Measuring Business Benefits of RosettaNet Standards
A Co-Adoption Model Conducted by the University of Illinois

Overview

Business Challenges

The factors that influence an organization's decision to implement a given technology have long been the subject of industry debate. Several theoretical models, referred to as technology diffusion models, have been developed to better understand the role of these factors in the adoption and use of certain types of technology.

This paper provides background, positioning, and related insights around a recent technological development in B2B e-commerce known as XML-based Interorganizational Systems (IOS). Specifically, the University of Illinois has developed a Co-Adoption Model of XML-based IOS. The theoretical model is developed to empirically evaluate the influential factors leading to adoption and internal diffusion (volume, diversity and breadth) of the target technology. The term RosettaNet IOS refers to a type of XML-based IOS as developed by the RosettaNet consortium. The term co-adoption is intended to imply the mutual adoption of the same technology innovation between two different organizations. The factors under study include compatibility, relative advantage, environmental and three control variables: 1) Seller versus Buyer; 2). technology conversion type; and 3). location in supply chain.

RosettaNet Standards

A field study covering 12 implementations of the target technology was conducted with the RosettaNet consortium. RosettaNet Partner Interface Processes® (PIPs®) included in this study are PIP 3A4: Request Purchase Order, PIP 3A8: Request Purchase Order Change, PIP 3A9: Request Purchase Order Cancellation, PIP 3D8: Distribute Work in Process, PIP 3D9: Query Work in Process, and PIP 5D1: Request Ship from Stock and Debit Authorization.

Business Benefits

From the compatibility construct, the XML-based IOS solution earned greater compatibility levels in four of the five common task needs as compared to the Electronic Data Interchange (EDI) solution. Findings also indicate substantial improvements in all direct financial and operational measures, including ROI, transaction costs, payback, cycle time and throughput. For example, transaction cost savings ranged from 16% to 87%. The most common indirect benefits include reduced negotiation time of technical standards and improved resource allocation time, while the most important gains are compliance with business partner mandates and product cost advantages. In addition, significant indirect benefits were derived from a supply-chain focused interorganizational architecture standards-setting consortium such as RosettaNet that is over and above direct transaction cost savings. Examples of the benefits from such a consortium include designing and promoting modularity in IOS architecture, enabling a blanket Purchase Order process, and increased level of trust among business partners. The relative advantages of direct measurement variables (transaction cost savings, ROI, operational improvements) are key constructs in sustaining interest in the target technology and likely leading toward greater levels of internal diffusion.

Background of Technological Innovation

Many claims have been made that business-to-business (B2B), e-commerce growth over the Internet is constrained by HTML's (Hypertext Markup Language) inherent limitations, which includes minimal content structuring capability, application coupling with back-end systems and limited options to customize electronic business documents. Development for eXtensible Markup Language (XML) started in 1996 and was formerly recommended by the World Wide Web Consortium (W3C) in 1998. By affording programmers and system developers the flexibility to define and invent electronic business documents, field attributes and data tags, XML provides an alternative to HTML -– overcoming many of the obstacles faced by the industry while substantially improving the ability to conduct B2B e-commerce via the Internet.

The very benefits that characterize XML, however, have led to a multitude of new challenges. To fully leverage the B2B e-commerce benefits that surround XML, industry groups and supply chain partners must agree on common sets of electronic business documents, field definitions, data attributes and communication protocols. This requirement has spawned a host of new horizontal and vertical industry organizations to develop XML-based standards for their respective industries. Output from such groups has included XBRL for Extensible Business Reporting Language, HR-XML for Human Resource-based XML, and Math XML for XML use in advanced mathematical equations, among others. In fact, in August 2001, the *XML.org Registry* listed 105 different registered submissions for XML-based standards, spanning 25 vertical and seven horizontal industries. Similarly, *XML in Industry* had 450 different submissions for XML-based standards spanning 54 vertical and nine horizontal industries.

An example of one such vertical standards organization is RosettaNet. Founded in 1998, RosettaNet is a non-profit consortium focused on developing XML-based business process standards for the Information Technology, Electronic Components and Semiconductor Manufacturing industries. To fully address the business needs of supply chain companies across the trading network; RosettaNet maintains an ongoing, symbiotic relationship with the Solution Provider community. Like RosettaNet, many of these newly formed XML standard-setting bodies have not limited their standards to consistent field attributes and definitions, but rather they have expanded the standards repertoire to include business dictionaries, networking protocols and technical dictionaries organized around shared business processes between partner organizations. RosettaNet has developed standards for more than 75 of these shared business processes, ranging from *Request Engineering Change* to *Cancel a Purchase Order* to *Notify of Authorization to Build.* The content of each is complete with messaging service standards, business dictionaries, technical dictionaries and business process choreography. These XML-based shared business process standards form point-to-point connections, via the Internet, that enable execution of the relevant business processes within and between different organizations on a global basis. They are, in effect, modularized XML-based interorganizational information systems. On an individual basis, the scope of these packaged standards is narrow and traditionally limited to a single business function. Collectively, however, and within a business process-by-business process, industry-by-industry framework, RosettaNet is developing the foundation necessary to facilitate and enable future B2B e-commerce growth over the Internet.

