INTEGRATING TECHNOLOGY & HUMAN DECISIONS: GLOBAL BRIDGES INTO THE 21ST CENTURY

VOLUME II

Edited by

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JULY 4-7, 1999
ATHENS - GREECE
# Management Information Systems

[M11] EVALUATING MIS DEVELOPMENT AND SUCCESS IN INNOVATIVE WAYS
A Business Process Modelling Approach Based on Activity Theory: Capturing "Softer"
Aspects of Organisational Behaviour .................................................. 1019
by G. Michael McGrath, Martin Ellison
A Modelling Approach for Information Systems Evaluation Based on Fuzzy Cognitive Maps .......... 1022
by Dimitris Kardaras, Vassilis Karakostas
Key Issues in Information Systems Management: Extending Initial Key Issues Selection
Procedure .................................................. 1025
by Peter Gottschalk, Bo Hjort Christensen, Richard T. Watson
Assessing the Negative Effects of Proposed Information Systems: A Method Based on de
Bono's Thinking Hats .................................................. 1028
by Ayman Abu Hamdiah, Julie E. Kendall
Forgotten Human Dimensions in Dysfunctional Collaboration .................................................. 1031
by G. Michael McGrath, Elizabeth More

[M12] GLOBAL ISSUES IN MIS
Firm-Level Strategic Alternatives for Setting Technology Standards in the Emerging Global
Economic Architecture .................................................. 1036
by Ray R. Gohani
Identification of the Issues of International Information Systems Management: A Perspective
of Foreign Affiliates .................................................. 1039
by Vincent S. Lai
A Study of Computer Self-Efficacy in Hong Kong .................................................. 1042
by Bo K. Wong, Jolie Lam, Vivian P.M. Tsoi

[M13] MANAGEMENT OF CHANGE IN IT ENVIRONMENTS
The Role of Information Technology in Organizational Transformation ........................................ 1045
by Shu-Yi Chen
Critical Success Factors in Enterprise Wide Information Management Systems Projects .............. 1048
by Mary R. Sumner
Symbolic Adoption of Information Technology ........................................................................... 1051
by Elena Karahanna
Lessons Learned from Successful Adoption of an ERP: A Case Study ........................................ 1054
by David Gefen, Milton Silver

[M14] HEIDEGGER AND INFORMATION TECHNOLOGY I
Cyberspace and Heidegger's Pragmatics ....................................................................................... 1057
by Richard Coyne
From Tool to Gestell Agendas for Managing the Information Infrastructure ................................ 1058
by Claudio U. Ciborra, Ole Hanseth

[M15] OBJECT ORIENTED APPROACHES AND APPLICATIONS
A Form Driven Object-Oriented Reverse Engineering Methodology ........................................... 1059
by Hesseok Lee, Cheonsoo Yoo
Object-Oriented Database Systems in Manufacturing .................................................................. 1062
by Qingyu Zhang
Does Modeling the Realworld in Object Oriented Systems Result in Well-Structured
Systems? .................................................................................................................................. 1065
by Helen Klein
### [M16] HEIDEGGER AND INFORMATION TECHNOLOGY 2
- Insistent Emplacement: Heidegger on the Technologies of Informing
  by Steve D. Brown, Geoffrey M. Lighthoof
  Page: 1070
- Calculative Thinking and Essential Thinking in Heidegger’s Phenomenology
  by John D. Haynes
  Page: 1071
- The Question Concerning Information Technology: Thinking with Heidegger on the Essence of Information Technology
  by Lucas D. Introna
  Page: 1072

### [M17] ANALYZING AND APPRAISING INVESTMENT IN IT
- Information Technology Investment and Financial Performance: An Exploratory Analysis of Firm Level Evidence
  by Theophanis Stratopoulos, Bruce Dehning
  Page: 1073
- Information Technology Charging Decisions
  by D.H. Drury
  Page: 1076
- The Dimensions of Network Quality
  by Choong Kwon Lee, Demetrios Karathanos, Sangjin Yoo
  Page: 1079
- Implementation of Formal Plans: The Case of Information Technology Strategy
  by Petter Gottschalk
  Page: 1082

