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Evaluation of B2B Back-End Integration models in e-procurement Usage

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ABSTRACT

This study provides empirical evidence that higher use of e-procurement technologies does not provide any significant benefits without higher supply chain integration practices. On the other hand, organizations focusing on higher supply chain integration can achieve benefits even though their e-procurement technology usage is not that high. Hence, an important conclusion of this study is that technology without organizational integration is not enough. Innovator firms benefit from early mover advantage from both the higher usage of the technology and the integration with supply chain partners.

KEYWORDS: e-procurement, supply chain integration, procurement practices, procurement performance.

INTRODUCTION

In today's environment, characterized by increasing global competition, declining profit margins and increasing uncertainty, the procurement function has been identified as a key area for current organizations to remain cost-effective and competitive (Mishra et al, 2013). With the advancements in e-procurement technologies, it is believed that the implementation of these initiatives will bring higher benefits not only to a firm but to the supply chain. However, as indicated by Devaraj et al (2007), just having the e-

business capability does not traduce to significant supply chain performance improvements but it does support supply chain integration (SCI) efforts. According to Flynn et all (2010), supply chain integration (SCI) must involve not only external integration but also internal integration, and many empirical studies fail to add this important component to the measurement of SCI (Cousins and Menguc, 2006; Koufteros et al, 2007). The sample size of many of the empirical studies is limited, and response rates are around 8 to 12%. Therefore, the need for more empirical studies to help clarify the real relationship between B2B back-end integration models and their impact on performance is growing. As stated by Wong et al (2015), prior studies have shown mixed results (Alam et al. 2014, Zhao et al, 2015).

This study presents the findings of a sample of 368 US manufacturing companies that verify some general findings about e-procurement technology usage, firm and supply chain performance but adds on the use of procurement practices and procurement performance. We suggest that firms pursuing high levels of SCI and using higher levels of e-procurement technology usage, receive early mover advantage. We also provide evidence that firms with low levels of SCI choosing to implement e-procurement technologies will not receive as many benefits as firms choosing to invest on SCI strategies and later move to implementation and usage of technology to achieve higher levels of integration.

LITERATURE REVIEW

In this paper, four mutually exclusive groups were defined that conceptually represent the major different levels of e-procurement and SCI. The authors use a taxonomy to classify the firms and analyze differences among them. Firms are classified as: Laggards (Quadrant I: low supply chain integration and low e-procurement usage), MINT's (Quadrant II: manual integration, low e-procurement usage and high supply chain integration), SI's (Quadrant III: symbolic integration-automation without integration, high e-procurement usage and low supply chain integration) and Innovators (Quadrant IV: full integration, high e-procurement usage and low supply chain integration). The

complete groups are presented in the B2B back-end integration model shown in Figure 1.