With regard to the industry's emerging XML standards landscape, the scope and purpose of these organizations has begun to shift. Some groups, for instance, have started to limit their scope to setting standards for simple XML-based business document attributes and common data definitions in their respective industries. Other consortia, such as RosettaNet, are developing XML-based shared business process standards that, again, are tantamount to a modularized XML-based IOS.

Co-Adoption Model of XML-Based IOS

Based on a review of current IOS and innovation diffusion literature, the following factors have influenced the adoption and internal diffusion of XML-based IOS. These identifiable factors can be classified into four constructs, including: compatibility, relative advantage, environmental and control variables (see Figure 1.0).

Compatibility

Technology compatibility is how the new technology is consistent with existing tasks, needs, prior experiences and processes of the adopters. A framework for assessing compatibility of a new technology is to evaluate assumption gaps between new technology characteristics versus task characteristic needs of the organization. In this instance, the scope includes three shared business processes – *Purchase Order (PO) Generation, PO Change/Cancel,* and shipments from made-to-stock items (a.k.a. *Ship from Stock and Debit*). Similar technological innovations are applied to these business processes that necessitate different task characteristics. The alternative technical solutions include XML-based IOS, web-based POs, EDI and manual-based process solutions. This will provide a useful framework for evaluating the alternative technical solutions to the shared business process types.

Relative Advantage

Relative advantage may be defined as the extent to which a potential adopting organization views the innovation as offering financial and operational benefits over previous methods of performing the same tasks. The financial indicators to be used include ROI transaction costs savings, investment and payback. The operational performance indicators include throughput (capability per unit of time) and cycle time.

Environmental

The two primary environmental factors under consideration include *partner power* and *expectations of market trends*. *Partner power* is measured as the percentage of sales (or purchases) that a business partner depends upon from their customer (or supplier). This use of the *power* variable is consistent with the industry under study, availability of substitute suppliers, low manufacturing capacity utilization rates and relatively low switching costs. *Expectations of market trends* are the degree of likelihood or expectation that industry players will pervasively adopt the target technology in the future. Partner organizations have a serious and vested interest in developing and setting the most appropriate standards required within their industry.

Control Variables

Three control variables are used in this study: *Buyers versus Sellers*, *location in supply chain* and *technology conversion type*. Buyer/Seller relationships are defined in each trading partner instance. The location in the supply chain depicts a manufacturing continuum from materials through manufacturing stages into distribution. Technology conversion is the type(s) of technology a company has used in the past and what newly deployed technology the company is currently using for B2B transactions.

Innovation Measures

The innovation measures included in this study focus on the notion of adoption and internal diffusion. Adoption is defined as a decision to invest resources necessary to accommodate the implementation effort, while internal diffusion is the extent of use of a particular innovation across people, projects, tasks or organizational units. In the area of IOS (and more specifically EDI), three additional dimensions relevant to internal diffusion are presented – volume, diversity and breadth. *Volume* refers to the ratio of business documents transmitted via the technology innovation channel, over the total number of business documents exchanged (regardless of the technology). *Diversity* refers to the count (or total instances) of the target technology that the organization has implemented. *Breadth* refers to the count of different trading partners with whom the respondent has co-adopted the target technology. The use of these definitions is consistent with other EDI studies. For analysis and discussion purposes, *diversity* and *breadth* are measured at the organizational level (as opposed to an individual business process level). Similarly, *adoption* will be measured at the RosettaNet-based standards level (as opposed to a specific type RosettaNet IOS).
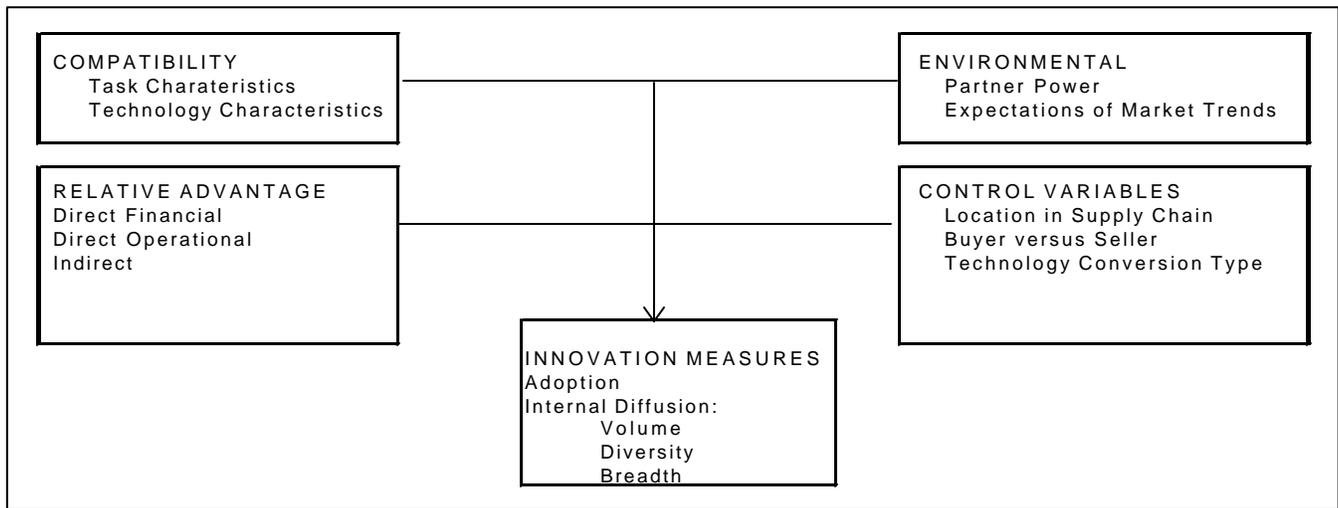
Figure 1.0
Co-Adoption Model of XML-Based Interorganizational Systems

