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改善跨組織資訊系統績效：從企業供應鏈能力著眼 研究成果報告(精簡版)

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改善跨組織資訊系統績效：從企業供應鏈能力著眼

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(一) 中英文摘要及關鍵字

ABSTRACT

This research aims to develop a framework for measuring the supply chain capability. The literature review and company interviews allow us to propose four capabilities and relative measurements. A field survey is then conducted in the Taiwan PC industry to assess the measurements. To ensure the measurements are valid, we apply two-step measurement assessments: the factor analysis and initial reliability are first conducted and then followed by item-total correlation, optimal reliability coefficients, convergent validity, and discriminant validity. The resulting model is an 18-item and three-dimension construct. The three dimensions are: (1) reducing transaction related risk, (2) promoting good relationship, and (3) managing environment change. The confirmatory factor analysis then suggests us to arrange the three dimensions in two groups. The first group includes the first dimension, indicating the firm capability, and the second group includes the other two, expressing the inter-firm capability. We further explore the relationships between the supply chain capabilities and IOS adoption, as well as supply chain roles. It is interestingly to note that different IOS requires different capability and so does different supply chain role.

Keywords: Supply Chain Collaboration, Supply Chain Capability, Inter-organizational Systems, Information Technology, E-Business

摘要

在面對多變的顧客需求、急縮的產品生命週期、以及日新月異的資訊技術，公司必須跟更多不同類型的供應商合作以應所需，公司的供應鏈體系漸漸從原本的鏈狀架構轉變成網絡架構。在面對這樣較複雜且易變的供應體系，許多公司開始借重各種不同的資訊系統，譬如供應商管理系統，電子下單，先進排程系統等，來改善跟這些供應商的聯繫與合作。然而，由於這一些系統是針對公司及供應商雙方面的流程改善，因此，若要能運作成功，光靠公司內部的資訊能力及管理能力是不夠的，必須整個供應鏈都要配合才行。在以往的資管文獻中，對於支援資訊技術的『公司能力』及『管理能力』多有研究，然而對於能支援供應鏈相關的資訊系統之『供應鏈能力』卻甚少著墨。因此，本研究將致力於建構一套能衡量公司供應鏈能力的參考指標，以幫助公司導入以及管理供應鏈相關之資訊系統。本研究結果顯示兩項重要之供應鏈能力：(1) 公司在交易階段中降低交易風險的能力以及(2) 公司互動能力，包含了促進良好的供應商關係的能力以及掌握大環境變動的能力。此研究也指出一個公司的 IT 能力對於好的跨組織資訊系統並非重大之績效決定要素。

*關鍵字：*供應鏈協同， 供應鏈能力， 跨組織資訊系統， 資訊技術， 電子企業

(二) 報告內容

1. INTRODUCTION

Supplier-customer relationships have undergone radical changes in recent years because the business environment has changed (e.g., volatility in demand, curtailment of product life cycle, changing of information technology, and so forth). Facing this situation, new organizational forms such as the extended or agile enterprise emerge to allow for a tighter link among strategic partners - customers, suppliers, or other third party service providers - that decide to dovetail their capabilities to provide a seamless and electronically enabled closed loop of unimpeded business processes. Corporate supply chains become more network-connected and involve more business partners. Since this kind of supply chain collaboration involves more business partners than traditional inter-firm coordination, the issue such as how to develop good supply chain capabilities to handle the increasing complexity and dynamism is becoming more important than ever.

According to resource-based theory, firm resources and capabilities are the source of sustained competitive advantage (Barney 1991 and Grant 1991). Thus, to make the supply chain collaboration successful, it is important to offer an integrated view of what capabilities a supply chain should obtain in terms of transaction handling capabilities, relationship capabilities, IT capabilities, and so on. Those capabilities may cause the firms to gain more competitive advantages and benefits. We believe that a systematic investigation of these influences could offer significant insights for firms to manage their supply chain network. Thus, this paper seeks to contribute to the literature on supply chain studies through (1) the development and formalization of a framework of supply chain capabilities within the supply chain network; and (2) the operationalization and test of the framework through primary field data obtained in industrial supply chains.

2. LITERATURE REVIEW

Some researchers have recognized the significance of supply chain capabilities. Riggins and Mukhopadhyay (1994) assert that companies with good supply chain capabilities can increase the interdependent benefits. Dyer and Singh (1998) emphasize the impact of relational rents on inter-firm collaboration, the benefits that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance. Angeles and Nath (2000) find that focal firms prefer to partner with suppliers that have good capabilities to handle supply chain problems including channel inventory management, manufacturing planning and scheduling, demand forecasting, and distribution and transportation planning. Further, Craighead and Shaw in 2003 argue that supply chain performance is dependent on multiple capabilities: supply chain partners capabilities, manufacturing firm capabilities, information technology capabilities, and operational capabilities. These capabilities, along with final customer's desire, create and accumulate the value of the supply chain.

Although researchers use different concepts and theories to investigate supply chain capabilities, we derive four levels of supply chain capability according to the resource-based view:

technology level, transaction level, relationship level, and environment level. We discuss each accordingly.

Technology Level. The basic resource-based theory examines the link between a firm's internal characteristics and performance. It suggests that firm's IT resources such as IT investment and IT staffs enable a firm to implement successful IT strategies. Some scholars also recognize that firm's IT capability not only affect firm's internal performance but also the performance of supply chain. Bensaou and Venkatraman (1995) propose that the greater the multiplicity of channels and the frequency of information exchanges, the greater the information processing capabilities of the dyad. They assert the information processing capabilities of a relationship will increase with greater intensity and scope of the use of the technology between the two firms. In similarly, Riggins and Mukhopadhyay (1994) suggest that the great volume of business communications for which the firm uses EDI and the high degree to which the firm becomes immersed in EDI of doing business as the efficient ways to maintain partner relationship.

Transaction Level. Clemons and Row (1992) propose three major sources of transaction risk: transaction-specific capital, asymmetries in information, and loss of resources control, and suggest create firm's capability that better control these resources can resolve these transaction risks. For the transaction-specific capital, Clemons and Row (1992) suggest that the characteristics of software used, such as reusability, modularity, replicability of know-how, coupled with open standards, IT support for conversion and transaction, and intuitive interfaces that reduce the costs of training or re-training can reduce this risk substantially. On the other hand, information asymmetries, the second source of transaction risk, mostly possibly occur in cases of performance measure ambiguity. Kuman and van Dissel (1996) refer that the performance measure ambiguity may be reduced by using information technology to generate and collect monitoring information that would otherwise be too expensive to collect manually. The third transaction risk, loss of resource control, occurs when resources are transferred as part of the relationship and these resources cannot be returned or controlled in the event of the termination of the relationship (Clemons and Row 1992). Information know-how is the most possible resource that may be lost of control, since firms are very difficult to control the access and subsequent utilization of such resources. Previous literature also shows that such resource contention and conflict can be much reduced while conducting pre-established concurrency control and security mechanisms beforehand. Besides, the control of such resource is better placed in the hands of a neutral third party such as a trade association, exchange, government agency, or a joint venture company (Kumar and van Dissel 1996).

Environment Level. Facing the increasing complex and dynamic environment, some RBV studies find that the successful market players have the capability of timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences (Teece 1997). They define the ability to achieve new forms of competitive advantage as "dynamic capabilities". The focal point is to hold the timing and then to adapt, integrate, and reconfigure internal and external resource to response the rapid technological change and changing business environment. Such capabilities can be mainly divided into two groups based on their focused problems. One is to handle information uncertainties and the other is to task uncertainties. In order to handle information

uncertainty, Clemons and Row (1993) suggest related technologies and systems to gather information surrounding dynamic supply chain environment, for example, a system to help firms gather dynamic information to forecast the customers' needs. Besides, open and frequent communications between firms and firms' partners is also a way to handle the information uncertainty risk (Angeles and Nath 2000). Task uncertainty arises due to the specific set of tasks carried out by the organizational agent responsible for the interorganizational relationship. In this work, the task uncertainty refers to the uncertainty of selling/buying activities because our research focuses on selling and buying activities of the supply chain. Bensaou and Venkatraman (1995) suggest that setting up the clearly known way, established practices and procedures employees follow, as well as detail and clear job descriptions are the ways and means to handle the uncertainty of selling/buying activities.