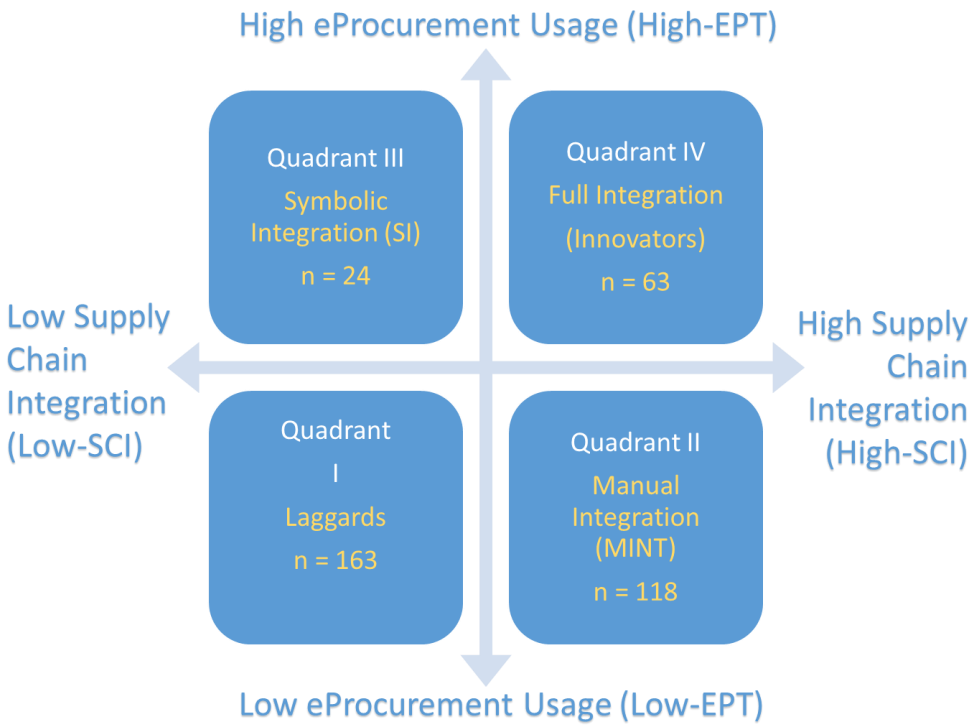

Figure 1. B2B back-end integration model. Research model and respondents sample.

The mean score of all sample respondents under supply chain integration (3.32) and e-procurement technology usage (2.90) was used to classify firms as low/high supply chain integration and low/high e-procurement technology usage, respectively.

The research question of this study is: Are there differences in

e-procurement practices and performance;

firm and supply chain performance; and

e-procurement barriers to implementation

among organizations in different quadrants of the B2B back-end integration model?

In the following sections, we collect literature to support hypotheses coming from the research question when comparing the quadrants.

e-procurement technology usage (EPT)

An e-procurement technology is a digital platform that can lead to optimization, streamlining and centralization of the procurement process (Barahona and Elizondo, 2014). EPT has been defined as the extend of usage of electronic network technologies and practices that support the purchasing process to achieve connectivity among supply chain partners. As indicated in the literature, information technology can enhance the capabilities of SCI, being an enabler of the inter- and intra-organizational integration (Xu et al., 2014).

Barriers to implementation of e-procurement

There are various barriers to the implementation of any technology, and e-procurement is not the exception. A better understanding and analysis of these barriers will allow managers to prioritize their focus to mitigate root barriers for the effective implementation of e-procurement. Among the common barriers, the authors identified: lack of security, fear of internet fraud, legality of internet transactions, lack of management support, poor telecommunication infrastructure, unfamiliarity with the e-procurement technologies, lack of readiness for technological advancement, cost of e-procurement investment, lack of awareness for best solution according to company's needs and downward prices pressure on vendors resulting in lower customer service and quality issues. The higher the barriers to implementation, the lower the advantages of the company to successfully implement the technology. We expect that in the taxonomy, the higher barriers to e-procurement implementations are in Quadrant I, where laggards struggle more than other companies in the taxonomy to overcome the barriers. Also, we expect that Innovators will be the ones with the least barriers to implementation of e-procurement technologies, followed by SIs and MINTs, respectively. Therefore, we can develop the following hypothesis.

H1: The barriers to e-procurement implementation decrease as the position of a company advances in the B2B back-end integration model.

Supply chain integration (SCI)

In the literature, supply chain integration was introduced since the late 90s (Morash and Clinton, 1998; Wei and Krajewski, 2000; Frohlich and Westbrook, 2001). A decade

and a half later, businesses are using more technologies that are easily available to support such integration efforts. When it all started, it was really hard for small to medium-sized businesses to think about supply chain integration due to lack of resources. There are many definitions of supply chain integration, and that is the reason why many more studies are required to provide empirical evidence on the real benefits of SCI after implementation. If a definition is not clear, then, results can mean different things for different authors and audiences. In this paper, we follow the definition by Flynn et all, 2010; where supply chain integration measures both the internal and the external integration (Zhao, Feng and Wang, 2015). An organization cannot really achieve benefits of external integration if their internal departments and functions are not working as a unit. On the other hand, there could be internal integration, but not external integration with customers or suppliers. Therefore, for purposes of this study, we measure the extend in which an organization works as a unit internally, but also recognizes and practices close, interactive relationships with customers and suppliers.

