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EXPLORING THE IMPACTS OF WEB-BASED E-PROCUREMENT ON ORGANIZATIONAL PERFORMANCE

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Abstract

Web-enabled applications for business-to-business (B2B) procurement are not only expected to reduce the cost of purchasing process but also to alter the activities of purchasing, transform the purchasing process from an operational into a strategic activity, and provide opportunities for improving market coordination by reducing asset specificity and by making additional partners available. From organizational and inter-organizational perspectives, this study proposes a performance impact model of implementing Web-based e-procurement system for direct procurement. In the performance impact model, the strategic dimension is about partner relationship, and the operational efficiency dimension includes supplier performance, buyer performance, process integration, and process automation. Based on a survey of Taiwanese manufacturing firms, the results of this study show that the electronic execution of purchasing activities improves both of the operational efficiency dimension and the strategic dimension. The results demonstrate implementing Web-based e-procurement system not only could enhance the performance of the buyer organization but also could enhance the performance of the supplier organization and improve partner relationship management.

Keywords: Web-based e-procurement, performance impact, inter-organizational coordination.

1 INTRODUCTION

Driven by the increasing trend toward purchasing inputs and other raw materials from outside the organization, implementing electronic procurement (e-procurement) has become a significant tactic in most companies' e-business strategies (Deloitte Consulting 2001). Today baseline procurement capabilities are rapidly becoming a cost of doing business. More and more companies are conscious of the needs to introduce Internet-based technologies in their order process, due to the benefits of saving transaction cost, increasing competitive sourcing opportunities, and enhancing inter-organizational coordination. According to the 2006 e-Business W@tch survey, more than half of the interviewed enterprises said that they have intention to place orders online (e-Business W@tch 2006).

When pre-Internet information technology (IT) such as Electronic Data Interchange (EDI) was applied in B2B transactions, information systems studies have focused on direct materials. Based on a proprietary B2B network, the implementation and maintenance of EDI is very expensive and mainly large-sized companies and conglomerates can afford (Gebauer and Buxmann 2000). The Internet led to substantial changes in B2B transactions for every type of industry and organization. Most traditional e-procurement has been evolved to Web-based e-procurement, using lighter-weight protocols for creating electronic bonds (Subramaniam and Shaw 2002, Subramaniam and Shaw 2004, Croom, 2005). Web-enabled applications for B2B procurement are expected to reduce transaction cost, increase competitive sourcing opportunities, enhance inter-organizational coordination and improve relationships among business partners (Subramaniam and Shaw 2002, Saeed et al. 2005).

The benefits resulting from implementing Web-based e-procurement system for direct procurement (i.e. purchasing production-related items) can be either belong to organizational level or inter-organizational level (Grey et al. 2005, Ash and Burn 2006, Wagner and Essig 2006). The organizational-level benefits are generated by Web-based e-procurement through automating procurement process and reengineering the internal processes of an organization. The inter-organizational-level benefits are generated by Web-based e-procurement through reengineering the procurement process among trading partners and reconfiguring the linkages of trading partners. The benefit produced from the consequential of implementing Web-based e-procurement is the interesting issue for research and practice. Investigating impacts of implementing Web-based e-procurement is the area of research that will have tremendous value for organizations in the new economy.

B2B e-commerce is rapidly transforming how organizations structure and coordinate their business relationships. Thus evaluating the impacts of Web-based B2B systems on organizational performance becomes critical. Despite previous studies have revealed the importance of Web-based e-procurement to organizational performance, empirical research pertaining to Web-based e-procurement affected organizational performance phenomenon has been limited and piecemeal. This study draw on concepts from the interrelated literature streams of inter-organizational systems (IOS), supply chain management (SCM), and strategic management to develop key constructs and relationships associated with Web-based e-procurement affected organizational performance. Specifically, from organizational and inter-organizational perspectives, this study proposes to develop a comprehensive performance impact model of Web-based e-procurement for direct purchases, encompassing operational and strategic impacts.