Relationship Level. Besides the dynamic view, some scholars extend the RBV to relational view while arguing that a firm's critical resources may extend beyond firm boundaries, and the benefits often linked to the relational network that the firm is embedded (Jeffrey 1998). Applying the relational view to the supply chain context, firms that have capabilities to maintain good relationships with trading partners can reduce transaction costs, negotiation costs, and uncertainty about the opportunistic behavior, thereby having a positive effect on performance. These capabilities include long-term relationship, reputation, investment both sides, complementarity of technology, business practice, goal, and culture, as well as regulations to handle the management dependency (Dwyer et al. 1987, Dyer and Singh 1998, Hart and Saunders 1998, Kumar and van Dissel 1996). We summarize them into three categories: trust, complementarity, and management dependency and describe them in the following paragraphs respectively.

Based on Dwyer, Schurr, and Oh (1987), trust is defined as "the belief that a party's word or promise is reliable and the party will fulfill his/her obligations in an exchange relationship". Lewis and Weigert (1985) recognize the significance of trust in uncertain/risky environment and refer that persons involved in a risky course of action can act competently and dutifully while they trust with each other. Therefore, trust is an important concept in understanding expectations for cooperation and planning in a relational contract.

Dyer and Singh (1998) define complementary resource endowments as distinctive resource of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner. Similarly, Bensaou (1997) argue that compatibility in goals and technological capabilities reduce the uncertainty about the partner's inclination and potential intentions for opportunistic behavior and therefore invite cooperation. Further, cultural differences between two organizations are also likely to exacerbate the transaction risks by increasing the risk of different interpretations of the transaction contract (Kumar and van Dissel 1996).

Management dependency is another important factor to handle the fairness of supply chain relationship. According to Hart and Saunders (1998), relative dependence in a dyadic relationship between customer and supplier is a determinant of power. Often the powerful partners provide software free of charge, long term incentive, risk sharing, education seminar, and cost subsidy to less power company who otherwise may not be able to justify the investment (Riggins et al. 1994, Wang and Seidmann 1995).

In summary, firm's supply chain capabilities result from different perspectives of internal or

external firm resources and shared by relational network partners. These resources and capabilities may result in special competitive advantages or benefits in supply chain collaboration.

3. RESEARCH FRAMEWORK

According to our previous discussion, we argue that an enterprise with good supply chain capability should be able to handle the supply chain collaboration more successfully. These views are synthesized into the following definition and are characterized by Figure 1:

Supply chain capability is a company-owned ability to well operate company's supply chain networks, which can efficiently aid the companies to handle the collaborative activities with their trading partners. The scope of considering the supply chain capability is from the basic technology level to the environment level, which include how to improve the transaction efficiency, how to reduce the transaction risk, how to promote a good relationship, and how to resolve the uncertainty in the dynamic environment.

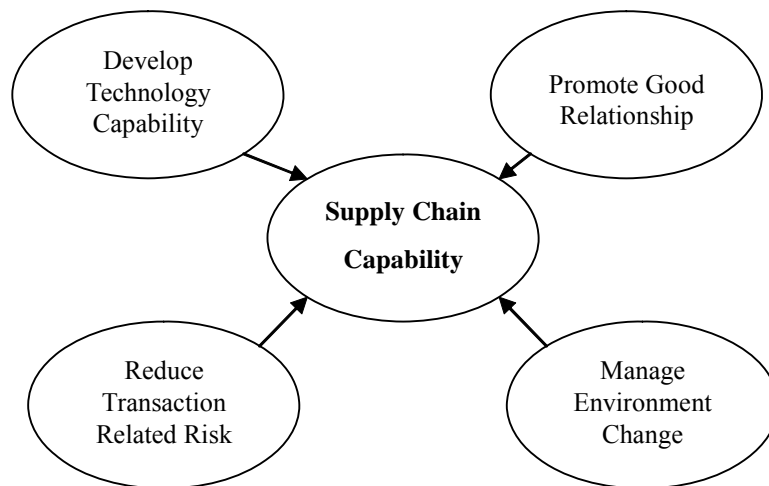


Figure 1. Research Framework for the Development of Supply Chain Capability Construct

4. RESEARCH METHODOLOGY

The content analysis results in an initial pool of 26 items with at least 4 items in each dimension. Table 1 shows the measures for each dimension, operationalized using the items provided in the referenced studies. Each item is presented on a seven-point Likert scale.

In preparation for large-scale data collection, the resulting questionnaire was pilot-tested by six executives that are directly responsible of IOS collaborations during fall 2004. These six executives come from three different types of firms in Taiwan PC industry: the component supplier, the service provider, and the manufacturer. The findings of pilot-test are consistent with our model.

Table 1. Item Measures for Supply Chain Capability Construct

Factors	Items	Measures of Develop Technology Capability (TC)
IOS usage and integration	TC1	Percentages of transaction by IOS links (Bensaou and Venkatraman 1995, Riggins and Mukhopadhyay 1994)
	TC2	Number of partners that are connected by IOS links (Bensaou and Venkatraman 1995)
	TC3	Degree of IOS integration with each process (Bensaou and Venkatraman 1995, Riggins and Mukhopadhyay 1994)
	TC4	Degree of IOS integration with current enterprise systems (Bensaou and Venkatraman 1995, Riggins and Mukhopadhyay 1994)
	TC5	
Information technology infrastructure	TC6	Degree of technology investment in IOS (Riggins and Mukhopadhyay 1994)
	TC7	Establishment of IT infrastructure (Bensaou and Venkatraman 1995, Iskandar, Kurokawa, and LeBlanc 2001)
	TC8	Establishment of applications to support tasks (Bensaou and Venkatraman 1995)
Factors	Items	Measures of Reduce Transaction Related Risk (TR)
Reducing transaction-specific capital	TR1	Successful implementation experience (Clemons and Row 1992)
	TR2	Modularity and replicability of know-how (Clemons and Row 1992)
	TR3	Following the industrial standard (Clemons and Row 1992)
Managing information asymmetries	TR4	Pre-established security mechanisms (Kumar and van Dissel 1996)
Managing loss of resource control		
Factors	Items	Measures of Promote Good Relationship (GR)
Trust	GR1	Existed undergoing supply chain collaboration projects (Bensaou 1997)
	GR2	Establishment of clear norms for business behavior (Bensaou 1997, Dyer and Singh 1998)
	GR3	Sharing confidential or proprietary information (Angeles and Nath 2000, Dyer and Singh 1998, Soliman and Janz 2003)
	GR4	Open and frequent communications (Angeles and Nath 2000)
Complementarity	GR5	Similar IT infrastructure (Konsynski and McFarlan 1990, Kumar and van Dissel 1996)
	GR6	Compatible company culture (Dyer and Singh 1998)
	GR7	Similar decision processes to handle transactions (Kumar and van Dissel 1996)
	GR8	Providing similar support of cooperative firms by top management (Angeles and Nath 2000, Bensaou 1997)
Management dependency	GR9	Technology support or cost premiums (Riggins and Mukhopadhyay 1994, Wang and Seidann 1995)
	GR10	Education seminars or system implementation expertise (Riggins, Kriebel, and Mukhopadhyay 1994)
Factors	Items	Measures of Manage Environment Change (EC)

Manage information uncertainty	EC1	Related technologies and systems to help gather information (Clemons and Row 1993)
	EC2	Explicit regulations to measure trading performance (Kumar and van Dissel 1996)
	EC3	Sending the timely, accurate, and complete information (Angeles and Nath 2000)
Manage uncertainty of selling/buying activities	EC4	Clearly known practices and procedures in doing inter-firm tasks (Bensaou and Venkatraman 1995)

After pilot test, we conduct a general survey in Taiwan PC industry to validate our proposed framework. Data were collected using a questionnaire instrument. We coordinated with six Taiwan PC firms, three of which have participated in our pilot-test. For each firm, a purchasing and/or engineering senior manager at the central division was first asked to select a set of suppliers under his or her responsibility. Then for each of the selected suppliers these senior managers helped identify the purchasing agent and/or engineer to whom we could send the questionnaire. The total data set constitutes a representative sample of $n = 352$. Among all returned questionnaires, 55 were found to be complete and usable; this represented a response rate of 15.625 percent.