Xu, Huo and Sun (2015) found that technology implementation is an enabler of SCI; furthermore, they found that supplier integration affects firm performance, contrary to customer integration. This is an example in which integration is not involving internal integration. Other studies have found positive relationships between supply chain integration and firm performance (Vickery et al., 2004; Swink et al, 2007; Flynn et al., 2010; Liu et al., 2013, Ralston et al., 2015).

Previous research has shown that implementing IT in the supply chain process does not necessarily guarantee higher performance (Yu, 2015). As Mishra et al. (2013) indicate, “the impact of procurement integration competence on performance is completely mediated by digital procurement competence. For the technology to be successful, it is important to increase supply chain integration and processes. Thus, we can posit the following hypotheses:

H2. Higher e-procurement technology usage (EPT) shows higher benefits (firm, procurement and supply chain performance) for organizations with high supply chain integration practices (Innovators).

Procurement Practices

Procurement practices in current research is switching from strategic procurement practices to sustainable procurement practices, focusing more on green initiatives (Mansi, 2015). In this paper, however, the authors focus the attention on the traditional operational view of procurement practices (Presutti, 2003) that involve: information gathering, supplier contact, contracting and intelligence and analysis. Information gathering is the identification of a need, establishment of specifications, identification of alternatives, evaluation of alternatives and selection of suppliers to contact. Supplier contact includes requests for: quotes (RFQ), proposals (RFP), information (RFI) and bids (RFB). Contracting is the outcome of successful negotiations based, amongst other criteria, on price, availability, quality, delivery times and flexibility of products and services. Intelligence and analysis is the analysis of the negotiation and fulfillment of orders, which includes tracking orders and shipments of materials, product specification and data, complaints of defective or late materials, history of supplier performance, historical spending on materials, demand analyses and procurement performance. The use of e-procurement technology usage and a higher supply chain integration can enable these procurement practices. Therefore, we postulate the following hypothesis:

H3. Organizations with higher positions in the B2B back-end integration model will have higher levels of procurement practices.

THEORETICAL DEVELOPMENT/MODEL

Methodology

We used a large-scale survey instrument distributed to a total of 2,712 firms from the Institute of Supply Management (ISM) database. The final usable sample was 368, for a response rate of 13.57%. Two non-respondent bias tests were performed in terms of SIC code distributions. The results showed that there is no significant difference between the original 2,712 ISM members that were contacted to complete the survey, and the 368 respondents who responded. A second non-respondent bias test was performed between the first responders (those who responded to the first email) and the second round of respondents that completed the survey after multiple contacts. Both

tests verify that the sample is unbiased since no significant differences were found in SIC code distribution in both tests at 95% confidence level. The constructs were based on a comprehensive literature review as explained above. Confirmatory factor analysis was performed for each of the main constructs: procurement practices, procurement performance, firm performance, supply chain performance and e-procurement implementation barriers. Results from the CFAs are shown in Appendix A, all factor loadings are higher than the acceptable 0.5 (Hair et al., 2009), along with all reliability values higher than the desired 0.7 (Hair et al., 2009).

ANOVA tests were conducted to identify differences among the different quadrants. When differences were found, post-hoc tests were performed to identify which pairs were significantly different.

ANALYSIS AND RESULTS

ANOVA results are presented in Table 1 below. As expected, H1 is supported. This is important in carefully analyzing the rest of the results. When there are lower barriers of EPT implementation, this means that Innovators (full integration) have a competitive advantage when it comes to support for EPT initiatives. Symbolic Integration (SIs), Manual Integration (MINTs) and Laggards have less trust on internet transactions and security, lack of management support, poor telecommunication infrastructure, less knowledge of EPTs, EPT investment is higher when compared to revenue percentages, higher pressure from customers to reduce prices which in turn, might translate to lower quality or customer service standards.