2 LITERATURE REVIEW

2.1 Web-based e-procurement

Enterprise-level procurement usually covers two types of purchases: indirect procurement and direct procurement (Subramaniam and Shaw 2002, Chaffey 2004). Indirect procurement addresses goods

and services that are not part of the finished product but support internal business activities, such as computers, office equipment, maintenance, repair and operating (MRO) goods. Direct procurement addresses the raw materials and components that are used in the manufacturing process of a finished product. In this study, we focus only on the direct procurement category. Managing direct procurement involves strategic activities such as sourcing, negotiating with suppliers, and coordination with R&D (Eyholzer and Hunziker 2000). Procurement for direct materials is more than putting purchasing decisions online, its functions also include linking suppliers and buyers into the purchasing network and rethinking of inter-organizational processes driven by transactions.

Web-based e-Procurement can be defined as the usage of Web-based functions and services that allow buyer organization to purchase goods and services and allow suppliers to manage and communicate the fulfilment of purchase orders delivered (Subramaniam and Shaw 2002, Chaffey 2004). Web-based e-Procurement system is a compound application that contains many usable functions to assist company in processing the activities of purchasing transaction. The use of a Web-based procurement system can strengthen search ability, facilitate faster and more accurate data transmission, provide quicker and more plentiful information, and achieve relatively low communications and coordination cost. Hence, Web-based procurement mainly affects four of the organization's major B2B tasks: search, purchase processing, monitoring and control, and coordination (Subramaniam and Shaw 2002).

To summarize, Web-based e-procurement has covered procurement automation for internal organizational processes, and supplier collaboration for inter-organizational processes. The former addresses automated, paperless internal process from end user item selection, to creation and routing of purchase request and approval to purchase order creation, and receiving. The latter is about connectivity with suppliers for electronic catalogs, transaction management and on-going relationship management. To realize the benefits of Web-based e-procurement, an understanding of the impacts influencing the value forming is needed so that the solution may be developed to facilitate the implementation of Web-based e-procurement system.

2.2 The impacts of implementing Web-based e-procurement system

Web-based e-procurement system plays a fundamental role in B2B purchasing by streamlining the buying process and providing the information needed to make more effective purchasing decisions (Osmonbekov et al. 2002, Presutti 2003). Previous studies allude to the fact that many companies have found benefits from their implementation of e-procurement system. The adoption of Web-based e-procurement system in the B2B purchasing transaction allows firms to reduce transaction costs, improve internal procurement process efficiency, and increase collaboration with suppliers (Chaffey 2004, Barbieri and Zanoni 2005). The benefits of technology-based supports for procurement activities can be organized into two broad categories: organizational level and inter-organizational level.

In organizational level, previous studies suggested that implementing Web-based e-procurement system could make company's procurement process more efficient and effective through automating procurement process, reengineering the internal processes and enhancing inter-organizational coordination. For example, Davila et al. (2003) thought that implementing e-procurement the firm could shorten the order fulfillment cycle time, lower inventory levels and the price paid for goods, and reduce administrative costs of procurement. Eakin (2003) argued that the benefits of e-procurement can be classified to hard benefits (such as price savings and process cost reductions), soft benefits (such as individual time freed up through more efficient processes), and intangible benefits (such as cultural change, financial approval for all spending, and high visibility of supplier performance). Presutti (2003) found e-procurement system can bring benefits to the company such as reducing time-to-market cycles, reducing material and transactions costs, and reducing stock levels. Chaffey (2004) argued that the benefits of e-procurement include reduced purchasing cycle time and cost, enhanced budgetary control, elimination of administrative errors, increasing buyers' productivity, lowering prices through product standardization and consolidation of buys, improving the payment process, and improving information management.

