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# VIEWING EDI-ENABLED INTERORGANIZATIONAL RELATIONSHIPS THROUGH MULTIPLE CONCEPTUAL LENSES

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# VIEWING EDI-ENABLED INTERORGANIZATIONAL RELATIONSHIPS THROUGH MULTIPLE CONCEPTUAL LENSES

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## Abstract

*This paper explores the theoretical underpinning of EDI research over the period from 1993-2001. We focused mainly on the EDI studies that dealt with some aspect of interorganizational relationships. We used a metatriangulation approach to view the conceptual foundations of the research. Fifty-three articles are summarized. They suggest a predominant concern with outcomes realized with EDI use. As a majority of the studies are of the survey nature using single cross-sectional snapshots, the emphasis appears to be on short-term outcomes. Implications of the findings are discussed.*

*It has been widely acknowledged that interorganizational information technology helps reduce coordination costs, leading to improved communication and coordination between business partners. Perhaps the most common form of technology to support interorganizational relationships between business partners is Electronic Data Interchange (EDI). EDI is the movement of business documents electronically between or within firms in a structured, machine-retrievable format that permits data to be transferred, without rekeying, from a business application in one location to a business application in another (Hansen & Hill, 1989). However, EDI has not been adopted in the numbers previously anticipated, and many trading partners are turning to web-based approaches, including exchanges and web-based procurement. This migration reflects a movement away from EDI's dyadic approach, to approaches that capitalize on many-to-many relationships.*

*We have undertaken this study to understand the theoretical underpinnings of EDI research over the last 9 years. This exploration may uncover the theoretical nature underlying EDI and other trading partner relationships. To understand the various theoretical contributions, we have employed the metatriangulation data gathering and analysis approach outlined by Lewis & Grimes (1999).*

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<sup>1</sup>Lead author; please address all questions to Dr. Saunders.

## Methodology

### Lenses

In the groundwork phase, we defined the phenomenon of interest, collected a metasample and determined our paradigm lenses. The phenomenon of interest was EDI-enabled interorganizational relationships. Our analysis search included all refereed articles that we could find on the topic of EDI that dealt with some aspect of interorganizational relationships. The articles were identified by searching all peer-reviewed articles in the Business Source Premier database provided by EBSCO over the last 9 years (1993-2001) using with the search term ‘EDI.’ We reviewed each retrieved article’s title, abstract, and key words to ensure that it addressed interorganizational relationships to some extent. This eliminated articles on EDI that focused on security, standards or other such issues not related to interorganizational relationships. Our final sample consisted of 53 articles from 29 journals. The listing of journals and their associated fields is displayed in Table 1. Articles about interorganizational relationships in EDI were published predominantly in MIS journals. The sample representation can also be considered very broad in the sense that the articles include studies of EDI adoption and implementation in a wide range of countries: Australia, Canada, China, Denmark, Finland, Hong Kong, Ireland, Japan, Singapore, United Kingdom, and the United States.