### [M18] ELECTRONIC COMMUNICATION AND ORGANIZATIONAL MEMORY IMPLICATIONS FOR MIS
- The Effects of Member’s Identity on Electronic Peer Feedback
  by Ruth C. King, Vikram Sethi
  Page: 1085
- The Effect of Electronic Communication on Organizational Memory
  by Albert H. Huang
  Page: 1088
- Facilitating the Diffusion of Technological Innovations: An Exploratory Study of the Role of Communication on Individual Perceptions
  by Sylnovie Merchant
  Page: 1091
- Strategic Cognitive Management System (SCSM) as a Model for Integrating Technology and Human Decisions
  by Gjorgji Manev
  Page: 1094
- Video Broadcasting on the Internet: Bridging the Communications Gap
  by D.R. Lawrence, A. Sloane, A. Harris
  Page: 1097

### [M19] MIS PROBLEMS RELATING TO SMALL AND MEDIUM-SIZED ENTERPRISES
- The Structure of Impediments to EDI Adoption and Integration: A Survey of Small- and Medium-Sized Enterprises
  by Deepak Khazanchi
  Page: 1100
- Strategic Information Systems - A Portuguese SME Approach
  by António Serrano
  Page: 1103

### [M10] PANEL: THE INTRODUCTORY MIS COURSE - INTERNATIONAL PERSPECTIVES ON MIS CURRICULUM AND PEDAGOGY
- Adel M. Aladwani, Bill Amadio, Petter Gottschalk, Tor Guimaraes, Laurette Poulos
  Page: 1107
- Simmons, Mary Sumner

### [M11] WORKSHOP: FRAUD AND COMPUTER CRIME HAS NO BOUNDARIES
- Susan Haugen, Robert Behling, Saleha Khumawala
  Page: 1108

### [M12] TOPICS IN MIS
- The Information Systems Department as a Profit Center
  by J.L. Boockholdt, R.K. Gunnells
  Page: 1109
- An Information Systems Architecture for Improved Project Management
  by Kazuo Nakatani, Alex J. Ruiz-Torres
  Page: 1112
- Performance/Capacity Models for Distributed Systems
  by Pawel Radzikowski
  Page: 1115
- Examining the Service Orientation of IS Personnel: Productive or Perfunctory?
  by Janette W. Moody
  Page: 1118
THE STRUCTURE OF IMPEDIMENTS TO EDI ADOPTION AND INTEGRATION:
A SURVEY OF SMALL- AND MEDIUM-SIZED ENTERPRISES

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ABSTRACT

Electronic Data Interchange (EDI) is the key enabling component of business to business electronic commerce. As firms continue to adopt EDI either through mandates or by choice, it is important to understand the nature and structure of impediments they are likely to face during adoption and integration. This paper reports the results of a survey of EDI-capable SMEs that assessed the nature of EDI impediments faced by them. Analysis of data revealed an eight-factor structure that best describes the nature of EDI impediments.

INTRODUCTION

Powerful computer-based information systems (CBIS) and inter-organizational systems (IOS) such as Electronic Data Interchange (EDI) have changed the way organizations do business. Corporate America’s EDI-related expenditures are expected to reach a total of $6.4 billion by the turn of the century. Further, it is predicted that almost 90% of all businesses will use some form of electronic data transfer in their operations by the end of the century. However, small companies who are at the receiving end of the EDI mandate have failed to obtain the benefits promised by this technology. They are faced with the adoption of a technology that results in enormous challenges for the organization and in some instances has become a drain on the firm’s resources.

According to the U.S. small business administration, small- to medium-sized enterprises (SMEs) employing less than 500 employees constitute 99.7% of all businesses in the U.S. and consequently dominate the typical supply chain of most large companies. Thus, any new information technology initiative (or imperative) from Federal or State level procurement agencies and larger corporate organizations has critical ramifications for small- to medium-sized firms. Although many research studies have investigated the business impact of EDI on large corporate organizations in various industrial sectors, very few have specifically focused on analyzing the impact of EDI on SMEs.

Therefore, the goal of this paper is to describe the findings of a research project undertaken to address the specific issues relating to identifying and evaluating the nature and seriousness of impediments associated with EDI adoption and integration in SMEs.