Research Framework

The field study is organized into four cases (see Figure 2.0). Each case represents a shared business process between two separate organizations 'paired' on each end of the IOS (with the exception of Case #2, which includes three *closely related* shared business processes grouped into a single case). Thus, the scope of the field study includes six instances of RosettaNet IOS (for a total of 12 different installations) between eight RosettaNet Partner companies each paired set of organizations mutually agreed to co-adopt, with implementations, the shared business processes utilizing the target technology (RosettaNet IOS). With respect to each case, the participating organizations are tagged with control variable attributes. Thus, every case has a Buyer and a Seller organization. Similarly, each organization participates in a different role in the same supply chain and each has an assigned technology (e.g. semi-automated, EDI, manual) prior to implementing the target technology.

PRIOR TECHNOLOGY	ROLE IN SUPPLY CHAIN W.R.T. BUSINESS PROCESS	SHARED BUSINESS PROCESS			ROLE IN SUPPLY CHAIN W.R.T. BUSINESS PROCESS	PRIOR TECHNOLOGY
		SELL SIDE	SHARED BUSINESS PROCESS DESCRIPTION	BUY SIDE		
CASE #1						
SEMI-AUTOMATED (FAX / E-MAIL)	MANUFACTURER	Company A-1	*Ship From Stock & Debit*	Company B-1	DISTRIBUTOR	SEMI-AUTOMATED (FAX / E-MAIL)
CASE #2						
EDI	OUTSOURCING PARTNER	Company C-2	*PO Generate, Change & Cancel*	Company D-2	MANUFACTURER	EDI
CASE #3						
PROPRIETARY IOS	OUTSOURCING PARTNER	Company E-3	*PO Generate*	Company F-3	MANUFACTURER	SEMI-AUTOMATED
CASE #4						
SEMI-AUTOMATED (FLAT FILE)	OUTSOURCING PARTNER	Company G-4	*Notify of Advance Shipment*	Company H-4	MANUFACTURER	SEMI-AUTOMATED (FLAT FILE)

Figure 2.0
Case Study Research Framework

Field study participants were selected based on the following criteria: both organizations in the trading partner relationship were willing to participate and the technology was already implemented. Data was collected between June 2001 and July 2002.

Results and Discussion

As a result of the consolidated responses from the field study, an empirical comparison was made to the Co-Adoption Model of XML-based Interorganizational Systems. The purpose of this comparison was to evaluate the proposed constructs and measurement variables utilized in the model while also providing an organized approach to analyzing the field study data.

Compatibility
Respondents were requested to identify and rank (with one as the most important) specific task needs associated with shared business processes. Next, respondents were requested to rate (on a 5-point Likert scale with *Strongly Disagree* as 1 and *Strongly Agree* as 5) the ability of the various technical solutions to meet those shared business process task needs. Responses were grouped into three shared business process types (*PO Generate, PO Change / Cancel, Ship from Stock and Debit*). Five task needs were found to be common among all shared business process types. These are indicated as 'Common.' The common task needs included (in order from most important to least): data accuracy & integrity, timeliness, effective communications, collaboration levels and transaction volumes. Several other task needs were found to be unique to the shared business process type; these requirements are indicated as 'Distinct'. (See Table A for a summary of compatibility findings.)