5. EMPIRICAL ASSESSMENT

Once the data is collected, the verification of this model is conducted through a series of statistical techniques. From a theoretical standpoint, the measurement properties of a construct can be evaluated using a variety of techniques, including internal and external validity, theoretical meaningfulness, internal consistency of operationalization, convergent validity, discriminant validity, and nomological validity. From an operational standpoint, however, the following minimal subset is considered important: unidimensionality and convergent validity, reliability, and discriminant validity (Byrd and Turner 2000, Sethi and King 1994). The statistical assessments follow the outline given in Figure 2 and the rationale of this outline is described as follows.

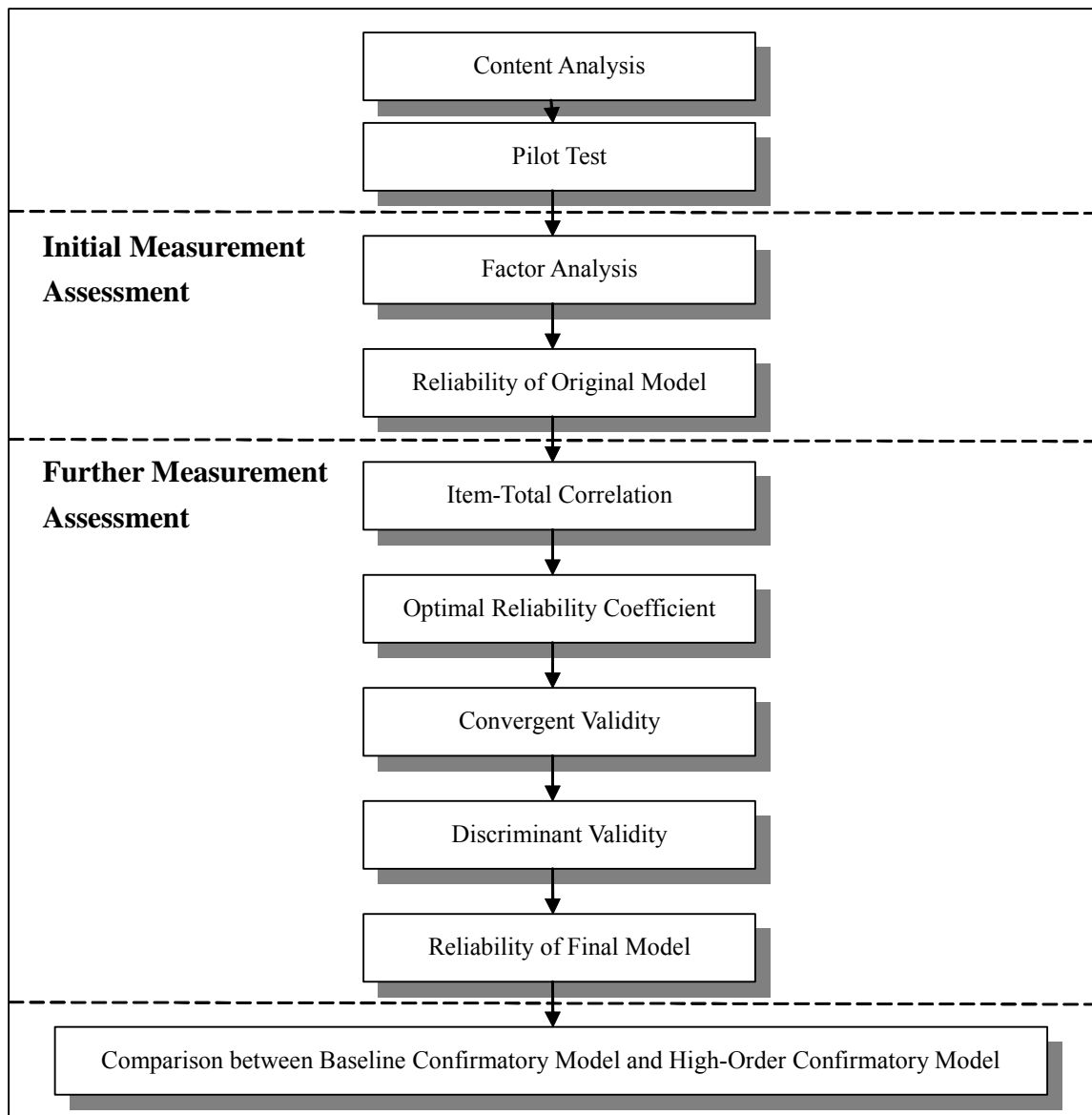


Figure 2. Outline of Statistical Assessments

5.1 Initial Measurement Assessment

The completeness issue is first investigated. Items in this study were selected based on a broad review of literature which satisfies the content validity. The pilot test was done with six executives that are directly responsible of IOS collaborations. Such methodology assures that the model is complete. We then conduct the factor analysis to identify underlying constructs from a large number of interrelated variables. The result is a solution with four factors, each with eigenvalues greater than 1.0. Two items (TC3 and TC4) are excluded from the original model as their factor loadings are less than 0.4 (0.35 recommended by Churchill (1979)), and three items (TC6, TC7, and TC8) that measure the information technology infrastructure are removed to Factor2, resulting in a 24-item model. According to the results of the factor analysis, we point out that the Factor1 measures the technology capability which related the IOSs, the Factor2 presents the technological and managerial capabilities to reduce the transaction related risk, the Factors3 contributes the abilities to promote the good supply chain relationships, and the Factor4 expresses the capabilities to handle the uncertainties of the environment change. The initial reliability is assessed by Cronbach's α coefficient for each of the dimensions determined from the factor analysis. The alpha coefficient for each factor is above 0.8 except TC (Table2), indicating an

acceptable reliability (Lewis and Byrd 2003).

Table 2. Measurement Properties of Proposed Model

Factors	Measures of Model Fit
Overall Model	Independence Model X^2 (276) = 4.994
	Factor Reliability = 0.940
Technology Capability (TC)	Independence Model X^2 (3) = 2.967
	Factor Reliability = 0.473
Capability to Reduce Transaction-Related Risk (TR)	Independence Model X^2 (21) = 15.260
	Factor Reliability = 0.818
Capability to Promote Good Relationship (GR)	Independence Model X^2 (45) = 10.036
	Factor Reliability = 0.838
Capability to Manage Environment Change (EC)	Independence Model X^2 (6) = 15.588
	Factor Reliability = 0.842

5.2 Further Measurement Assessment

To further improve reliability, item-total correlation and optimal reliability coefficients are suggested for use (Mahmood and Soon 1991). Under these two procedures, no items are dropped from the model, and therefore the model is still a 24-item model.