Implementing Web-based e-procurement system not only could make the operational processes of the buyer organization more effective but also could make the order fulfillment process of the supplier organization more efficient and improve partner relationship management. The main objective of the order fulfillment process that buyer expected is supplier can deliver qualified products to fulfill its orders at the right time and right place (Lin and Shaw 1998). The order fulfillment performance can be improved if supplier can recognize the order, so that the order demand patterns are more transparent to the supplier. In order for supplier to enhance order fulfillment performance, buyer and supplier have to share information. For instance, Toyota shares its inventory and sales information with its suppliers. Having access to such information helps Toyota's suppliers plan and manage their operations better and Toyota can coordinate the inventory orders effectively; as a result, the implementation of just in time (JIT) delivery strategy can be achieved (Kamath and Liker 1994, Chopra and Meindl 2001). Web-based e-procurement enables the information to be shared among trading partners, such as sales forecasts, production schedules, inventory levels, and product specifications.

As the relationships between OEMs and suppliers grow ever more complex, with increased interaction between participants of different tiers, buyer-supplier relationship continues to increase in strategic importance (Croom 2005). For effective management of buyer–supplier relationships, firms need to maintain a portfolio of relationships that may have different characteristics and objectives, and structure supply chain processes to fit the nature of those relationships. In addition, facilitating technologies that consistently support these relationships are needed. IOS such as Web-based e-procurement system has emerged as important technologies that support boundary-spanning activities associated with effective management of buyer–supplier relationships. Web-based e-procurement system can be regarded as the facilitator of coordination between supply chain partners. Process efficiency is the likely objective in the implementation of Web-based e-procurement system that entails close coordination between buyers and suppliers. Edwards et al. (2001) argue that in order to gain efficiencies, companies need to exchange large amounts of planning and operational data, ranging from information on annual contracts and periodic progress reporting to real-time delivery and invoicing data. In particular, partnership-type relationships require extensive information processing to facilitate mutual adaptations and process synchronization.

2.3 Synthesis of literature

The use of Web-based e-procurement system is thought to have implications for enhancing the capability in conducting the task of completing the procurement, and in particular for reducing information asymmetries and changing inter-organizational relationships. Operational benefits and strategic benefits are two major benefits of implementing Web-based e-procurement system. Operational benefits arise from lowered transaction cost and heightened information transparency. Examples include automating purchasing process, integrating the processes between procurement and engineering, and bring joint benefits for both trading partners. In contrast, strategic benefits arise through buyer organization positioning itself to take advantage of opportunities arising in the relationship. These include more advanced information sharing, tighter technology cooperation, and more enhanced ability to recognize and respond to changes in the relationship.

Research on the benefits of implementing Web-based e-procurement system can be summarized into a framework in Figure 1 to classify the value of and identify the factors that determine it.

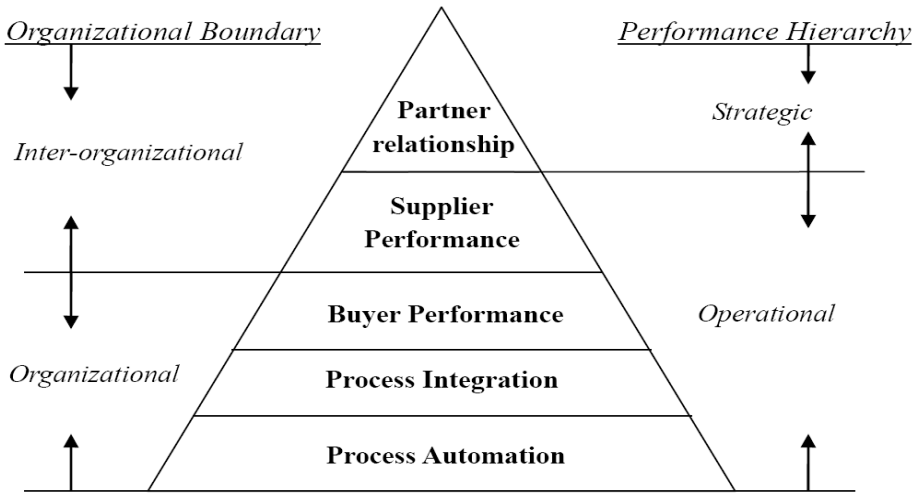


Figure 1. Summary of the performance impacts of Web-based e-procurement based on organizational boundary and decision hierarchy

3 RESEARCH MODEL

Figure 1 reveals that the performance impacts of implementing Web-based e-procurement system can be either operational or strategic. From this perspective, this study proposes the research model as shown in Figure 2.