<b>Table 1. Journals Publishing Articles in the Study</b>	
<b>Discipline</b>	<b>Journals (Number of Articles Published in Journal)</b>
MIS (32 articles)	<ol style="list-style-type: none"> <li>1. Computers &amp; Security (2)</li> <li>2. European Journal of Information Systems (2)</li> <li>3. Information &amp; Management (3)</li> <li>4. Information Services &amp; Use (1)</li> <li>5. The Information Society (1)</li> <li>6. Information Systems Management (2)</li> <li>7. Information Systems Research (3)</li> <li>8. International Journal of Electronic Commerce (1)</li> <li>9. International Journal of Information Management (2)</li> <li>10. International Journal of Technology Management (2)</li> <li>11. Journal of Information Systems (1)</li> <li>12. Journal of Information Technology (2)</li> <li>13. Journal of Management Information Systems (6)</li> <li>14. Journal of Organizational Computing and Electronic Commerce (1)</li> <li>15. MIS Quarterly (3)</li> </ol>
Logistics/Transportation/ Marketing (12 articles)	<ol style="list-style-type: none"> <li>1. International Journal of Physical Distribution &amp; Logistics Management (3)</li> <li>2. International Journal of Purchasing and Materials Management (1)</li> <li>3. International Journal of Retail &amp; Distribution Management (1)</li> <li>4. Journal of Business and Industrial Marketing (2)</li> <li>5. Journal of Business Logistics (4)</li> <li>6. Logistics and Transportation Review (1)</li> </ol>
Production/Operations Management/Management Science (5 articles)	<ol style="list-style-type: none"> <li>1. Industrial Management (1)</li> <li>2. International Journal of Operations and Production Management (1)</li> <li>3. International Journal of Production Economics (1)</li> <li>4. Management Science (1)</li> <li>4. Production and Operations Management (1)</li> </ol>
Management/General Management (4 articles)	<ol style="list-style-type: none"> <li>1. Academy of Management Executive (1)</li> <li>2. Journal of Small Business Management (1)</li> <li>3. Organization Science (2)</li> </ol>

To understand the underlying paradigms, we employed several paradigm lenses that have been used to understand relationships between trading partners. First we adopted the three causal structures (i.e., technological imperative, organizational imperative and emergent perspective) proposed by Markus and Robey (1988) to explore the role of Information Technology. This set of lenses has been highly cited (i.e., 143 times in IS literature according to the Social Science Citation Index) and has been used in

previous MIS research. This set of lenses refers to the beliefs about the nature of causality. Definitions of these imperatives are presented in Table 2. Transaction cost economics (TCE) (Williamson, 1991) offers a set of lenses (hierarchy, hybrid and market) that also is frequently used in EDI studies (Humphreys et al., 2001). Definitions of all three TCE categories are presented in Table 3. Our final two sets of lenses were derived from Oliver’s (1990) motives for interorganizational relationships and Hall’s (1999) characterization of types of interorganizational relationships. We coded four IOR forms based on Oliver (1990): buyer-supplier, joint program, joint venture and trade association. We adopted Fulk and DeSanctis’s (1995) ‘strategic alliance’ as a fifth IOR form. Tables 4 and 5 summarize definitions of IOR motives and IOR typologies respectively.

<b>Table 2. Causal Agency Definitions – Source: Markus and Robey, 1988</b>	
Technological	Change is caused by external forces (i.e., technology).
Organizational	People act purposefully to accomplish intended objectives.
Emergent	Change emerges from the interaction of people and events.

<b>Table 3. Transaction Cost Economics Categories – Source: Williamson, 1991</b>	
Hierarchy	<b>Hierarchies</b> are governed by administrative controls...Production is taken within the firm and the incentives to produce are reduced. Adjustments in changes in demand are through internal mechanisms for cooperation and coordination. Contract law does not apply. Internal contracts can be more incomplete than with hybrid governance.
Hybrid	<b>Hybrid</b> governance displays intermediate values for incentive intensity, administrative controls, adaptation and use of contract law. It preserves ownership autonomy, which elicits strong incentives and encourages adaptation by individual participants. “Because there is bilateral dependency, however, long-term contracts are supported by added contractual safeguards and administrative apparatus (information disclosure, dispute-settlement machinery).” These facilitate adaptation through coordination. There may be asset specificity. When there are conditions of asset specificity (because of labor location, physical asset, brand-name capital, dedicated assets, or temporal specificity), then bilateral dependence occurs.
Market	<b>Markets</b> are characterized by high incentives to produce, but virtually no administrative controls on the production. “Changes in the demand or supply of a commodity are reflected in price changes, in response to which ‘individual participants... [are] able to take the right action,’ or take autonomous action. Markets are governed by contracts. There is no asset specificity.

**Coding**

Using these four sets of conceptual lenses we generated and iteratively refined the coding scheme. To ensure the appropriateness of our categories, all seven coders coded five articles. Discussions about the rationale for our coding led to the refined coding scheme applied in this study.