Then, the construct validity of each item is examined to ensure that the items included in the model measure the construct. To establish the construct validity of a measure, the literature suggests that the analysis must determine convergent validity and discriminant validity (Hart and Saunders 1998, Mahmood and Soon 1991). A multi-trait/multi-method (MTMM) is used for convergent and discriminant validity of the model. The smallest within-dimension correlations for TC, TR, GR, and EC are 0.21, 0.38, 0.43, and 0.51. These correlations are significantly higher than zero and indicate convergent validity (Mahmood and Soon 1991).

To establish discriminant validity, the relationship between measures from different dimensions should be very low. Using the MTMM approach, discriminant validity for each item is tested by counting the number of times each inter-correlation more highly with an item of a different variable than with items of its parent dimension (Mahmood and Soon 1991). It is notable that all items of TC are dropped, eliminating the dimension from the model, and one item (TR2) of transaction level and two items (GR4 and GR7) of relationship level are excluded from the model. After above procedures, six items are dropped from the 24-item model, making it an 18-item model.

After a series of measurement assessment, Table 3 shows the reliability coefficient values for the final model. The reliability of two factors, TR and GR, is increased and the factor, EC, without adjusted items is leveling off. All the items in the factor TC are dropped because they

violate the discriminant validity. In summary, the adjusted model with an overall reliability of 0.943 represents good instrument validity. The summary of statistical assessment is shown in Figure 3.

Table 3. Measurement Properties of Final Model

Factors	Measures of Model Fit
Overall Model	Independence Model X^2 (153) = 6.070
	Factor Reliability = 0.943
Capability to Reduce Transaction-Related Risk (TR)	Independence Model X^2 (15) = 17.310
	Factor Reliability = 0.907
Capability to Promote Good Relationship (GR)	Independence Model X^2 (28) = 10.870
	Factor Reliability = 0.920
Capability to Manage Environment Change (EC)	Independence Model X^2 (6) = 15.588
	Factor Reliability = 0.842

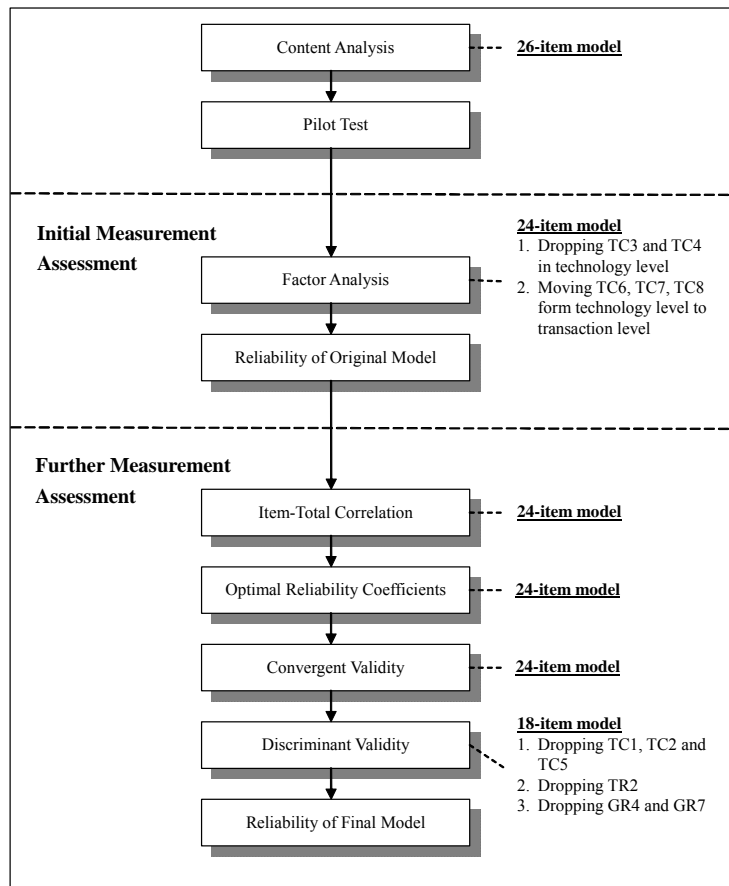


Figure 3. Summary of Statistical Assessments

5.3 Evaluating a Covariation Model of Supply Chain Capability

The further verification of this model is through the use of confirmatory factor analysis. According to Segars and Grover (1998), the analytical framework of confirmatory factor analysis provides an appropriate means of assessing the efficacy of measurement among scale items and the consistency of a pre-specified structural equation model with its associated network of

theoretical concepts. The EQS for Windows program (Version 6.0) is utilized as the analytical tool for estimating the measurement and structural equation models developed in this study.

The 18-item model, derived from last section, forms the baseline confirmatory model for the supply chain capability construct. The baseline model suggests that transaction, relationship, as well as environment are independent in their prediction of supply chain capability (Figure 4). Table 4 reports the goodness-of-fit summary for the baseline model. The χ^2 divided by its degrees of freedom is 1.99, which is conforming to the recommended 2 (Sethi and King 1994). The goodness-of-fit (GFI) for the baseline model is 0.834, which is below the recommended 0.9 (Sethi and King 1994). However, it is not out of line with other exploratory studies developing measures for complex organizational phenomena. The root mean square residual (RMSR) is 0.089, which is below the recommended 0.1 (Sethi and King 1994), providing further evidence of a good fit for this model. The reliability is above the cutoff of 0.8 that is good for exploratory studies. Overall, the fit indicators seem to suggest that each criterion is capturing a significant amount of variation in the latent dimensions of the supply chain capability construct.

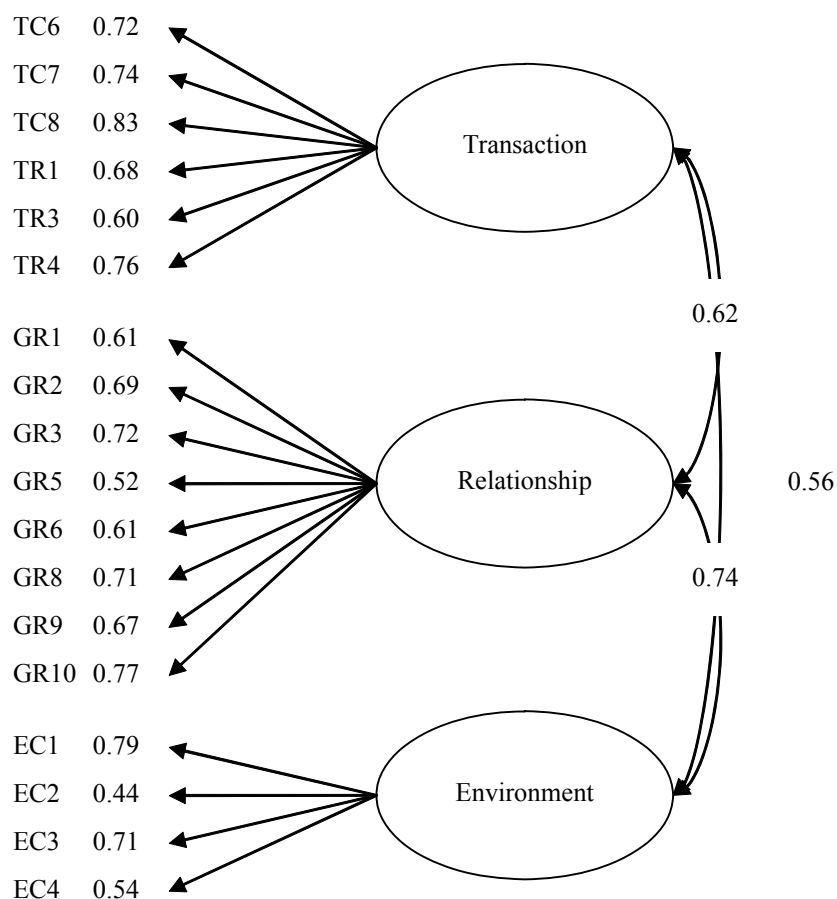


Figure 4. Baseline Confirmatory Model for Supply Chain Capability Construct

Table 4. Model Fit Indices for Baseline Model

Number of Latent Variable	3
Total Number of Items	18
X^2 /degrees of freedom	262.674/132=1.99
p-value	0.000001
Goodness of Fit	0.834
Root Mean Square Residual	0.089

The comparative methodology contrasts a baseline model with a model featuring a second-order model. The second-order model was iteratively modified to improve its fitness. Table 5 shows the model fit indices for the alternative model and the structure is shown in Figure 5. Overall, the fit indices for the second-order model are satisfactory based on the criteria of X^2 /degrees of freedom (df), GFI, RMSR, and reliability.