Procurement Practices

As presented in Table 1, the only procurement practice that was significantly impacted by high e-procurement technology usage is supplier contact, regardless of the level of supply chain integration. This means that supply chain integration is not really affecting supplier contact, the only factor improving supplier contact by itself is the usage of e-procurement technologies. However, it is important to emphasize that from all variables analyzed in this study, only supplier contact is positively affected by just

using the e-procurement technologies without formally integrating the supply chain. In fact, even if the organizations show high levels of supply chain integration, the benefits from e-procurement technology usage are the same as the organizations with no efforts in integrating the supply chain. On the other hand, information gathering process of procurement practices is highly and positively affected by higher levels of both e-procurement technology usage and supply chain integration strategies. Innovators obtain a competitive advantage over the rest of the companies in the quadrant, when it comes to information gathering of the procurement process. Finally, in terms of contracting and intelligence and analysis, the benefits higher supply chain integration strategies are substantially higher than laggards. Both Innovators and MINTs show significantly higher levels of contracting and intelligence and analysis over laggards. This means that supply chain integration by itself, will be the best strategy for improving those two procurement practices. The e-procurement technology usage by itself does not have any effect on either contracting or intelligence and analysis. On the other hand, low supply chain integration strategies do not allow for companies to be significant benefits in the areas of contracting or intelligence and analysis. In summary, if an organization's target is to improve the level of procurement practices by using either e-procurement technologies or supply chain integration strategies, or both; it is better to exercise higher levels of supply chain integration and higher levels of e-procurement technology usage. The technology itself will only provide benefits on supplier contact, and the supply chain integration by itself will only provide benefits on contracting and intelligence and analysis. On the other hand, higher levels of e-procurement technology usage with higher levels of supply chain integration (Innovators) will have significantly higher benefits than one or many of the other companies in terms of procurement practices, especially in information gathering of the procurement process.

Procurement Performance

Innovators have significantly higher procurement performance than any other quadrant in terms of internal operations, supplier-related and internal customer performance of the procurement function. In all three of those procurement performance

measures, when companies do not have high levels of e-procurement technology usage, having higher levels of supply chain integration (MINTs) is better than laggards (no integration and no technology). Once again, technology usage by itself (SIs) does not show any significant benefits over companies that do not have the technology or the integration (laggards). On the other hand, higher levels of supply chain integration (MINTs) are significantly better than laggards (no integration and no technology). In terms of materials quality, higher supply chain integration is the key factor in achieving higher performance levels: both innovators and MINTs show significantly higher materials quality than those with low levels of supply chain integration (either SIs or laggards). Again, the e-procurement technology usage by itself does not have provide enough benefits in terms of materials quality, on the other hand, supply chain integration by itself is enough to translate into significantly higher materials quality than those not integrating their supply chains.

CONCLUSIONS

Given the evidence, we can conclude that this study provides empirical evidence that higher use of e-procurement technologies does not provide any significant benefits without higher supply chain integration practices.

In addition, when organizations focusing on higher supply chain integration can achieve benefits even though their e-procurement technology usage is not that high.

Technology without organizational integration is not enough. Innovator firms benefit from early mover advantage from both the higher usage of the technology and the integration with supply chain partners

Descriptive Statistics: Mean (Standard Deviation)		Innovators (n=63)	SIs (n=24)	MINTs (n=118)	Laggards (n=163)
Procurement Practices	Information Gathering	3.90 ++ (0.85)	3.32 (0.99)	3.48 (0.80)	3.33 (0.84)
	Supplier Contact	3.91 ** (0.94)	3.79 ** (0.96)	3.23 (0.99)	3.06 (1.05)
	Contracting	4.47 * (0.59)	4.17 (0.74)	4.35 * (0.57)	3.99 (0.74)
	Intelligence/Analysis	4.21 * (0.74)	3.76 (0.74)	4.05 * (0.71)	3.7 (0.86)
Procurement Performance	Internal Operations	4.12 ++ (0.68)	3.61 (0.89)	3.61 * (0.82)	3.28 (0.79)
	Supplier-Related	4.35 ++ (0.66)	3.85 (0.79)	4.05 * (0.74)	3.59 (0.85)
	Internal Customer	4.22 ++ (0.53)	(3.81) (0.73)	4.00 * (0.63)	(3.69) (0.68)
	Materials Quality	4.14 *** (0.70)	3.63 (0.90)	3.96 *** (0.78)	3.58 (0.73)
Firm Performance	Financial Measurements	3.86 ++ (0.69)	3.55 * (0.80)	3.55 * (0.64)	3.23 (0.67)
	Quality Measurements	3.98 ++ (0.67)	3.51 (0.78)	3.74 * (0.57)	3.49 (0.64)
Supply Chain Performance	Supplier Performance	4.26 ++ (0.45)	3.82 (0.58)	4.03 * (0.49)	3.70 (0.57)
	Partnership Quality	3.96 ** (0.61)	3.55 (0.56)	3.86 ** (0.59)	3.33 (0.68)
	Flexibility: Customization	4.25 ** (0.78)	3.77 (0.82)	4.10 * (0.67)	3.84 (0.81)
	Flexibility: Response to Variation	3.80 ** (0.83)	3.18 (0.82)	3.54 * (0.85)	3.05 (0.85)
	Customer Responsiveness	4.08 * (0.37)	3.96 (0.43)	3.99 (0.40)	3.91 (0.42)
Barriers	Barriers to Implementation	2.15 -- (0.74)	2.61 (0.68)	2.59 (0.67)	2.69 (0.71)