Primary and secondary coders were assigned to each remaining article. To decrease the potential of systematic biases arising from specific pairings of coders, coders were randomly assigned to each article. Each coder independently coded each assigned article. Differences were resolved between the two coders and a group coding for each article was entered into the database. If the two coders could not resolve disagreements for a particular article, the issues were discussed among all group members and the primary coder entered the codes agreed upon by the group. The intercoder agreement was high, 79%.

**Results – Theoretical Underpinnings of EDI Studies**

All four theoretical lenses were found in the EDI studies in our sample. A summary of each article’s casual agency, research context, IOR form and IOR typology is summarized in Table 6.

Necessity	<ul style="list-style-type: none"> <li>• An organization establishes linkages or exchanges with other organizations to meet the legal or regulatory requirements.</li> <li>• Mandating relationships increases the frequency of interactions between organizations and reduces an organization’s perception of power over its environment.</li> </ul>
Asymmetry	<ul style="list-style-type: none"> <li>• Refers to the potential of an organization to exercise power or control over another organization or its resources.</li> <li>• Resource scarcity prompts organizations to attempt to exercise power, influence and control.</li> </ul>
Reciprocity	<ul style="list-style-type: none"> <li>• IORs are based on cooperation, collaboration and coordination among organizations</li> <li>• IORs occur for the purpose of pursuing mutual beneficial goals and interests</li> <li>• Assumptions: resource scarcity induce cooperation rather than competition; the process of linkage formation is based on balance, harmony, mutual support, benefits for forming the linkage exceed the costs of managing the linkage and partially loss of decision making.</li> </ul>
Efficiency	<ul style="list-style-type: none"> <li>• IORs are prompted to improve the internal input/output ratio of an organization and internal efficiency. The movement from market-mediated transactions to formal interorganizational arrangements will occur as a result of an organization’s attempt to economize on the transaction costs.</li> </ul>
Stability	<ul style="list-style-type: none"> <li>• IORs formation is an adaptive response to environmental uncertainty (generated by resource scarcity or lack of perfect knowledge)</li> <li>• The purpose is to achieve stability, predictability and dependability in relationship with others.</li> </ul>
Legitimacy	<ul style="list-style-type: none"> <li>• Pressure of the institutional environment motivate organizations to increase their legitimacy in order to appear in agreement with the prevailing norms, rules or expectations of external constituents and/or to improve their image, reputation, prestige.</li> <li>• IOR formation will be directed especially towards organizations whose level of legitimacy is perceived to be higher</li> </ul>

Pairwise (Dyadic) IORs	Relationship between 2 organizations
Interorganizational set	<ul style="list-style-type: none"> <li>• Emphasis on a focal agency and its dyadic relationships with other organizations</li> <li>• Variation: Action Set: a group organizations formed in a temporary alliance for a limited purpose</li> </ul>
Interorganizational Network	Multiple organizations linked by a specified type of relation to achieve certain goals or resolve specific problems

**Underlying View of Causal Agency**

Causal agency refers to the analyst’s beliefs about the identity of the causal agent: whether external forces cause change, whether people act purposefully to accomplish intended objectives or whether change emerges from the interaction of people and events (Markus and Robey, 1988). According to Markus and Robey, there are three perspectives underlying causal agency: the technological imperative, the organizational imperative or the emergent perspective. In the technological imperative, information technology is viewed as the cause of organizational change; it is an exogenous force that determines or constrains the behavior of individuals and organizations. The organizational imperative views the actions of the designers of information technologies as a cause of organizational change. Information technology use is dependent upon the organization’s information processing needs and managers’ choices. In the emergent perspective, organizational change emerges from complex social interactions between information technology and its human and organizational users.