Table 5. Model Fit Indices for Second-Order Confirmatory Model

Number of Latent Variable	5
Total Number of Items	18
X^2 /degrees of freedom	262.674/129=2.04
p-value	0.000001
Goodness of Fit	0.834
Root Mean Square Residual	0.089
Factor Reliability	0.943

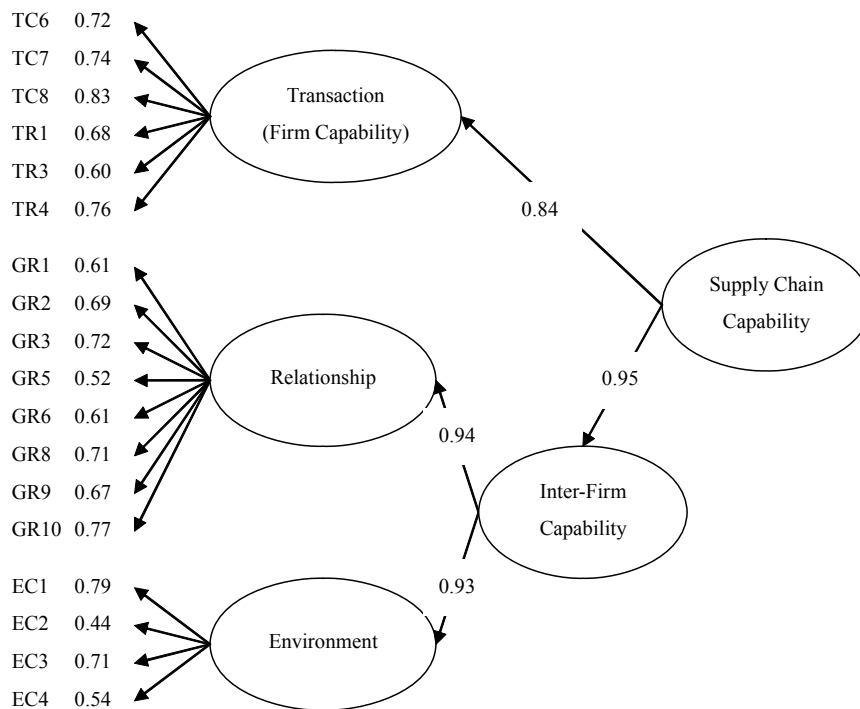


Figure 5. Second-Order Confirmatory Model for Supply Chain Capability Construct

It has been suggested that the efficacy of second-order model be assessed through examination of the target (T) coefficient ($T = X^2$ (baseline model) / X^2 (alternative model)) (Segars and Grover 1998). The coefficient has a lower bound of 1.0 if the higher-order model is sufficiently captures the factor in the model. As shown in Table 5, the coefficient between the baseline model and second-order model is 0.98. The value suggests that the addition of the second-order model does increase chi-square. Therefore, the second-order model is a truer

representation of the model structure and that the second-order model can be accepted over the baseline model.

6. DISCUSSION

6.1 Items of the Construct

It is notable that all items of TC were either dropped or moved, eliminating the dimension from the construct. The possible reason is that technology capability is not a performance differentiator for both suppliers and original equipment manufacturers (OEMs) in Taiwan PC industry. Most of the suppliers in Taiwan PC industry are small and medium-sized enterprises (SMEs); therefore the trading means of the interorganizational collaboration may greatly depend on the requests of their customers. The customers choose the suppliers with a long-term relationship so that the quality, cost, and the price of the offerings are trustworthy, rather than choose those simply having better technology abilities. Thus, from the SMEs' perspective; suppliers do not consider the technology capability as a major ability for supply chain collaboration. On the other hand, from the perspective of OEMs, they are big and powerful in the Taiwan PC market. Due to the government support and similar customer pool, most of them have developed high but similar technology capability to conduct the inter-firm coordination. Technology capability can not generate competitive advantage for them.

The statistical analysis also suggests us to move the items that measure the IT investment to the transaction level, indicating that the investment of IT infrastructure is an important factor to reduce transaction related risks. This change represents that the firms' IT infrastructure can not directly influence the supply chain capability by itself, but it indirectly affect by reducing the transaction risks. This finding is basically consistent with previous IT research (Bakos 1991, Clemons and Row 1992, 1993, Kumar and van Dissel 1996). For example, Kumar and van Dissel (1996) propose a framework that considers the IT as a supporting role in reducing transaction costs and transaction risks. In order to reduce the transaction risks such as overgrazing of the common, fouling or contaminating, and poaching the commons, Kumar and van Dissel (1996) suggest that IT may be used effectively as the village constable to guard against these risks. According to the results of Clemons and Row (1992), IT is both creating the opportunity for cooperation and providing the monitoring capability to reduce the transaction risk associated with cooperation. Their research shows that the IT increases the amount or timeliness of information transferred across firm boundaries as well as reduces the information asymmetries which result in transaction risks. Therefore, instead of being treated as an independent supply chain capability, IT should be viewed as one of the transaction enablers.

In summary, our research points out the IT capability is not a significant supply chain capability for good supply chain collaboration. This result is contrast with most of past related studies as they treat technology as one of the important factor for inter-firm collaboration. Though this finding may need further justification in the future, it reflects the fact that more and more companies view IT as a foundation for inter-firm transaction, but not a weapon for creating competitive advantage. In our interview, most companies agree that technology is not a major concern while considering supply chain collaboration, other factors like trust or the power of

partners play more important role.

6.2 Structure of the Construct

Another interesting aspect of this study is the discovery of a second-order confirmatory model. The three dimensions are modeled as baseline latent variables, determined by two second-order latent variables. The first label presents the firm capability which can effectively help company handle the transaction related risk with the technical and managerial abilities. The second label expresses the inter-firm capabilities that include the abilities to promote good supply chain relationship and capacity to handle the uncertainties in the dynamic environment. The dimensions of our final model are described as follows.

Firm capability: The dimension consists of a transaction level describing abilities of reducing transaction risks: degree of technology investment in IOS (TC6), establishment of IT infrastructure (TC7), establishment of applications to support tasks (TC8), successful implementation experience (TR1), following the industrial standard (TR3), and pre-established security mechanisms (TR4). The first three items are from the technical perspective to reduce the transaction risks and the other three items are from the managerial perspective to prevent the transaction risks.

Inter-firm capability: the dimension includes two levels – (1) promote good relationships and (2) manage environment change. The relationship level measures how to well maintain the supply chain relationships with trading partners, including the items of existed undergoing supply chain collaboration projects (GR1), establishment of clear norms for business behavior (GR2), sharing confidential or proprietary information (GR3), similar IT infrastructure (GR5), compatible company culture (GR6), providing similar support of cooperative firms by top management (GR8), technology support or cost premiums (GR9), and education seminars or system implementation expertise (GR10). The environment level comprises of the capabilities of handling the environment uncertainties: related technologies and systems to help gather information (EC1), explicit regulations to measure trading performance (EC2), sending the timely, accurate, and complete information (EC3), and clearly known practices and procedures in doing inter-firm tasks (EC4).