Overall, the RosettaNet IOS technology was found to be more compatible than EDI and semi-automated solutions with meeting the task needs for all three-shared business process types. From a RosettaNet IOS versus semi-automated perspective, the RosettaNet IOS solution earned more than twice the compatibility rating than the semi-automated technology. This is not surprising as the semi-automated solutions include informal process steps with a hybrid of e-mails, faxes and phone calls. In fact, the largest to smallest compatibility ratings of RosettaNet IOS over the semi-automated solutions are improved data accuracy and integrity, collaboration levels, timeliness, effective communications and transaction volumes. Similar results were found when comparing EDI versus semi-automated solutions.

When comparing RosettaNet IOS and EDI, the RosettaNet IOS solution earned greater compatibility levels in four of the five common task needs. In order of largest to smallest, the respondents considered the RosettaNet IOS solution to have higher compatibility levels than EDI with the following business process task needs (collaboration levels, data accuracy and integrity, effective communications, timeliness). According to the survey respondents, RosettaNet IOS and EDI have the same compatibility rating with respect to their ability handle large transaction volumes.

BUSINESS PROCESS TASK NEEDS	SHIP FROM STOCK AND DEBIT (5D-1)				REQUEST PO (3A-4)				CHANGE PO AND CANCEL PO (3A-8, 9)				OVERALL ROSETTANET		
	RANK	Semi-Auto	RN IOS	EDI	RANK	Semi-Auto	RN IOS	EDI	RANK	Semi-Auto	RN IOS	EDI	RANK	LARGEST BENEFIT OF RN VS SEMI-AUTO	LARGEST BENEFIT OF RN VS EDI
COMMON															
Ability to manage transaction volumes	5	3.0	4.0	5.0	5	2.5	4.8	4.5	2	2.5	4.5	4.5	5	2.0	0.0
Enhanced timeliness	3	2.0	5.0	4.0	2	2.5	4.8	4.0	2	2.0	4.5	4.0	2	2.4	0.7
Effective communication	2	2.0	5.0	4.0	3	2.8	5.0	4.3	3	3.0	5.0	4.0	3	2.3	0.9
Improved data accuracy and integrity	1	2.0	5.0	3.0	1	2.0	5.0	4.0	1	1.5	5.0	4.0	1	3.1	1.1
Collaboration levels with S.C. Partners	4	2.0	5.0	3.0	4	2.0	4.5	3.3	2	2.0	5.0	3.0	4	2.7	1.6
DISTINCT															
Ability to utilize standards on a global-basis						2.0	5.0	3.0		2.0	5.0	3.0			
Enhanced consistency with other business processes						4.0	4.0	4.0		4.0	4.0	4.0			
Ability to be automated (reduced people touch-points)						4.0	4.0	3.0		4.0	4.0	3.0			
Integration with Back-end systems						1.0	5.0	5.0		1.0	5.0	5.0			
Ease of Implementation of New SC Partner						1.0	5.0	2.0		1.0	5.0	2.0			

Table A
Compatibility Rating of Technical Solutions versus Business Process Tasks Needs

Relative Advantage

The relative advantage construct is broken into direct financial impact, operational performance impact and indirect impact of the new target technology. This required respondents to calculate transaction costs before and after implementation of the target technology. The direct cost components included technical standards negotiation time (between the two participants), hardware, software and implementation-related expenses. These direct cost components were consolidated, amortized and divided by the average volume of business document exchanges (associated with the shared business process) to determine the ongoing transaction cost for pre- and post-implementation scenarios. The initial up-front investments associated with implementing the new technology were isolated to calculate the ROI and payback financial indicators. The direct operational impact of the new technology was simpler to assess. Respondents were requested to identify the new technology's impact on cycle time and throughput (processing capability per unit of time). Evaluating the indirect impact of the target technology was similar in structure to the compatibility segment of the survey. Respondents were requested to identify, rank and rate the indirect impact of the new RosettaNet IOS technology.

As indicated below in Table B, the summarized findings associated with the direct financial and operational measurement variables in the relative advantage construct were notable. During the course of the study, five respondents provided quantifiable survey responses and three provided relative assessments ('moderate' to 'slight'). Overall, the direct financial benefit of the new technology is significant. Transaction cost savings enabled by the new technology range from 16% to 87%.