It is often very difficult to ascertain the author’s view of causal agency in these studies. Thus we coded an approximate percentage to represent the author’s reliance on the technological imperative, organizational imperative or emergent perspective. An amazingly large percentage of articles (75%) adopted the technological imperative perspective that suggested that EDI was the principle driver in the changes uncovered in the studies or in theoretical models. Twenty-five percent (or 13/53) were purely based upon the technological perspective. Fifteen articles (28%) adopted a dominantly organizational imperative lens to suggest that EDI was used by managers to achieve their own individual or group goals. Only three used an entirely emergent perspective and two used a predominant emergent perspective. That is, less than ten percent adopted any adaptation of the emergent perspective.

**Table 6. Summary of Paradigmatic Lenses Underlying EDI Studies**

<b>Study</b>	<b>Primary Causal Agency</b>	<b>Research Context</b>	<b>IOR Form</b>	<b>IOR Typology</b>
Clemons & Row (1993)	Organizational	Market	Dyad	Buyer-Supplier
Premkumar, Ramamurthy & Nilakanta (1994)	Organizational	Market	Dyad	Buyer-Supplier
Riggins & Mukhopadhyay (1994)	Organizational	Hybrid	Set	Buyer-Supplier
Riggins, Kriebel & Mukhopadhyay (1994)	Emergent	Market	Dyad	Buyer-Supplier
Williams (1994)	Organizational	Market	Dyad	Buyer-Supplier
Banarjee & Sriram (1995)	Technological	Hybrid	Dyad	Buyer-Supplier
Daugherty, Germain & Droge (1995)	Technological	Hierarchy	Dyad	Buyer-Supplier
Fulk & DeSanctis (1995)	Emergent	Hybrid	Network	Strategic Alliance
Mukhopadhyay, Kekre & Kalathur (1995)	Organizational	Hybrid	Set	Buyer-Supplier
Walton & Miller (1995)	Organizational	Hybrid	Dyad	Buyer-Supplier
Gottardi & Bolisani (1996)	Technological Organizational Emergent	Hybrid	Set	Buyer-Supplier
Kumar & VanDissel (1996)	Technological	Hybrid	Dyad	Buyer-Supplier
Mackay & Rosier (1996)	Technological Organizational	Market	Dyad	Buyer-Supplier
Massetti & Zmud (1996)	Technological	Hybrid	Set	Buyer-Supplier
Marcussen (1996)	Technological Organizational	Hybrid	Network	Buyer-Supplier
Murphy & Daley (1996)	Technological	Market	Set	Buyer-Supplier
Barua (1997)	Emergent	Market	Set	Buyer-Supplier
Bensaou (1997)	Technological	Hybrid	Dyad	Buyer-Supplier
Bergeron & Raymond (1997)	Organizational	Hybrid	Dyad	Buyer-Supplier
Hart & Saunders (1997)	Emergent	Hybrid	Dyad	Buyer-Supplier
Philip & Pedersen (1997)	Technological	Market	Set	Buyer-Supplier
Teo, Tan & Wei (1997)	Organizational	Hierarchy	Network	Joint Venture
Vijayarathy & Robey (1997)	Technological	Market	Dyad	Buyer-Supplier
Vijayarathy (1997)	Organizational	Hybrid	Dyad	Buyer-Supplier
Boudreau, Loch, Robey & Straub (1998)	Technological	Hierarchy	Network	Joint Program
Chen (1998)	Technological	Hybrid	Set	Buyer-Supplier
Crook & Kumar (1998)	Organizational	Hybrid	Set	Buyer-Supplier
Hart & Saunders (1998)	Organizational	Hybrid	Dyad	Buyer-Supplier
Peffers (1998)	Technological	Hybrid	Dyad	Buyer-Supplier
Ratnasingham (1998)	Technological	Hybrid	Dyad	Dyads
Williams, Magee & Suzuki (1998)	Technological	Hybrid	Dyad	Buyer-Supplier
Wilson & Vlosky (1998)	Organizational	Market	Dyad	Buyer-Supplier
Fearon & Philip	Organizational	Hybrid	Set	Buyer-Supplier
Holmes (1999)	Organizational	Market	Dyad	Buyer-Supplier
Larson & Kulchitsky (1999)	Technological Organizational	Hybrid	Set	Buyer-Supplier
Lee, Clark & Tam (1999)	Organizational	Market	Set	Buyer-Supplier
Murphy & Daley (1999)	Technological	Market	Set	Trade Association
Ramamurthy, Premkumar & Crum (1999)	Technological Organizational	Market	Set	Buyer-Supplier
Ratnasingham (1999)	Technological	Hybrid	Dyad	Buyer-Supplier