Thus, to understand firms' supply chain capability, this study suggests the companies have to consider two dimensions: firm capability and inter-firm capability. The firm capability presents the abilities to reduce the transaction related risks, and the inter-firm capability indicates the abilities to handle the relationships and environment issues. It is interesting to notice that past research seldom considers the ability to handle environment uncertainty as an important supply chain capability. However our study indicates that such capability becomes more and more important in the current e-business environment where customer requests frequently change, product obsoletes quickly, and customization becomes a norm

7. CONCLUSION

Many organizations are reengineering their business processes in order to take full advantage of supply chain collaboration. Our study seeks to uncover the key company-owning capability that can contribute to the supply chain collaboration. The proposed framework measures the supply

chain capability in four levels: (1) the technology capability in terms of IOS usage and integration as well as information technology infrastructure, (2) the transaction risk resolution capability, (3) the capability to maintain good relationships, and (4) the capability to reduce uncertainties of external environment.

To pretest the applicability of this model, we conduct interviews with three companies in Taiwan PC industry. The findings are consistent with our model. To further test the model, we conduct a general survey with main Taiwanese PC firms during spring 2005. After a series of measurement assessment, the supply chain capability construct is adjusted as a second-order model. The model consists of two groups of items. The first group captures the firm capability for resolving the transaction risk. The other group presents the inter-firm capabilities for promoting good relationship and managing the environment uncertainties with trading partners.

As any empirical investigation, weaknesses in our methodology and data are present (Lewis and Byrd 2003). First, the number of observations upon which the analyses are performed is in the barely acceptable range. Although we have cited evidence that our sample size is minimally adequate, we recognize that other researchers might take exception to our small size. Second, the survey data utilized in this study are collected from firms in the Taiwan PC industry. Although the utilized sampling frame has been widely-used in similar studies and contains organizations which likely participate in the activity of interest, no claim of external validity for this study's findings can be made. Instead, these findings can only be generalized to the population of firms within the sampling frame.

However, at the very least, the components of supply chain capability and the measurement instrument developed in this study provide a good starting point for further investigations of the supply chain capability construct. Validated supply chain capability measures can help managers better gauge the characteristics of the collaborations. IT researchers can build upon the model developed in this study through further examination of the factors that are discovered. Further research can be conducted by the cross-industry or cross-country survey in the future to verify these results.

REFERENCE

1. Angeles, R., and Nath, R., "An Empirical Study of EDI Trading Partner Selection Criteria in Customer-Supplier Relationships," *Information and Management* (37:5), 2000, pp. 241-255.
2. Bakos, J. Y., "Information Links and Electronic Marketplaces," *Journal of Management Information Systems* (8:2), 1991, pp. 31-52.
3. Barney, J. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99-120
4. Bensaou, M., "Interorganizational Cooperation: The Role of Information Technology, An Empirical Comparison of U.S. and Japanese Supplier Relations," *Information Systems Research* (8:2), 1997, pp. 107-123.
5. Bensaou, M., and Venkatraman, N., "Configurations of Interorganizational Relationship: A Comparison between U.S. and Japanese Automakers," *Management Science* (41:9), 1995, pp. 1471-1492.
6. Byrd, T. A., and Turner, D. E., "Measuring the Flexibility of Information Technology

- Infrastructure: Exploratory Analysis of a Construct,” *Journal of Management Information Systems* (17:1), 2000, pp. 167-208.
7. Clemons, E., and Row, M., “Information Technology and Industrial Cooperation: The Changing Economics of Coordination and Ownership,” *Journal of Management Information Systems* (9:2), 1992, pp. 9-28.
 8. Clemons, E., and Row, M., “Limits to Interfirm Coordination through Information Technology: Results of a Field Study in Consumer Packaged Good Distribution,” *Journal of Management Information Systems* (10:1), 1993, pp. 73-95.
 9. Craighead, C. W., and Shaw, N. G., “E-Commerce Value Creation and Destruction: A Resource-Based, Supply Chain Perspective,” *Database for Advances in Information Systems* (34:2), 2003, pp. 39-49.
 10. Dwyer, F. R., Scurr, P. H., and Oh, S., “Developing Buyer-Seller Relationships,” *Journal of Marketing* (51:2), 1987, pp. 11-27.
 11. Dyer, J. H., and Singh, H., “The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage,” *Academy of Management Review* (23:4), 1998, pp. 660-679.
 12. Hart, P. J., and Saunders, C. S., “Emerging Electronic Partnerships: Antecedents and Dimensions of EDI Use from the Supplier’s Perspective,” *Journal of Management Information Systems* (14:4), 1998, pp. 87-111.
 13. Iskandar, B., Kurokawa, S., and Leblanc, L., “Adoption of Electronic Data Interchange: The Role of Buyer-Supplier Relationships,” *IEEE Transactions on Engineering Management* (48:4), 2001, pp. 505-517.
 14. Kumar, K., and van Dissel, H. G., “Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems,” *MIS Quarterly* (20:3), 1996, pp. 279-300.
 15. Lewis, B. R., and Byrd, T. A., “Development of a Measure for the Information Technology Infrastructure Construct,” *European Journal of Information Systems* (12:2), 2003, pp. 93-109.
 16. Lewis, J. D., and Weigert, A., “Trust as a Social Reality,” *Social Forces* (63), 1985, pp. 967-985.
 17. Mahmood, M. A., and Soon, S. K., “A Comprehensive Model for Measuring the Potential Impact of Information Technology on Organizational Strategic Variables,” *Decision Sciences* (22:4), 1991, pp. 869-897.
 18. Riggins, F. J., Kriebel, C. H., and Mukhopadhyah, T., “The Growth of Interorganizational Systems in the Presence of Network Externalities,” *Management Science* (40:8), 1994, pp. 984-998.
 19. Riggins, F. J., and Mukhopadhyay, T., “Interdependent Benefits from Interorganizational Systems: Opportunities for Business Partner Reengineering,” *Journal of Management Information Systems* (11:2), 1994, pp. 37-57.
 20. Robert M. Grant, “The Resource-Based Theory of Competitive Advantage: Implications for Strategic Formulation,” *California Management Review* (33:3), 1991 pp. 114-135
 21. Segars, A. H., and Grover, V., “Strategic Information Systems Planning Success: An Investigation of the Construct and Its Measurement,” *MIS Quarterly* (22:2), 1998, pp. 139-163.
 22. Sethi, V., and King, W. R., “Development of Measures to Assess the Extent to Which an

Information Technology Application Providers Competitive Advantage,” *Management Science* (40:12), 1994, pp. 1601-1627.

23. Soliman, K. S., and Janz, B. D., “An Exploratory Study to Identify the Critical Factors Affecting the Decision to Establish Internet-based Interorganizational Information Systems,” *Information and Management* (41:6), 2004, pp. 697-706.
24. Teece, D.J., Pisano, G., and Shuen, A. “Dynamic capabilities and strategic management,” *Strategic Management Journal* (18:7), 1997, pp. 509-533
25. Wang, E., and Seidmann, A., “Electronic Data Interchange: Competitive Externalities and Strategic Implementation Policies,” *Management Science* (41:3), 1995, pp. 401-418.