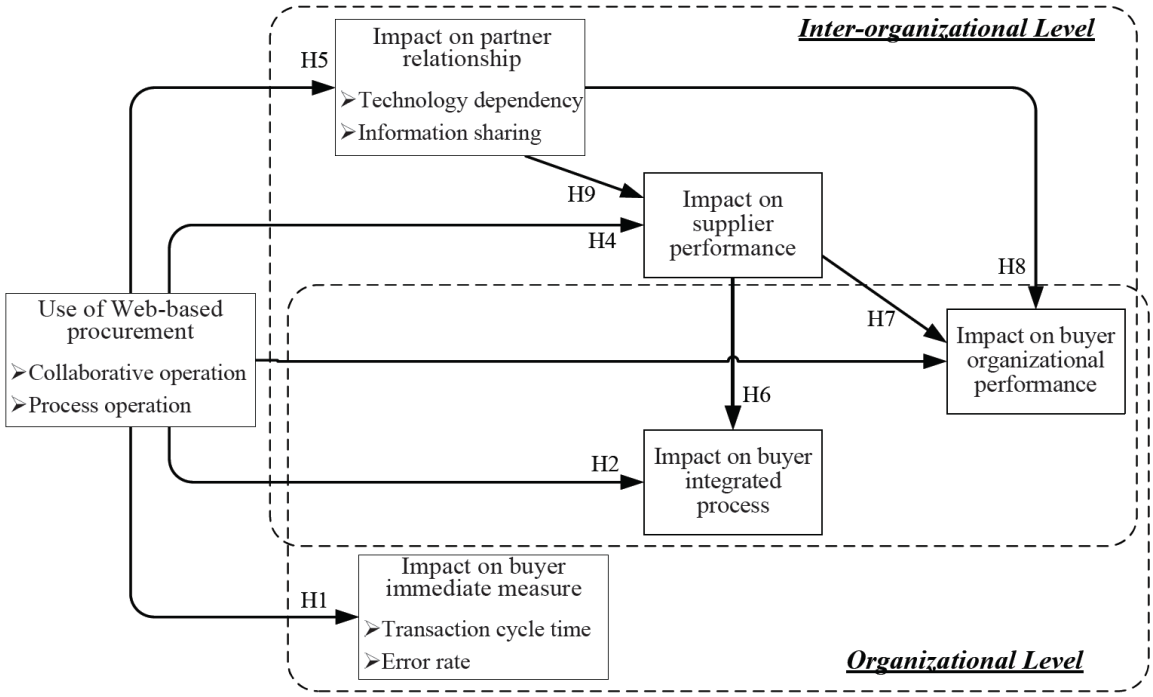


Figure 2. Research model

This study assumes that firms through implementing Web-based e-procurement systems target five performance outcomes: buyer immediate measure, buyer integrated process, buyer organizational performance, supplier performance, and partner relationship. The interactions among supply chain participants that result in these performance outcomes can be grouped into organizational level and inter-organizational level. In organizational level, this study assumes that: (1) Use of Web-based procurement positively influences buyer immediate measure (H1), (2) Use of Web-based procurement positively influences buyer integrated process (H2), (3) Use of Web-based procurement positively influences buyer organizational performance (H3). In inter-organizational level, this study assumes that: (1) Use of Web-based procurement positively influences supplier performance (H4), (2) Use of Web-based procurement positively influences partner relationship (H5), (3) Supplier performance positively influences buyer integrated process (H6), (4) Supplier performance and partner relationship positively influence buyer organizational performance respectively (H7 and H8), (5) Partner relationship positively influences supplier performance (H9).

4 RESEARCH METHODOLOGY

Table 1 shows the operationalization and measurement of various first-order constructs represented in the research model (Figure 2).