Study	Primary Causal Agency	Research Context	IOR Form	IOR Typology
Riggins & Mukhopadhyay (1999)	Organizational	Market	Dyad	Buyer-Supplier
Young (1999)	Technological	Market	Set	Buyer-Supplier
Chan (2000)	Technological	Market	Network	Buyer-Supplier
Damsgaard & Truex (2000)	Technological	Hybrid	Dyad	Buyer-Supplier
Johnston & Gregor (2000)	Emergent	Market	Network	Buyer-Supplier
Nakayama (2000)	Technological	Hybrid	Dyad	Buyer-Supplier
Rassameethes, Kurokawa & LeBlanc (2000)	Technological	Market	Dyad	Buyer-Supplier
Shirland (2000)	Technological	Market	Network	Buyer-Supplier
Sriram (2000)	Technological Organizational Emergent	Hybrid	Dyad	Buyer-Supplier
Ahmad & Schroeder (2001)	Technological	Market	Network	Buyer-Supplier
Damsgaard & Lyytinen (2001)	Technological	Market	Set	Buyer-Supplier
Humphreys, Lai & Sculli (2001)	Technological	Hierarchy	Set	Strategic Alliance
Lim & Prashant (2001)	Technological	Hybrid	Network	Buyer-Supplier

**Transaction Cost Economics Categories, IOR Forms, and IOR Typology**

Transaction Cost Economics (TCE) categories, IOR forms and IOR typology describe the interorganizational relationship. TCE theory served as a theoretical base for a number of these studies, as well as for other EDI writings (Humphreys et al., 2001). TCE can be used to assess the impact of EDI on interorganizational economic efficiency. It is also especially pertinent in IOR studies because of the reduced IOR coordination costs that it generates, and the resulting efficiencies realized to markets. Not surprisingly, only four (8%) were classified as hierarchies. In hierarchies, production is taken within the firm and the incentives to produce are reduced. Adjustments in changes in demand are through internal mechanisms for cooperation and coordination. Hierarchies focus on internal aspects of the EDI relationship. In contrast, most studies demonstrated an external focus. Twenty-two (42%) were markets and 27 (51%) were hybrids. Markets are ruled by contracts and heavy emphasis is placed on selecting from multiple trading partners on the basis of commodity price. On the other hand, hybrids are characterized by bilateral dependency and long-term contracts that are supported by added contractual safeguards and administrative apparatus (information disclosure, dispute-settlement machinery) (Williamson, 1991).

Virtually all IOR forms in our study were buyer-supplier (43, or 81%). Those articles that were coded as a “Strategic Alliance” IOR form were associated with IOR types with increasing levels of complexity: 0 dyads, 2 sets, 3 networks. Conversely, when considering IOR typology, the number of studies for each type decreased with the level of complexity: 25 dyads (47%), 17 sets (32%), and 11 networks (21%). Dyads represent the buyer-supplier relationship that develops between trading partners establishing EDI. When considering long-term relationships, dyads may be especially important. Nakayama (2000) suggests that the TCE-based market view is inappropriate for viewing EDI relationships because it fails to consider close, long-term relationships with trading partners. An alternative to the dyad is the set, as when considering a “hub and spoke.” The hub organization interfaces with the spokes in its set of trading partners. As EDI moves toward the Internet, networks, or exchanges may develop.