RESEARCH RATIONALE AND QUESTIONS

"The impact of EDI on small businesses can be answered with one word—devastating. After being on EDI for over two years, spending hundreds of hours quoting the federal government over two million dollars of products that are on GSA Contracts and not receiving a dime worth of business, I can only say forget it... All of my business with the government is being done outside of EDI, and I will continue to do business in this manner until it is no longer feasible or profitable. I would rather close this business than go through another two years of frustration working through EDI... I have talked with various people (and organizations)... but they really don’t want to hear about the "down" side of EDI." [Extracted from a letter sent to the author by a SME owner in December 1997].

The above reaction is not uncommon from SMEs, especially, as many large (hub) corporations, the Federal and State governments are mandating the use of EDI in their procurement activities Small firms have little choice but to install EDI without too much forethought or planning. Past research has focussed on the potential merits of EDI adoption and integration, factors that influence the ability of small and large firms to obtain operational and strategic benefits from EDI, and the financial and technological readiness of firms. Although some researchers have identified key challenges or perceived barriers to EDI adoption, a handful have attempted to characterize the nature and structure of EDI impediments, especially in the context of small firms.

Impediments to EDI Adoption and Integration

EDI impediments are challenges, hurdles, barriers or obstacles that are faced by organizations attempting EDI implementation and integration. These impediments may have an impact on the different phases of the EDI implementation process: Pre-implementation (adoption) phase, Implementation (or installation) phase, and Post-implementation (or Integration phase). For the purpose of this research, the different impediments to EDI implementation identified by various authors were initially conceptually organized into four distinct categories: 
Technical Challenges; Organizational Challenges; 
Resource Challenges; and Education/Training-related Challenges.
Research Questions

There are two related questions addressed in this paper. What is the nature and seriousness of impediments to EDI adoption and integration are faced by an SME? What (if any) is the structure of the "impediment" construct? In other words, are there underlying factors associated with EDI impediments?

METHOD

A survey research design was adopted to elicit the data needed to address the research questions posed earlier. The survey questions were designed on the basis of past literature and two case studies on the impact of EDI adoption in small businesses. Pilot test and initial validation of the survey items was done by circulating the survey to a panel of three experts in survey design. Many survey items were revised, reformulated, simplified, and reformatted to make them easy to read and understand.

Instrumentation

Respondents were asked to rate each EDI impediment item on a 3-point Likert-type scale with verbal labels ranging from “not serious at all” (coded as a 1), "somewhat serious" (coded as a 2) and “extremely serious challenge” (coded as a 3). A “not an impediment” (coded as a 0) response was also provided. In addition, an ordinal, open-ended question was included to elicit the three major EDI impediments faced by responding firms. Demographic data for the responding SMEs was also collected.

Data Collection

The survey was mailed to 353 EDI-capable SMEs in the Commonwealth of Kentucky. Nearly half of these companies were identified from the EDI World 1998 directory and the remaining were located by approaching EDI hub companies and government organizations. Anonymity was promised in return for completed surveys. Various measures to reduce non-response rates were also undertaken. These efforts culminated in an effective response rate of 24.3%, that is, 86 useful responses.

RESULTS AND DISCUSSION

Description of the Survey Sample

All 86 responding firms provided information about their industrial sector. The two largest categories are manufacturing (57%) and wholesale trade (27%) making up nearly 84% of the sample. Nearly 49% of the responding firms have less than 100 full-time employees with 36% having less than 50 employees. Organizations with more than 100 employees but less than 500 made up 36% of the sample. A large number (nearly 70%) of responding firms had gross sales over $1 million in 1997 with more than half (47%) generating over $10 million in sales. The remaining firms were evenly split between $10,000 and $1 million in gross sales. Nearly a dozen firms (14%) did not reveal their sales numbers.

The Nature and Seriousness of EDI Impediments

When companies implement EDI they face various challenges, hurdles or difficulties. In order to understand the nature of impediments faced by Kentucky SMEs, surveyed organizations were asked two questions. The first asked respondents to identify the top three impediments faced by their organizations. The second question attempted to assess the “seriousness” of these barriers or impediments to EDI adoption, implementation and integration.

The three most frequently mentioned impediments faced by small- to medium-sized organizations in Kentucky are “availability of managerial time to expand EDI use,” “ability to seamlessly integrate EDI with existing internal applications,” and “learning new technology and methodology.” However, the three major impediments by ranking are “high startup costs,” “low volume or frequency of orders,” and “maintaining one system for EDI-capable and another for non-EDI capable partners.” The apparent difference between the two results (frequency versus average rank of top three impediments) can be further analyzed by studying the results of the seriousness of each EDI impediment.