(三) 計畫成果自評

本研究的成果如下：

(一) 發現優良之技術能力並非關鍵的供應鏈能力

由於大部分在台灣的電腦供應商都屬於中小企業(SME)；因此其跨組織的協同交易經常都要靠其客戶的回應。客戶之所以與供應商有長期的合作關係也是為了保持品質、成本和價格在供應上的互相信賴，並非只是選擇技術能力好之供應商。因此，在供應鏈協同上供應商並非將擁有好的技術視為能產生競爭優勢之主要供應鏈能力。而從 OEM 的角度來看，由於政府的支持及類似的客戶群，他們大多都發展出一個不錯但相似的技术能力來帶領跨公司的協同合作，所以技術能力也並不能為他們產生出額外之競爭優勢。這項結果與以往的相關研究視 IT 科技為跨公司協同的重要關鍵因素大有不同。雖然這項發現在未來仍需進一步的証實，但是其反映出一件事實就是越來越多的公司將 IT 當作是跨公司交易的基礎，但不是創造競爭優勢的武器。反而是其他的因素像是信任及夥伴的能力扮演了一個更重要的角色。

(二) 提出改善跨組織系統績效之供應鏈能力模型

要了解一家公司的供應鏈能力，這份研究會建議企業要考慮兩個方面：公司能力以及公司的互動能力。公司能力代表著降低交易風險的能力，而公司互動能力則指出處理關係以及面對大環境相關議題的能力。在過去的研究中，鮮少有人把處理大環境的不確定性視為供應鏈中重要的一項能力。儘管如此，我們的研究顯示此項能力在現今普遍的 E 化企業環境下，也就是當客戶的需求改變愈來愈頻繁、產品淘汰速率加快、以及客製化儼然成為一個基準規範時是愈來愈重要了。

本計畫之研究成果豐碩。在過去一年中，階段性之研究成果已有兩篇國際會議論文(Pre-ICIS workshop -- the 5th Workshop on e-Business)，及一篇SSCI的期刊論文 (Information Systems Journal)

行政院國家科學委員會補助國內專家學者出席國際學術會議報告

2007 年 1 月 16 日

附件三

報告人姓名	張欣綠	服務機構 及職稱	國立政治大學資管系
時間 會議 地點	2006/12/9-2006/12/13 美國密爾瓦基	本會核定 補助文號	NSC 95-2416-H-004-053-
會議 名稱	(中文) 第五屆 Pre-ICIS E-business Workshop 暨 ICIS 2006 (英文) Web 2006 and ICIS 2006		
發表 論文 題目	(中文) 1. 評估商業環境和 IT 環境適切度對電子採購系統的影響 2. 從資源理論觀點看跨組織資訊系統能力 (英文) 1. The Assessment of the Business-IT Fit in E-Procurement Systems: A Case Study 2. Resource-based View of the Inter-organizational Information System Capability: A Field Study in Taiwan PC Industry		
報告內容包括下列各項： 一、參加會議經過 二、與會心得 三、建議 四、攜回資料名稱及內容 五、發表論文			

壹、 參加會議經過

This conference started on 12/9 and ended on 12/13. Since I can't get the returning seat, I came back one day earlier. The whole trip plan is as follows,

日期	活動行程
12月8日	搭機赴美
12月9日	參加 Web2006 開幕式，發表論文，並會後餐敘
12月10日	參加 ICIS 會議開幕酒會
12月11日	參加 ICIS 會議
12月12日	參加 ICIS 會議，回程

This year, the conference theme is 'Real-World Impact of e-Business Research.' A total of 56 papers were accepted for presentation, covering a broad range of technical, empirical, managerial, and economic aspects of e-business. Eight focused sessions were arranged in the conference: security informatics, agent-based information systems, e-business standards development, research opportunities in e-business, web intelligence, web-based services in health care, web services and architectures, and e-market and market engineering. There were also two keynote addresses and two invited talks. The conference was sponsored by AIS SIGeBIZ, AOL, and Caterpillar. Besides, four universities (i.e. University of Illinois, University of Utah, University of South Florida, and National Sun Yat-Sen University) co-organized the entire program. Combining all the varieties, this conference has significant impacts on e-business and information systems research.

Dr. Krishnan Ramayya gave the keynote speech. He is the W.W. Cooper and Ruth F. Cooper Professor of Information Systems at Carnegie Mellon University. In his speech, he discussed the opportunities for Interdisciplinary research: the Internet, Web2.0 and Beyond. Steve Miller, founding dean of the school of Information Systems at Singapore Management University, gave another keynote afterwards. He introduced an industry-university collaboration for service innovation: the standard chartered iLAB@SMU.

Following the keynote speeches, my two papers were presented on Session 1a and Session 3d. After the series of sessions, a panel discussion is chaired by Raj Veeramani, Robert Ratner Chair Professor from University of Wisconsin-Madison. Four noted scholars were invited to discuss the emerging e-business practices and challenges.

貳、 與會心得

Many interesting papers are discussed in the sessions that I participated. In general, I categorize the topics into three groups and summarize the discussion results.

[E-Business and ERP System Integration]

Hsu and Kraemer from University of California, Irvine built upon resource-based view to investigate the complementary effect between ERP and e-Business technologies. They argued that it is the complementarily use of ERP and e-business technologies to build system and business integration capabilities that is more likely to create business value. Their results showed that the complementary effect between ERP and e-business technologies in creating business value is stronger than the main effects of ERP or e-business technologies alone.

[Online Dynamic Pricing on Consumer Perceptions and Behaviors]

Lee from University of Illinois raised the question of whether dynamic pricing can actually work in the electronic commerce environment. In her paper, she aimed to fill the gap by examining whether there are tactical ways of implementing dynamic pricing strategies so as to moderate consumers' negative perceptions. She used different ways of presenting product's price, in addition to previous research using price comparisons, to study consumer behavioral responses.

[Operational and Strategic Benefits of IOS]

Ibrahim from Erasmus University and Ribbers and Bettonvil from Tilburg University demonstrated how different types of IOS-related resources influence the development of IOS capabilities and subsequently the attainment of benefits. The study develops a conceptual model combining multiple theories including transaction cost economics, resource-based view and strategic management. They proposed that the use of specific types of resources positively influences the development of distinctive IOS capabilities and that these IOS capabilities positively influence the attainment of operational and strategic benefits.

參、 建議

The participants made valuable suggestions and comments to our two papers. I summarize their recommendations below.

Paper 1: The Assessment of the Business-IT Fit in E-Procurement Systems: A Case Study

1. Clarify the operationalization of their measures and why the "level of integration" determines the types of e-procurement system. As one reviewer points out, any of the e-procurement system can be implemented at the different levels of integration.
2. Carefully review the results and reflect upon the implications for their central research question. Make sure that your discussion does not make contradictory statements.

Paper 2: Resource-based View of the Inter-organizational Information System Capability: A Field Study in Taiwan PC Industry

This is an interesting study with the scope for being extended to a large scale investigation of the success of IOS implementations. I recommend accepting this paper after the authors have addressed the following issues.

1. I do not understand the rationale behind dropping the IOS integration factor. Since IOS integration is accepted as an important factor for its success, was it dropped because of difficulty of measurement? Or is it captured in other factors?
2. The discussion of "Physical Assets" for hypotheses 1 (page 5) is not consistent with the measures they propose in page 7. Are they measuring the extent of physical assets dedicated for IOS or are they measuring the IOS capability? The items themselves, such as "degree of technology investments in IOS and establishment of IT infrastructure need some elaboration. Or, the authors can consider using IOS infrastructure capability instead of physical assets. The authors have to be consistent with their conceptualization of this variable and its operationalization. Another minor issue here is the references used for operationalization (page 7) are completely different from the references used in the discussion (page 5).
3. The "path dependency" is very similar to "prior experience with similar implementations." Their discussion on page 5 focuses on the IOS implementation and learning process (which is a development perspective), whereas the operationalization on page 7 focuses on "EDI usage" (which is a usage perspective). I think the authors have to decide on the perspective they like to use and follow it in the discussion and operationalization.
4. On page 8, the authors mention the use of MTMM for validity assessment and Cronbach's alpha for reliability assessment. It may be useful to present a small table showing the reliability and factor loadings to give the readers a sense of the measure properties.