**Results – EDI and Methodological Issues**

*Types of Studies*

Table 7 lists the topic areas in the sample: General Outcomes (EDI benefits and shortcomings), Collaboration/Coordination Outcomes, Power/Trust/Risk, EDI Adoption, EDI Use/Diffusion, Typologies, and Strategy. Thirty-one (or 58%) focus on EDI outcomes, especially benefits. A much larger percent focus on implementation and use compared to adoption (42% vs. 17%, respectively). Only 15% were found to be strategy related based on an examination of titles and keywords. A relatively smaller number of articles try to tease out specific aspects of the relationship such as improvements in collaboration, or the counterbalancing forces of power, trust and risk.



Table 7. Topic Areas of the EDI Studies Sample

Study	General Outcomes (Benefits & Shortcomings)	Collaboration/ Coordination Outcomes	Power/ Trust/ Risk	EDI Adoption	EDI Use/ Diffusion/ Implementation	EDI Typologies	Strategy
Clemons & Row (1993)		X	X				
Premkumar, Ramamurthy & Nilakanta (1994)					X		
Riggins & Mukhopadhyay (1994)	X						
Riggins, Kriebel & Mukhopadhyay (1994)	X						
Williams (1994)			X	X			
Banarjee & Sriram (1995)	X			X	X		
Daugherty, Germain & Droge (1995)				X			
Fulk & DeSanctis (1995)		X					
Mukhopadhyay, Kekre & Kalathur (1995)	X						
Walton & Miller (1995)			X	X			
Gottardi & Bolisani (1996)						X	X
Kumar & VanDissel (1996)		X	X			X	
Mackay & Rosier (1996)	X						
Massetti & Zmud (1996)					X		X
Marcussen (1996)					X		
Murphy & Daley (1996)	X						
Barua (1997)	X						X
Bensaou (1997)		X					
Bergeron & Raymond (1997)	X				X		
Hart & Saunders (1997)	X		X	X	X		
Philip & Pedersen (1997)	X				X		
Teo, Tan & Wei (1997)	X						
Vijayarathy & Robey (1997)		X					
Vijayarathy (1997)	X			X			
Boudreau, Loch, Robey & Straub (1998)	X						
Chen (1998)	X						
Crook & Kumar (1998)	X				X		
Hart & Saunders (1998)			X		X		
Peffer (1998)	X			X	X		
Ratnasingham (1998)			X				
Williams, Magee & Suzuki (1998)	X				X		
Wilson & Vlosky (1998)	X		X				
Fearon & Philip (1999)	X				X		
Holmes (1999)		X			X		
Larson & Kulchitsky (1999)	X						
Lee, Clark & Tam (1999)	X				X		
Murphy & Daley (1999)	X						
Ramamurthy, Premkumar & Crum (1999)	X		X		X		
Ratnasingham (1999)			X				
Riggins & Mukhopadhyay (1999)			X				
Young (1999)	X						X
Chan (2000)	X						X
Damsgaard & Truex (2000)	X				X	X	
Johnston & Gregor (2000)					X		
Nakayama (2000)	X		X		X		

Study	General Outcomes (Benefits & Shortcomings)	Collaboration/Coordination Outcomes	Power/Trust/Risk	EDI Adoption	EDI Use/Diffusion/Implementation	EDI Typologies	Strategy
Rassameethes, Kurokawa & LeBlanc (2000)	X				X		
Shirland (2000)	X						
Sriram (2000)	X		X		X		X
Chatfield & Yetton (2000)		X		X			X
Ahmad & Schroeder (2001)	X				X		
Damsgaard & Lyytinen (2001)				X			
Humphreys, Lai & Sculli (2001)	X	X	X		X	X	X
Lim & Prashant (2001)	X						X

**Motives for EDI Adoption and Use**

Since there is an overriding concern in discovering the benefits of EDI, it could be anticipated that the motives for EDI adoption and use might vary substantially over this global sample. To understand the motives, we used the six motives outlined by Oliver (1990). The sample displays surprisingly little variance. Every study suggests that efficiency was a motive for EDI adoption or use. Clearly the anticipation of operational cost savings underlies many decisions to adopt and to continue to use EDI. Only one study highlights legitimacy motives. This study (Rassameethes, Kurokawa, LeBlanc, 2000) examines first and second tier suppliers in the automotive supply chain and finds that while first tier suppliers are adopting EDI, they have not been able to persuade the second tier suppliers to do so.