ORG	RN SOLUTION	BUY / SELL SIDE	DIRECT FINANCIAL IMPACT			OPERATIONAL IMPACT	
				RETURNS			
			TRANS COST	ROI (1 YEAR)	PAYBACK (YEARS)	THRU-PUT CAPABILITY	CYCLE-TIME
CASE #1							
A-1	SHIP FROM STOCK & DEBIT	SELL SIDE	-87% savings	High	1.9	650% increase	91% reduction
B-1	SHIP FROM STOCK & DEBIT	BUY SIDE	-40% savings	High	1.8	67% increase	40% reduction
CASE #2							
C-2	PO GENERATE, CHANGE, CANCEL	SELL SIDE	-32% savings	Moderate	10.4	PO CREATE (no change) PO CHANGE (tested at 19x incr)	PO CREATE (no change) PO CHANGE (tested at 86% reduction)
D-2	PO GENERATE, CHANGE, CANCEL	BUY SIDE	-16% savings	Moderate	14.8	PO CREATE (tested at 2x incr.) PO CHANGE (tested at 2x incr.)	PO CREATE (98% reduction) PO CHANGE (98% reduction)
CASE #3							
E-3	PO GENERATE	SELL SIDE	-37% savings	Moderate	4.2	100% increase	99% reduction
F-3	PO GENERATE	BUY SIDE	-32% savings	Moderate	8.6	Tested at 2x increase	99% reduction
CASE #4							
G-4	NOTIFY OF ADVANCE SHIPMENT	SELL SIDE	Slight Savings	Slight	Slight	Slight	Slight
H-4	NOTIFY OF ADVANCE SHIPMENT	BUY SIDE	Slight Savings	Slight	Slight	Moderate	Moderate

Table B
Direct Financial & Operational Impact Measurement Variables for Relative Advantage

The direct operational impact from the new technology is significant as well. Overall, throughput (processing capability per unit of time) improvements range from *no change* to *19-fold (19X)* improvements. Three respondents (organizations C-2, D-2 and F-3) provided throughput improvement estimates based on system capacity testing. Actual throughput improvements may be larger. Cycle-time reductions range from *slight* to *99%*. The drivers causing these operational improvements will vary depending on the shared business process type and the type of technology that the organization converted from. For instance, Case #1's business process type is *ship from stock and debit* that utilized semi-automated procedures prior to implementing the target

technology. The ubiquitous data access, automated centralized approval-progression procedures and automated tolerance checks enabled by the RosettaNet IOS has reduced the size of the debit memo re-work queue, thus enabling the 650% through-put increase by the Seller and 67% through-put increase by the Buyer. This also accounts for the cycle-time improvements for Case #1. Case #2's business process type, PO processing (*generate, change & cancel*), utilized EDI prior to implementing the new technology. The real-time processing, consistent data structures and reliable data packets enabled by the RosettaNet IOS have contributed to the significant increases in throughput capability and reductions in cycle time experienced on both ends of the IOS. Case #3's business process type, *PO generate,* utilized a semi-automated solution (SAP fax and e-mails) from the Buyer to the Seller prior to the implementation of the target technology. The operational performance improvements are enabled by traditional benefits experienced with automating a semi-manual shared business process (real-time communications, data accuracy and data communication integrity.). Case #4's business process type, *notify of advance shipments,* utilized a semi-automated solution (flat file) for data communications prior to the target technology's implementation. The slight to moderate operational performance improvements resulted in increased data communications reliability, timeliness and accuracy enabled by the new RosettaNet IOS.

Assessing the indirect impact of the target technology was similar in structure to the compatibility segment of the survey. Respondents were requested to identify, rank and rate the indirect impact of the new XML-based IOS technology. This process, however, was limited to rating the ability of RosettaNet IOS towards meeting and achieving the identified XML-based IOS indirect benefits. See Table C (Panels 1 & 2) for a summary of the indirect benefits.

Overall, the indirect benefits are among the most significant findings gleaned from the field study. The most common indirect benefits include *reduced negotiation time of technical standards* and *improved resource allocation time*. While the most important indirect benefits included *product cost advantages* and *compliance with business partner mandates*. Table C (Panel 1) organizes indirect benefits between those *Common to Buyer* organizations, those *Common to Seller* organizations and *Distinct* (unique from an individual respondent). The RosettaNet-IOS solution scored an overall rating of 3.68 (out of 5.0 as the highest and best rating) for demonstrating the ability to successfully provide the indirect benefits of XML-based IOS. Buyer organizations felt RosettaNet-IOS technology was able to provide greater indirect benefits than Seller organizations (an overall rating of 3.92 by Buyers versus 3.61 by Sellers).

All respondents included comments regarding the substantial timesavings associated with having an independent, open, supply-chain focused organization dedicated toward establishing consistent standards for XML-based IOS solutions. Although this causes an overlap between the direct and indirect benefits (since the costs associated with these time savings are reflected in the direct transaction cost impact), respondents indicated there are benefits derived from the over and above transaction cost savings. Examples of these additional benefits include enabling and facilitating a *real* blanket PO process, designing and encouraging modularity in IOS architecture and design, reduced tensions between business partners regarding non-core issues, government tax-breaks for enabling interconnectivity between organizations, reduced internal IT development expenditures and others.