First-order construct	Operationalization
(WPO)Process operation	Finding the suitable product has become more quickly. Finding the suitable product has become more easily. Inquiring the product purchasing progress has become more conveniently. Acquiring the new product information has become timelier.
(WCO)Collaborative operation	Monitoring the order has become more effectively. Monitoring the logistic process has become more effectively. The order that the supplier receive has become more accurately. The communication between our company and supplier has become more smoothly.
(BTCT)Transaction cycle time	The purchasing time has become shorter. Receiving the order has become faster. Response time of the order has become shorter. Monitoring cost of the product quality has become lower.
(BE)Error rate	The error rate of the order has become lower. The error rate of the order information transmitting among inner-enterprise has become lower.
(PIS)Information sharing	Our company and strategic partner exchange more inventory information. Our company and strategic partner exchange more demand forecasting information. Our company and strategic partner exchange more product specification information.
(PTD)Technology dependence	Our company executes more collaborative manufacturing with strategic partner. Our company executes more collaborative product development with strategic partner.
(SP)Impact on supplier performance	Delivery time has become more precisely. The service cost of our supplier has become lower. The work-force cost of our supplier has become lower. The product provided by our supplier has fitted our requirement more precisely.
(BIP)Impact on buyer integrated process	Inventory cost has become lower. The purchasing process has become more transparent. Our company has become more satisfying for the transaction with suppliers.
(BOP)Impact on buyer organizational performance	Total procurement costs have become lower. Product quality has become higher. Production lead time has become shorter. Deliver reliability has become higher. Dealing with demand uncertainty has become more flexible.

Table 1. Construct operationalization and measurement

Items designed to measure the constructs were developed based on the integrative view of IOS in a supply chain context. Specifically, the development of a construct is based on the adoption of relevant research streams. For example, items designed to measure the impact on partner relationship were developed from review the interrelated literature streams of strategic management and SCM, and items designed to measure the impact on buyer immediate measure were developed from review the interrelated literature streams of IOS. All items are measured on a five-point Likert scale.

A two-step procedure was employed to create items for the constructs developed in this study, and establish its content face validity. First, this study used a focus group to discuss the items proposed in relevant literatures. The focus group was assembled, including two professors who have researched IOS, SCM and strategic management fields several years and six postgraduates who have studied the same fields under guidance at least one year. Then, this study generates items that can reflect to the first-order constructs. Second, this study brought together a content validity panel, proposed by Lawshe (1975), to reconsider the items generated in second step for determining the applicability and semantics of each items. A content validity panel was assembled, including two professors from management schools at universities and six managers from manufacturing firms. Based on these tests, the items were modified to create the instruments for the full-scale study.

The survey methodology was chosen given the context of the study. Part of the sampling frame is the directory of buyer organizations compiled by Ministry of Economic Affairs of Taiwan, which consisted of firms that have qualified for corporate IT readiness. The rest of the sampling frame is the Fortune 1000 list provided by the Commonwealth Magazine. The unit of analysis in the survey is the purchasing department of buyer organization.

The questionnaire was mailed to 250 senior managers of domestic companies, including 69 companies that participant in e-Business Projects sponsored by Ministry of Economic Affairs of Taiwan, and 181 companies sampled from domestic Fortune 1000 manufacturers list provided by the Commonwealth Magazine. Finally, 137 valid questionnaires were returned, yielding a 54.8% valid response rate.

5 ANALYSIS RESULTS

This study chooses partial least squares (PLS) for analyzing the model of Web-based e-procurement effects on organizational performance. PLS allows the testing of psychometric properties of the scales used to measure a variable (the measurement model) and the estimation of the strength and direction of the relationships between the variables (the structural model).

5.1 Results of assessing measurement model

This study assessed convergent and discriminant validity by factor analyzing items grouped under the first-order constructs. Items should be unidimensional in their representation of the latent variable, and therefore correlated with each other. This study found that the items loadings are above 0.707 (WPO: 0.817~0.843; WCO: 0.806~0.854; PIS: 0.763~0.795; PTD: 0.811~0.819; BTCT: 0.753~0.794; BE: 0.843~0.851; BIP: 0.782~0.829; SP: 0.732~0.814; BOP: 0.758~0.822), showing that more than half of the variance is captured by the constructs.