Necessity also is infrequently used as a motive for EDI adoption and use. Ironically, though Humphreys, Lai and Sculli (2001) use Oliver’s categorization to understand the benefits of EDI to upstream and downstream EDI trading partners, necessity alone is not included, perhaps because it is viewed as nonvoluntary. One of the five studies focusing on necessity (Damsgaard and Lyytinen, 2001) looked at the role of industry associations in compelling organizations to adopt EDI. This study highlights two deficiencies of EDI research: (1) failing to consider institutional forces behind EDI implementations, and (2) failing to consider the international context of EDI adoption.

Asymmetry as a motive for adoption of EDI refers to the potential of an organization to exercise power or control over another organization or its resources (Oliver, 1990). Asymmetry is cited as a motive in 22 of 53 studies. Thirteen of the studies with asymmetry as a motive explicitly discuss bargaining power of one of the trading partners as a reason to adopt EDI. Nine of them include power as one of the variables into their model. Reciprocity as a motive for EDI adoption assumes that interorganizational relationships occur for the purpose of pursuing mutual beneficial goals and interests (Oliver, 1990). Reciprocity is identified as a motive in 27 studies. When EDI adoption is an adaptive response to environmental uncertainty and the purpose of EDI adoption is predictability and dependability of the trading relationship, the motive of stability applies. Stability as a motive is coded in 8 of the 53 examined studies.

**Research Approach, Time Span and Epistemology**

Thirty-two (or 60%) were single-shot cross-sectional surveys, as compared to only seven (or 13%) that took a more long-term approach using longitudinal data gathering, multiple cross-sectional surveys or process traces. All but two (e.g. Bergeron and Raymond, 1997; Mackay and Rosier, 1996) of the 22 survey studies and all seven field studies used single-shot cross-sectional data. In contrast the case studies used a combination of longitudinal, single-shot cross-sectional, multiple cross-sections and process traces.

Positivism is the dominant epistemology in EDI research. Thirty-one articles (58%) were theoretically grounded while another 18 (34%) were descriptive. Only four interpretive and two critical studies were represented in this sample. An analysis of the theoretically grounded studies revealed that the most frequently-used theories in understanding the benefits of EDI are diffusion of innovation (23%), organization theory (10%) , and transaction cost theory (16%).

## **Discussion and Conclusion**

EDI research can be distinguished by its broad appeal: It is studied globally across a broad range of disciplines. However, a review of the research suggests both methodological and conceptual gaps in the research that has been performed.

### ***Methodological Gaps***

Most studies in this research employ the technological imperative to understand the short-term benefits and shortcomings of EDI. While these impacts could certainly be long-term, the EDI studies to date in this perspective do not typically address the more progressive or evolving nature of the impacts. The theories studied with this perspective (if there are any stated) tend to be conceptually simpler than theories drawing from the organizational or emergent perspectives. They tend to be easier to test empirically because their linear propositions and hypotheses can be more clearly specified. Hence, there was a heavy reliance on cross-sectional surveys when the technological imperative was applied --- an approach that is appropriate for studying short-term, direct impacts of EDI. Yet to focus exclusively on this level is to attribute to it more influence than it has (Perrow, 1965). To extend the horizon, the organizational imperative more often looks beyond the immediate impact to understand EDI's use. An even longer-term orientation (and methodology) is required to study the evolution suggested by the more complex, albeit less exact, emergent perspective. It is more difficult to develop and test the theoretical predictions of this perspective because of the non-linearity of emergent patterns. Longitudinal studies can be expected to be more useful than cross-sectional and short-term studies in studying the underlying, evolving dynamics of EDI implementation and use. However, many longitudinal studies are case-studies and they suffer from generalizability limitations. Thus, the more generalizable surveys and field studies may be augmented with case studies to add richness to our understanding for the evolving nature of EDI use and its second order impacts such as improved customer relations or tighter control over the 'supply chain.'