The operational performance improvements, as well as the indirect benefits, are relatively balanced between both Seller and Buyer organizations. There does appear to be a trend toward greater financial and operational performance improvements among organizations converting from semi-automated procedures in the old environment. It was originally hypothesized that EDI users would not experience as great financial and operational benefits as compared to organizations that utilized manual or semi-automated technologies in their old environment. However, organizations in Case #2 (former EDI users) are earning comparable, or greater benefits from the new technology. This is a solid endorsement of XML-based IOS solutions, as they outperform EDI solutions in interorganizational architecture.

	BUYERS		SELLERS		RN OVERALL	
	RANK	RATE	RANK	RATE	RANK	RATE
COMMON						
Improved resource allocation time	1	4.3	3	3.5	1	4.0
Product cost savings (advantages)	2	3.3	4	3.5	2	3.3
Reduced negotiation time of technical standards	3	4.5	2	5.0	3	4.7
Compliance with supplier or customer mandates	6	4.0	1	4.0	4	4.0
Improved employee morale	4	4.0	5	3.0	5	3.6
Increased accuracy	5	4.5	6	3.0	6	4.0
DISTINCT						
Improved manufacturing lead time		3.0				3.0
Improved response times		4.0				4.0
Enables & improves the 'Blanket' PO process				3.0		3.0
Nightly batch vs Real-time processing				3.0		3.0

Table C (Panel 1)

Indirect Benefits of RosettaNet IOS (Buyers and Sellers)

	SHIP FROM STOCK AND DEBIT (5D-1)		REQUEST PO (3A-4)		CHANGE PO AND CANCEL PO (3A-8, 9)	
	RANK	RATE	RANK	RATE	RANK	RATE
COMMON						
Reduced negotiation time of technical standards	4.0	5.0	3.0	4.8	2.0	5.0
Product cost savings	2.0	5.0	2.0	3.0		
Improved resource allocation time	1.0	4.0	1.0	4.0	1.0	3.5
Improved employee morale	3.0	4.0	5.0	3.7	3.0	4.0
Compliance with supplier or customer mandates	5.0	3.0				
Increased Accuracy & Integrity			4.0	4.0	3.0	3.5
DISTINCT						
Compliance with supplier or customer mandates			2.5	4.0	3.0	4.0
Product cost advantages						
Enables & Improves the 'Blanket' PO Proces			7.0	3.0	7.0	3.0
Compliance with Industry-based technical standards			4.0	4.0	4.0	4.0
Nightly batch vs Real-time processing			8.0	3.0	8.0	3.0
Manufacturing Lead Times			5.0	3.0	5.0	3.0
Improved Response times			4.0	4.0	4.0	4.0
OVERALL		4.20		3.67		3.70

Table C (Panel 2)

Indirect Benefits of RosettaNet IOS (By Shared Business Process Type)

Environmental

The two environmental measurement variables include *partner power* and *expectations of market trends*. Table D provides a summary of findings for the environment measurement variables. *Partner power* is measured by the percentage of sales (or purchases) that a business partner depends on from their customer or supplier. In place of quantitative data, the terms high, moderate and low are used to denote relative qualitative values. *Expectations of market trends is* based on the respondents expectations for market dominance of XML-based IOS over other types of IOS technology from three perspectives: (1) RosettaNet technology overall (2) XML-based IOS technology in general, and (3) Specific RosettaNet IOS applicable to each case's business process. The respondents were requested to assess market dominance using a five- point Likert scale with one as strongly disagree and five as strongly agree.

		PARTNER POWER	EXPECTATIONS OF MARKET TRENDS		
ORG	BUY / SELL SIDE	% of sales (purchases) on partner	The RosettaNet Consortium?	XML-based IOS?	This Specific PIP?
CASE #1					
A-1	SELL SIDE	MODERATE	3.0	4.0	3.0
B-1	BUY SIDE	LOW	5.0	5.0	2.0
CASE #2					
C-2	SELL SIDE	HIGH	4.0	5.0	4.0
D-2	BUY SIDE	LOW	5.0	5.0	3.0
CASE #3					
E-3	SELL SIDE	MODERATE	4.0	5.0	4.0
F-3	BUY SIDE	LOW	3.0	4.0	3.0
CASE #4					
F-4	SELL SIDE	MODERATE	4.0	5.0	4.0
G-4	BUY SIDE	LOW	TBD	TBD	TBD
TOTALS	SELL SIDE	MODERATE	3.8	4.8	3.8
	BUY SIDE	LOW	4.3	4.7	2.7
	TOTAL		4.0	4.7	3.3