* Significantly higher than Lagards

**Significantly higher than Lagards and MINTs

***Significantly higher than Lagards and SIs

++ Significantly higher than Lagards, MINTs and SIs

-- Significantly lower than Lagards, MINTs and SIs

Table 1. ANOVA results at alpha = 0.05

Appendix. Confirmatory Factor Analysis for Constructs in the Study

Item	Cronbah's Alpha	% of Variance Explained	Factor (Construct)			
			ianf	ig	cnf	sc
ig1	0.818	12.88		0.75		
ig2				0.84		
ig3				0.74		
ig4				0.70		
sc2	0.81	7.39				0.80
sc3						0.80
sc4						0.83
cnf1	0.81	7.87			0.75	
cnf2					0.67	
cnf3					0.64	
cnf4			0.32		0.57	
cnf5					0.77	
ianf1	0.87	32.41	0.68			
ianf3			0.61			
ianf4			0.72			
ianf5			0.77			
ianf6			0.66			
ianf7			0.74			
ianf8			0.75			
Note: Factor loadings of 0.3 or below were suppressed from the table.						

Table x. Procurement Practices

Item	Cronbah's Alpha	% of Variance Explained	Factor (Construct)			
			IC	IP	MC	SR
pp1	0.88	9.92		0.84		
pp2				0.82		
pp3				0.69		
pp4				0.77		
pp5				0.72		
pp6	0.79	6.55			0.72	
pp7					0.80	
pp8			0.34		0.71	
pp10				0.33	0.53	0.33
pp11	0.87	5.09	0.37			0.77
pp12			0.34			0.79
pp13			0.3			0.71
pp14	0.93	47.16	0.63			0.34
pp15			0.68			
pp16			0.78			
pp17			0.8			
pp18			0.76			
pp19			0.79			
pp20			0.78			
pp21			0.70			
Note: Factor loadings of 0.3 or below were suppressed from the table.						

Table x. Procurement Performances

Item	Cronbah's Alpha	% of Variance Explained	Factor (Construct)	
			FP	QP
fp1	0.90	57.54	0.74	0.34
fp2			0.74	0.30
fp3			0.85	
fp4			0.85	
fp5			0.83	
fp6			0.69	
fp7	0.81	13.04		0.87
fp8				0.87
fp9			0.57	0.61
Note: Factor loadings of 0.3 or below were suppressed from the table.				

Table x. Firm Performance

Item	Cronbah's Alpha	% of Variance Explained	Factor (Construct)				
			SP	PQ	CR	SCR	SCF
scp1	0.84	6.00					0.86
scp2							0.83
scp4	0.85	9.65	0.30			0.67	0.31
scp5						0.85	
scp6						0.84	
scp11	0.89	36.77	0.75				0.33
scp12			0.79				
scp13			0.79				
scp14			0.74				
scp16			0.62			0.46	
scp17			0.71				
scp18			0.65			0.34	
scp19	0.87	11.83		0.76			
scp20				0.78			
scp21				0.83			
scp22			0.36	0.79			
scp23	0.80	7.70			0.84		
scp24					0.81		
scp25					0.88		
Note: Factor loadings of 0.3 or below were suppressed from the table.							

Table x. Supply Chain Performance

CONCLUSIONS AND RECOMMENDATIONS