For example, consider trust between or interorganizational collaboration of EDI trading partners. It could be expected that building collaborative or trustful relationships will take time and can only be studied through longitudinal analysis. Further, it can be anticipated that use of the EDI technology will impact coordination and collaboration, and over time the trading partners may learn to appropriate the technology to improve coordination. In their case study, Hart and Saunders (1997) described how a trusted trading partner used information derived from the EDI systems to propose a change in the use of the system when partial orders were delivered. Instead of using EDI to send a transaction that reflected the unfilled portion of the original order, the partners agreed to use information systems to keep track of the unfilled portions without sending a new request for the unfilled order. To fully understand such an evolving use of EDI, an emergent perspective using a case study with a longitudinal approach is desirable. Similarly, Damsgaard and Truex (2000) suggest that the emergent perspective is particularly important for the topic of EDI standards. Because organizational forms, partnerships and business relationships are constantly evolving, EDI standards, as an emergent grammar, are also evolving.

### ***Conceptual Gaps***

Our review suggests a number of areas where conceptual gaps inhibit our full understanding of EDI's impact on IORs. These include research on targeted TCE categories, IOR typologies and IOR forms. It is not surprising that there are relatively few EDI studies of hierarchies. Hierarchies focus on internal efficiencies rather than the relationships between trading partners. While the focus may continue to be placed on hybrids when studying IORs and supply chains, e-commerce relationships may make the study of markets more salient. Internet EDI and exchanges are often premised on many-to-many relationships. They may offer a forum for many suppliers to reach a large number of buyers. Horizontal exchanges, auctions and other such web-based approaches focus on price and the type of commodity-based transactions that characterize markets. Thus, the movement of EDI into the arena Internet EDI (or exchanges) may lead to more studies of markets.

Associated with the movement toward Internet EDI is the issue of standards. As open standards become prevalent, more research will need to focus on trade associations since it will be the trade associations, and not buyer-supplier pairs, that promote widespread use of EDI. Further, as organizations turn increasingly to supply chain management (SCM), more research will be needed on sets and networks (as compared to dyads). Such research may expand upon the research of Kumar and Van Dissel (19996) that considers the sub-optimization of adjacent nodes in the value/supply chain. Kumar and Van Dissel suggest that an overall design across the entire value system/supply chain may require different structuring and design within the adjacent nodes, as well as open standards to promote communication across nodes within interorganizational sets and networks.

Finally, the international perspective on EDI is a research area that warrants increased focus for several reasons. First, differences in the availability, maturity, compatibility, and reliability of IT infrastructure across national boundaries may subject IORs to additional complexity and risks. Second, differences in customs, business practices and regulations across national boundaries may also increase the potential for conflict (Kumar & Van Dissel, 1996). The importance of the cultural context was demonstrated in Damsgaard & Lyytinen's (2001) cross-cultural study that found that local contingencies, past history, and cultural traditions affected the EDI diffusion process, and manner in which trade and industry associations can deploy different strategies.

In summary, our review of 53 EDI articles demonstrated a fair amount of consistency in terms of epistemology employed (positivist), time-span considered (single-shot cross-sectional), and forms of IOR (buyer-supplier) and market categories (not hierarchies) studied. It appears that future research could benefit from adopting a market perspective of Internet EDI, a more complete understanding of the impact of open standards on EDI-enabled IORs -- especially in terms of the role of trade associations, and increased focus of EDI's role in supply chains. Studies abound on EDI benefits and implementation. What appears to be an especially fertile area for research is the study of ways to improved collaboration and coordination in EDI relationships among trading partners.

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<sup>2</sup>The complete list of coded articles is available upon request from the lead author.