Table D
Environmental Measurement Variables

From a *partner power* perspective, Buyer organizations have the 'power' advantage in all four cases. Case #2 is the most extreme situation where the Seller organization (C-2) has low power and the Buyer organization (D-2) has high power in the dyadic relationship. Seller organizations included in the survey indicated that they were not coerced or mandated to adopt this technology. In Case #2 for example, the Seller organization decided to adopt the RosettaNet IOS only after it implemented a new ERP system and its technical architecture was consistent with RosettaNet IOS standards. Thus, the adoption decision was based on compatibility issues and timing ('a good fit… when it was convenient for us'), as opposed to coercion by the Buyer organization.

From a market trends perspective, respondents indicated an extremely high expectation of market dominance for XML-based IOS technology (4.7), slightly less for RosettaNet (4.0) and slightly less, again, for the specific RosettaNet IOS installed for their shared business process (3.3).

Innovation Measures
All respondents in this study have adopted and implemented the target technology. Thus, the insightful innovation measures include varying degrees of internal diffusion. Current and projected levels (over the next 12 to 24 months) of internal diffusion were collected (See Table E). Three measures of internal diffusion were collected: volume, diversity and breadth.

Volume refers to the ratio of business documents transmitted via the technology innovation channel, over the total number of business documents exchanged (regardless of the technology). With the exception of respondent C-2, all current volume levels are low. However, with the exception of respondent F-3, significant volume growth rate increases are projected over the next 12 to 24 months ranging from 100% to 800% increases. This is indicative of the recent development of this technological innovation and consistent with the expectations of future market trend findings.

Diversity refers to the count (or total instances) of the target technology that the respondent has implemented. *Breadth* refers to the count of different trading partners with whom the respondent has co-adopted the target technology. All respondents are expecting significant diversity and

breadth growth projections. During the next 24 months, respondents anticipate that the number of RosettaNet IOS implementations (diversity) will triple to 871. In addition, it is expected that the number of trading partners (breadth) will more than double to 352.

From a sell-side versus buy-side comparison, Buyers are projecting greater diffusion in diversity and breadth of the technology over the next 12 to 24 months. From a volume perspective, Sellers are projecting slightly higher growth over the next 12 months, while Buyers are expecting significantly greater growth over the next 24 months. These results are consistent with the Buyer power dominance and the probable need for Sellers to *catch-up* with technology. This could be explained through Buyer organizations (manufacturers and distributors) in this industry that are likely setting the technological trends with the Sellers (outsourcing partners) quick to follow suit.

It is true that positive *expectations of market trends* and low levels of *compatibility with the old technology* are correlated (in all cases) with increases in *internal diffusion*. However, the caution relates to the degree of these relationships. The *environmental* results suggested that the *expectations of market trends* occurred for '*This specific RosettaNet IOS'* were moderately positive (3.3 on a 5-point Likert scale). However, *internal diffusion* results indicated the greatest growth projections were associated with *volume*. Thus respondents are indicating the greatest levels of internal diffusion are expected to occur with the specific RosettaNet IOS they have implemented, even though they have only moderately positive confidence levels in the future market trend of that RosettaNet IOS. An explanation could be similar to the *environmental* discussion. Respondents rated *expectations of market trends* for the RosettaNet consortium (overall) higher than the specific RosettaNet IOS under study. This could be attributed to the fact that trading partners may have a higher level of confidence (and a greater need) around non-proprietary, independent supply chain- focused consortia to develop IT interorganizational architecture solutions, rather than the specific technical solutions that they release.

Overall, *environmental* factors (*partner power* and *expectations of market trends*) and *indirect benefits* jointly resulted in the participating organizations' *adoption* of RosettaNet-based solutions decision. The *relative advantage* construct is determined to be the key construct that will sustain interest in the target technology, likely leading to greater levels of internal diffusion.