A descriptive analysis of the “seriousness of EDI impediment” was useful for clarifying the earlier results. The three most serious impediments faced by Kentucky SMEs are “high startup costs,” “learning new technology and methodology”, and a tie between “high cost of integration and expansion of EDI use”, “ability to seamlessly integrate existing applications with existing internal applications,” and “availability of managerial time to expand EDI use.” The detailed result shows that a majority of the impediments to EDI adoption and integration faced by the sampled-firms are serious, but are not insurmountable challenges.

Hence, it can be concluded that responding firms find the costs for EDI setup and ongoing integration to be high but not prohibitive. Also, finding managerial time to learn and implement a new technology and trading procedures is a serious challenge for these enterprises.
The Structure of EDI Impediments

The EDI impediment items were analyzed using the "principal components analysis (varimax rotation with Kaiser Normalization)" statistical technique. An eight-factor structure was found, explaining nearly 71% of the sample variance. Nearly all the "impediment" scale items had a loading greater than 0.5 on the factor to which they were attributed. Off the 31 impediment items, five had a score less than 0.5 and all save one had factor loading scores greater than 0.45. Communalities for the eight factors ranged between 0.56 to 0.82 with one exception at 0.49. This is another indication of the validity of the latent factor structure. Further, each of the eight factors has at least three items loading on them. This is in line with the recommendation of some authors that in judging the value of a factor analysis it is "more crucial to have at least three variables per factor" than achieving a higher ratio of the number of variables to the number of underlying factors.

The eight categories of EDI impediments found by the factor analysis can be described as follows:

- Factor 1 can be named "organizational (business-specific) challenges," and it relates to the impediments associated with the increased responsibility of employees, changing business processes, resistance to change, size of business, and stakeholder commitment;
- Factor 2 can be named "technology adoption and implementation challenges," and it relates to the impediments associated with integrating multiple EDI systems and/or VAN connections, dealing with multiple EDI formats, absence of uniform EDI standards, implementing multiple trading partners, and selecting means for communications with trading partners;
- Factor 3 can be named "change management challenges," and it relates to the impediments associated with understanding potential benefits of EDI, considering EDI as a natural extension of pre-existing internal operations, availability of managerial time to expand EDI use, and end users and customer continued reliance on paper-based transactions;
- Factor 4 can be named "technology-business integration challenges," and it relates to the impediments associated with determining appropriate internal applications to apply EDI, translating customer/supplier data for direct use in internal applications, selecting the hardware to run EDI software, and the ability to seamlessly integrate EDI with existing internal applications;
- Factor 5 can be named "trading and communications security challenges," and it relates to the impediments associated with managing data and transmission security and auditability, dealing with the exposure to ever-changing customer/supplier requirements about EDI system (due to the dependence on the trade linkages), and addressing legal issues (e.g., electronic orders, signatures, legal agreements);
- Factor 6 can be named "resource challenges," and it relates to the impediments associated with the availability of financial and technological resources, and the high costs associated with startup, integration and expansion of EDI use within the firm;
- Factor 7 can be named "education/training-related challenges," and it relates to the impediments associated with obtaining general information about EDI, learning a new technology and methodology for conducting business, and the complexity of the technology itself.
- Factor 8 can be named "operational challenges," and it relates to the impediments associated with the characteristics of the specific technology (EDI) itself in the context of its use in small- to medium-sized firms. These attributes include diverse facets such as the impersonal nature of EDI, low volume or frequency of orders, and the difficulty of maintaining one system for EDI capable and another for non-EDI capable partners.

CONCLUDING REMARKS

Implications for Research and Practice

The results of this research study have potential implications for practice and research. SME owners can derive some consolation in the finding that although firms face many serious impediments to EDI adoption and integration, they are apparently not insurmountable. Also, SME owners can more effectively plan the adoption and/or integration of EDI in their organizations by addressing the critical impediment "groups" identified and clarified in this study. In terms of research implications, the findings of this study indicate that the "impediments" construct is made of eight latent factors that can be useful in other studies relating to information technology diffusion. Also, this multi-factor construct can be used as a moderating variable in studying the determinants of relative benefits attainable by the implementation of advanced information technologies such as EDI.

References

References are available from the author on request via e-mail: khazanchi@nku.edu.