Moreover, the internal consistency of reflective constructs was assessed by using Cronbach's alpha and computing the composite reliability (CR). A score of 0.70 or above is an acceptable value of internal consistency for exploratory research (Agarwal and Karahanna 1995, Barclay et al. 1995). The Cronbach's alpha ranged from 0.771 to 0.868 and CRs ranged from 0.826 to 0.912 (as shown in Table 2), all of them were above the 0.7 acceptable thresholds.

Another suggested criterion for discriminant validity is that the variance shared by a construct with its indicators should be greater than the variance shared with other constructs in the model. The percent of variance captured by a construct is given by its average variance extracted (AVE). A construct is

considered to be distinct from other constructs if the square root of the AVE for it is greater than its correlations with other latent constructs (Barclay et al. 1995). Table 2 shows the square root of the AVE for each construct greater than the correlation between that construct and other constructs.

Construct	Composite reliability (CR)	1	2	3	4	5	6	7	8	9
1. WPO	0.912	**0.849**								
2. WCO	0.909	0.602	**0.845**							
3. PIS	0.826	0.472	0.465	**0.785**						
4. PTD	0.838	0.453	0.487	0.569	**0.850**					
5. BTCT	0.869	0.429	0.424	0.216	0.231	**0.789**				
6. BE	0.862	0.465	0.437	0.225	0.207	0.592	**0.870**			
7. SP	0.881	0.401	0.413	0.476	0.424	0.238	0.256	**0.844**		
8. BIP	0.892	0.416	0.441	0.292	0.273	0.264	0.213	0.339	**0.820**	
9. BOP	0.898	0.438	0.422	0.417	0.402	0.237	0.256	0.343	0.218	**0.799**

Table 2. Inter-correlation among firs-order constructs

5.2 Results of testing the structural model

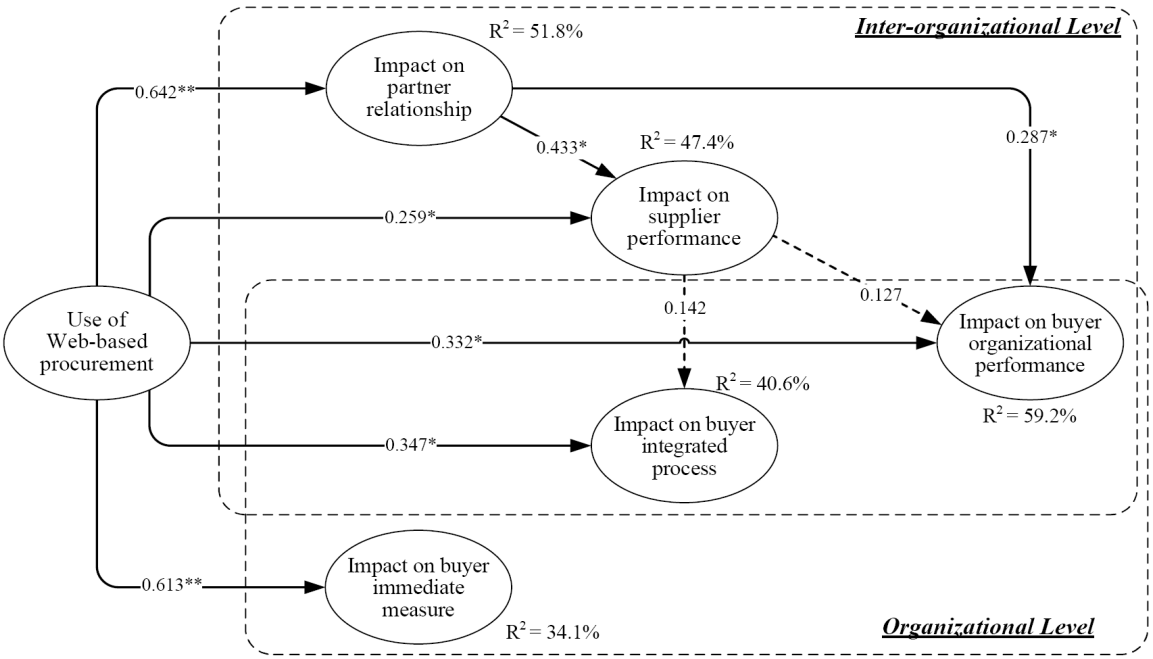
A test of the structural model is used to assess the structure of the impact of using Web-based e-procurement system and the influence of using Web-based procurement system on the organizational performance. Results of the analysis for the structural model are presented in Figure 2.