| | | | CURRENT | | GROWTH RATE PROJECTIONS | | | | | |
| | | | VOLUME | | VOLUME | | DIVERSITY | | BREADTH | |
ORG	TECH CONVERSION TYPE	BUY / SELL SIDE	RATIO	T.P. COUNT	*NEXT 12 MONTHS*	*NEXT 24 MONTHS*	*NEXT 12 MONTHS*	*NEXT 24 MONTHS*	*NEXT 12 MONTHS*	*NEXT 24 MONTHS*
CASE #1										
A-1	SEMI-AUTO	SELL SIDE	LOW	1	200%	300%	150%	200%	50%	50%
B-1	SEMI-AUTO	BUY SIDE	LOW	2	250%	450%	29%	100%	50%	200%
CASE #2										
C-2	EDI	SELL SIDE	MED	1	400%	800%	100%	200%	300%	500%
D-2	EDI	BUY SIDE	LOW	41	149%	398%	165%	429%	114%	329%
CASE #3										
E-3	MANUAL	SELL SIDE	MED	2	150%	250%	67%	150%	40%	100%
F-3	SEMI-AUTO	BUY SIDE	LOW	3	0%	0%	167%	233%	67%	133%
CASE #4										
G-4	SEMI-AUTO	SELL SIDE	LOW	5	80%	100%	100%	200%	25%	88%
H-4	SEMI-AUTO	BUY SIDE	LOW	5	100%	300%	165%	429%	114%	329%
TOTALS		SELL SIDE	LOW	9	144%	233%	95%	185%	65%	135%
		BUY SIDE	LOW	51	139%	367%	137%	360%	96%	289%
		TOTAL		60	140%	347%	133%	342%	91%	261%

Table E
Internal Diffusion Levels

Conclusion

This paper provided background and positioning regarding a recent technological development in B2B e-commerce known as XML-based interorganizational systems. A Co-Adoption Model of XML-Based IOS was introduced and defined. A field study covering 12 implementations of XML-based IOS was conducted with members of the RosettaNet consortium. Based on field study findings, the factors that influence the adoption and diffusion of XML-based IOS have become evident.

- From the *compatibility* construct, the XML-based IOS solution earned greater compatibility levels in four of the five common task needs as compared to the *EDI* solution. The XML-based IOS solution also earned more than twice the compatibility rating than *semi-automated* solutions.
- From the *relative advantage* construct, the *direct financial* and *operational improvements* enabled by the new technology were substantial. Transaction cost savings ranged from 16% to 87%. Most of these savings were generated through reductions in development, implementation and testing time of proprietary technical requirements that previously required negotiations with each business partner. Throughput improvements ranged from no change (*worst case*) to *19-fold* (19x) improvements and cycle-time reductions ranged from no change (*worst case*) to a 99% reduction.
- The *indirect benefits* were among the most significant findings from the field study. The most common indirect benefits include *reduced negotiation time of technical standards* and *improved resource allocation time* while the most important indirect benefits included *product cost advantages* and *compliance with business partner mandates*. Survey respondents indicated that there are significant indirect benefits derived from the existence of an interorganizational architecture standards setting consortium for their supply chain (such as RosettaNet), benefits that extend beyond direct transaction cost savings. Examples include enabling and facilitating a blanket PO process, designing (and promoting) modularity in IOS architecture and reduced tensions between business partners regarding non-core issues.
- From the *environmental* construct, partner power was heavily in favor of Buyer organizations. However, several Seller organizations indicated that coercion was minimal.
- The *expectations of market trends* proved to be a valuable finding. Although the respondents placed the greatest expectation of market trends on XML-based technology (in general), they placed a higher *expectation of market trend* on the existence of the RosettaNet consortium (overall) as compared to the specific RosettaNet IOS technology they had implemented.

A framework is emerging for the managerial implications concerning promoting greater adoption and diffusion of the target technology by XML-based standards setting organizations, which need to continuously re-assess and add value to the supply chain. Based on the *indirect benefits* and *expectations of market trends* survey results, supply chain business partners place a value on the standards setting organization that is greater than the sum of the individual XML-based IOS. This concept can be referred to as the economics of supply chain interoperability. XML-based standards setting organizations need to consider not only compatibility issues, but also the overall *organizational readiness* of supply chain business partners in adopting and further diffusing XML-based solutions. Organizational readiness considerations include, among others, technical compatibility, management willingness and financial capability. Based on preliminary findings, it appears as though *environmental* factors and *indirect benefits* jointly result in the participating organizations' decision to *adopt* RosettaNet-based solutions. However, the *relative advantage direct* measurement variables (transaction cost savings, ROI, operational improvements) is the key construct in sustaining interest in the target technology and likely leading toward greater levels of internal diffusion. The IOS technology provided via RosettaNet e-business process standards can help high technology supply chain companies achieve greater adoption and diffusion.

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XML in Industry information was gathered from web site: http://www.xml.org/xml/industry_industrysectors.jsp

XML Registry information was gathered from web site: http://www.xml.org/xml/registry.jsp

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About RosettaNet

RosettaNet is an independent, non-profit consortium dedicated to the collaborative development and rapid deployment of open Internet-based business standards that align processes within the global high-technology trading network. More than 400 companies representing over $1 trillion in annual information technology, electronic components and semiconductor manufacturing revenues currently participate in RosettaNet's standards development, strategy and implementation activities. A complete list of member companies and more information on RosettaNet is available at www.rosettanet.org.