitivity analysis do not suggest that this disparity is influential with respect to the overall reliability of the measure, the results do suggest that the measure relates almost exclusively to EDI benefits. Hence, the usage of the term EDI benefits versus the use of the term EDI issues (i.e., both benefits as well as risks) as originally planned.

## **DATA ANALYSES AND RESULTS**

A comparison of means from a stratified subsample of the data is used to test the hypotheses. To begin, the data are stratified into three groups (low, high then middle) based on composite scores relating to awareness of EDI benefits (for Hypothesis H1a and Hypothesis H1b) and perception EDI forced (for Hypothesis H2a and Hypothesis H2b). Thereafter, the growth stage means for the low and high groups—for each pair of hypotheses—are compared

using a one way ANOVA (between comparison) procedure; for each pair of hypotheses, both the low group as well as the high group represent approximately one-third of the 189 total cases.

Mathematically speaking, the growth stage means can be categorized as follows: 0.00 to 1.49 for initiation; 1.50 to 2.49 for contagion; and, 2.50 to 3.00 for maturity. However, practically speaking, the use of “hard” or static growth stage determination cutoff points or ranges may be viewed as arbitrary, at best, and misleading, at worst. Thus growth stage means, as well as their relative differences, are employed to assess approximate growth stage location.

With respect to awareness of EDI benefits, there is a statistically significant difference ( $p < 0.0000$ ) between the growth stage means of the two levels of awareness groups. The growth stage mean is 1.9382 for the high awareness group in contrast to the 1.3279 growth stage mean for the low awareness group. Given that the growth stage mean of the high awareness group is greater than the growth stage mean of the low awareness group by 0.6103 (representing a 46% difference using the low mean as the calculation base/denominator), it appears that the high awareness group is associated with a level of AIS/IS sophistication which is relatively higher than the level of AIS/IS sophistication associated with the low awareness group. This is consistent with Hypothesis 1a (high awareness and contagion) and Hypothesis 1b (low awareness and initiation). Stated otherwise, the stage means as well as their differences suggest that the low (high) awareness group is more closely associated with the initiation (contagion) stage than the high (low) awareness group. Thus the results support both Hypothesis 1a and Hypothesis 1b.

With respect to perception EDI forced, there is a statistically significant difference ( $p < 0.0005$ ) between the growth stage means of the two levels of perception groups. The growth stage mean is 1.3522 for the low perception group in contrast to the 1.7884 growth stage mean for the high perception group. Given that the growth stage mean of the high perception group is greater than the growth stage mean of the low perception group by 0.4362 (representing a 32% difference using the low mean as the calculation base/denominator), it appears that the high perception group is associated with a level of AIS/IS sophistication which is relatively higher than the level of AIS/IS sophistication associated with the low perception group. This is inconsistent with both Hypothesis 2a (high perception and initiation) as well as Hypothesis 2b (low perception and contagion). Stated otherwise, the stage means as well as their differences suggest that the low (high) perception group is more closely associated with the initiation (contagion) stage than the high (low) perception group. Thus the results do not support either Hypothesis 2a or Hypothesis 2b. Perhaps more importantly, the results suggest the opposite (associations) of what was expected (in Hypothesis 2a and Hypothesis 2b).

Given the overall mixed results of this research, it may be that the expected associations tested in this research are much more complex than formalized above. For example, if an owner/manager has a high level of awareness of EDI benefits, then this level of awareness may offset, to some degree, a high level of perception EDI forced. Stated otherwise, faced with implementing EDI, an owner/manager may choose to learn more about the technology. While still resentful about the circumstances related to the EDI implementation, a high level of awareness of EDI benefits may motivate an owner/manager to pursue/maximize EDI benefits. In contrast, if an owner/manager has a low level of awareness of EDI benefits but a high level of perception EDI forced, it is unlikely that an owner/manager will be motivated to pursue/maximize EDI benefits—especially if that owner/manager has a high awareness of EDI risks. Admittedly, additional complexities could arise from other inter-organizational factors

associated with perception EDI forced. In this regard, the results of supplemental analyses suggest that it is likely that perception EDI forced proxies for years of EDI usage, size of the agricultural equipment dealer (in terms of employees), and/or specific manufacturer affiliation. Thus, while the results of the ANOVA procedure reported above suggest that owner/manager perceptions of forced (mandated) EDI implementations may be associated with the level of AIS/IS sophistication to some extent, the results are difficult to interpret due, in part, to possible inter-organizational complexities.

## **IMPLICATIONS, LIMITATIONS AND EXTENSIONS**

While the overall results of this research are generally muddled, one specific finding appears to be fairly clear; that is, the results of the ANOVA procedure indicate that the level of AIS/IS sophistication is associated with owner/manager awareness of EDI benefits even though the results of the factor analysis suggest that owner/managers may not be as aware of EDI risks (versus EDI benefits). Armed with this information, internal consultants (such as in-house technology specialists) as well as external consultants (such as Certified Public Accountants) could focus on improving owner/manager awareness of EDI risks—as well as benefits—in order to maximize EDI implementation success. Admittedly, it is unlikely that most small businesses have sufficient in-house technology expertise; additionally, the cost of external consultants is likely prohibitive for most small businesses.

Arguably, owner/manager lack of EDI risk awareness may relate, in large part, to inter-organizational dynamics (Baiman and Rajan, 2002). Intuitively, larger trading partners seeking to motivate smaller trading partners to implement EDI would focus their inter-organizational communications on EDI benefits—not EDI risks. To the extent that this notion is true, it is likely that the unexpected results concerning perception EDI forced are linked (to some degree) to such sales tactics. Assuming that positive inter-organizational dynamics are critical to successful EDI implementations, it is in the best interest of the larger trading partners to assess the implementation success potential of the smaller trading partners (in terms of current versus required hardware, software, personnel, etc.) prior to the beginning the implementation in order to support the smaller trading partner before, during, as well as after the EDI implementation, as appropriate in the circumstances. Admittedly, even if the larger trading partner acts in a proactive manner, lack of EDI risk awareness (etc.) may be associated (to some degree) with other trading partner intra-organizational dynamics (Watad, 2011).

While the use of participants from a single industry segment limits the generalizability of the results, there are some industry segments similar to the agricultural equipment dealers (e.g. auto dealers, other whole goods retailers, etc.) to which the results may be particularly relevant. In turn, future research could focus on such industry segments. Further, the implications of the results could be evaluated with respect to other current or future technological change environments such as Radio Frequency Identification (RFID) or The Internet of Things (IoT), etc. (Bendavid et al., 2013).

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**APPENDIX**

**Table 1**  
**Factors Used for Composite Independent Variables**

<b>Perception EDI forced</b>	<ul style="list-style-type: none"> <li>Consideration of EDI costs</li> <li>Consultation with trading partner</li> <li>Usage forced/by choice</li> </ul>
<b>Awareness of EDI Benefits</b>	<ul style="list-style-type: none"> <li>Cost of ordering</li> <li>Response to customer needs</li> <li>Paperwork reduction</li> <li>Ability to compete</li> <li>Error reduction</li> <li>Order status checks</li> <li>Magnitude of errors</li> <li>Authorization issues</li> </ul>

**Table 2**  
**Factors Used for Growth Stage**

Number of computerized systems
Number of computers
Communication network
Level of specialized applications integration
Integration of user tasks
Level of general applications integration