The results provide support for the research model. One indicator of the predictive power of path models is to examine the explained variance or R2 values (Barclay et al. 1995, Chin and Gopal 1995). They indicate the amount of variance in the construct that is explained by the path model. As shown in Figure 2, 34.1 percent of the variance in impact on buyer immediate measure was explained by use of Web-based procurement. 40.6 percent of the variance in impact on buyer integrated process was explained by use of Web-based procurement and impact on supplier performance. 59.2 percent of the variance in impact on buyer organizational performance was explained by use of Web-based procurement, impact on supplier performance, and impact on partner relationship. 51.8 percent of the variance in impact on partner relationship was explained by use of Web-based procurement. 47.4 percent of the variance in impact on supplier performance was explained by use of Web-based procurement and impact on partner relationship.

Moreover, the results shown in Figure 2 provide strong for hypotheses 1 to 9 except H6 and H7. In organizational level, H1 is supported since relationship between use of Web-based procurement and impact on buyer immediate measure is positive and significant (path coefficient $b = 0.613$, $p < 0.01$). H2 is also supported since relationship between use of Web-based procurement and impact on buyer integrated process is positive and significant (path coefficient $b = 0.347$, $p < 0.05$). H3 is also supported since relationship between use of Web-based procurement and impact on buyer organizational performance (path coefficient $b = 0.332$, $p < 0.05$).

In inter-organizational level, H4 is supported since relationship between use of Web-based procurement and impact on supplier performance (path coefficient $b = 0.259$, $p < 0.05$). H5 is also supported since relationship between use of Web-based procurement and impact on partner relationship (path coefficient $b = 0.642$, $p < 0.01$). H6 is not supported since there is a non-significant relationship between impact on supplier performance and impact on buyer integrated process (path coefficient $b = 0.142$, $p > 0.05$). H7 is also not supported since there is a non-significant relationship between impact on supplier performance and impact on buyer organizational performance (path

coefficient b = 0.104, p > 0.05). H8 is supported since relationship between impact on partner relationship and impact on buyer organizational performance is positive and significant (path coefficient b = 0.287, p < 0.05). H9 is also supported since relationship between impact on partner relationship and impact on supplier performance is positive and significant (path coefficient b = 0.433, p < 0.05).



*Note: path coefficients, *p < 0.05, **p < 0.01*

Figure 3. Results of path analysis

6 CONCLUSION

Practitioners as well as researchers have advocated the advantages of e-procurement. This study investigates the impacts of Web-based e-procurement for direct procurement from organizational and inter-organizational level. A significant finding is that the implementation of Web-based e-procurement can lead to better partnership between buyers and suppliers. By adopting a completeness Web-based e-procurement solution, buyers can enhance their partnerships with suppliers with respect to information sharing and technology dependence. As verified in H8 and H9, partner relationship contributes to both supplier performance and buyer performance, indicating that good partnership paves the way for sounding SCM operating environment.

Initially started as an automation device, procurement eventually leads to the provision of value-added services such as sharing information and technology support. In a manufacturing firm, purchasing is closely linked to engineering design and the order fulfillment process because of the need for customized components and for responding to customer orders. Thus, the coordination benefits of a Web-enabled B2B supply chain are expected to be significant and cannot be ignored by organizations. Future research can explore how collaborative behavior in procurement may be affected in a value-trusted network.

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