肆、 攜回資料名稱及內容

- A. Conference paper abstracts
- B. Conference program outline
- C. Revision strategy and comments to my presented paper

伍、發表論文

The Assessment of the Business-IT Fit in E-Procurement Systems: A Case Study

Abstract

Because of the influence of globalization and updated information technologies (IT), firms face more and more uncertainties when they conduct daily procurement activities. This research aims to examine the fit of business and IT environment and study its impacts on the performance of alternative e-procurement systems (EP). A multiple-case study was taken in Taiwan PC-Notebook industry to verify the research framework. We find the firms' external and internal factors do affect the performance of EP, and the influence is mediated by the levels of system integration. Low-integrated EP leads to greater performance under lower environment, partnership, and process uncertainty, and lives up to more benefits under lower knowledge skills. We also observe that lack of fit between procurement practices and EP produces extra burdens and costs at both buyer side and supplier side. Therefore, the contribution of this research can be two-folded: first, practitioners who can use this framework to diagnose their environment conditions and then align to the appropriate type of EP. Second, researchers who can build upon this model to further examine the fit impact on EP performance.

Keywords: Business-IT fit, Electronic procurement, IT Alignment, Case Study, E-Business

1. Introduction

With most organizations spending at least one third of their income on purchasing goods and services, procurement holds significant business value (Gebauer and Segev 1998). It is even possible that many organizations spending 50% to 60% of their revenue on purchasing goods and services (Kalakota and Robinson 1999). A close survey on supply chain management made at Forrester Research 2002 revealed that 62% of \$1B+ the manufacturing firms surveyed deployed procurement and sourcing packaged applications and 35% of the firms could extend the applications to partners.

While more and more firms use electronic procurement systems (EP) to achieving purchasing efficiencies, they find IT alone can't guarantee good performance. This drives us to the question how EP can deliver the promised benefits. A key concern of this question is alignment – applying IT in an appropriate and timely way and in harmony with business strategies, goals, and needs (Luftman and Brier 1999). The external environment should also be considered into the issue of alignment, since the EP can be viewed as the IT-enabled inter-organizational processes which involve multiple trading partners with a wide range of communication and IT. Although there is no doubt that a good fit between the EP and the requirements of the business environment has positive impact on system performance, how to align is still open to question.

This study attempts to better examine the business-IT alignment, and our focus will be on the EP in direct purchasing. The research questions are as follows:

- (1) What impacting factors retard or encourage the successful implementation of corporate procurement systems?
 - (2) Under different environment conditions, which type of procurement system is more suitable
- 表 Y04

for organizations in terms of the system performance?

2. Literature Review

2.1 Use of Electronic Procurement Systems

In this study, EP is defined as the application of electronic commerce in procurement. It involves the use of various forms of Internet technology to automate and streamline the procurement process in business organizations (de Boer et al. 2002, Chan and Lee 2002). Some EPs are implemented as a form of application to application (AP-to-AP) connection, some use EC Turnkey, like EDI, and others are web-based procurement systems. According to Choudhury's typology (1997), application to application (i.e. AP-to-AP) connection and EC Turnkey are the examples of electronic dyads, where a buyer (seller) establishes individual logical links with each of a selected number of sellers (buyers) for a product. Web-based procurement system, on the other hand, is the example of multilateral IOISs, which, allows a firm to communicate with a large, potentially unlimited, number of trading partners over a single logical inter-organizational link. The system integration level is usually higher in the former type.

These technologies have been reported to have positive impacts on firm performance by some authors. Mukhopadhyay and Kekre (2002) showed in full detail that how EDI brings strategic and operational benefits for both suppliers and buyers. Other studies explored the value of web-based procurement systems (Baron et al. 2000; Subramaniam and Shaw 2002). Yet how to get these values is still uncertain. Therefore, we can not simply expect that firms can successfully implement EP as long as they have learned about a specific technology and found it valuable for their needs. There should be other factors which impact the performance of EP.

2.2 Studies of IT and Uncertainty

As Yu et al. (2003) argued, EP could create changes in the way organizations conduct business internally and externally and bring many dynamic changes both outside and inside the organization. This creates a high level of turbulence and, as a result huge uncertainty to involved parties. We summarize four major types of uncertainty that could affect EP performance in the following paragraphs.

Environment uncertainty is the most obviously and widely discussed one in the literature. It stems from the complexity of the environment and dynamism, or the frequency of changes to various environmental variables (Duncan 1972; Premkumar et al. 2005). Thus, Firms competing in an environment that existing higher uncertainty should need more reliable and timely information when they conduct purchasing decision, and therefore, challenge the performance of EP. The second uncertainty is about partnership. Given the interorganizational nature of the EP, partner's behavior in the future is highly uncertain to firms (Bensaou and Venkatraman 1995).

Usually, firms develop long-term relationships with a few suppliers and make relationship-specific investments to minimize transaction risks (Premkumar et al. 2005). Thus, lower partnership

uncertainty encourages greater information sharing between two firms, and therefore provides a closer collaboration for EP usage.

Process characteristics are categorized as the third uncertainty to EP performance. In their recent research on the value of EP, Subramaniam and Shaw (2004) referred to the fact that not all transaction processes are similar in terms of their search requirements, processing time and efforts, and errors, and so do their needs to EP. We may, therefore, reasonably expect the characteristics of the B2B process to greatly influence the realization of EP benefits. The last factor we want to emphasize is organizational knowledge. According to Grant (1996), knowledge resides in specialized form among individual organizational members and the essence of organizational capability is the integration of individuals' specialized knowledge. A close survey on supply chain integration made by Chen et al. (2004) revealed that the technology ability and application level of SMEs would highly constrain the degree of system automation. Thereby, a firm's knowledge to EP is a key determinant to EP performance.

2.3 The Fit Concept

The notion of fit in IS research has been an object of study for a long time. Over the past few decades a considerable number of studies have been made by using the task-technology fit (TTF) theory (Goodhue 1995, Zigurs and Buckland 1998, Dennis et al. 2001). While TTF is focused on use performance and user evaluation of IT and does not use structural contingency theory of fit as its basis (Khazanchi 2005), some authors argued that there is a need for investigating fit that expands beyond the individual and task levels of analysis to organizational level of analysis. For example, Gribbins et al. (2004) expanded Goodhue and Thompson's TTF (1995) to process-technology fit for better understanding of the acceptance and use of EP systems in organizations. In contrast to TTF, other authors use Galbraith's information processing theory (1973) to examine the fit between information processing needs and information processing capability. The first scholars to give much attention on information process theory were Bensaou and Venkatraman (1995). Following that, Premkumar et al. (2005) investigated fit in the interorganizational level of analysis and empirically examined its effect on performance.

Although above studies are important to examine the relationship of alignment, there is no comprehensive framework to consider all important factors together. Therefore, we propose that there is a need to consider both internal and external business environment when understanding the usage of EP. There are several reasons for this proposition. First, while TTF scholars focus on internal characteristics, other IOIS scholars give much attention to external characteristics and interaction relationship. Both views are quite unsatisfactory, given that they only consider one perspective of the problems. As EP is an IOIS which creates changes in the way organizations conduct business internally and externally and can bring many dynamic changes both outside and inside the organization (Yu et al. 2003), its performance should be influenced by both internal and external corporate environment.

Second, more and more scholars believe that the individual and task level of analysis are not applicable to EP study (Gribbins et al. 2004; Khazanchi 2005). They argue that organizations usually pursue excellence as a whole, rather than simply at individual's task. Besides, EP is a process-based IT solution which can consist of a suite of applications that are integrated to support the processes rather than independent tasks (Gribbins et al. 2004). Therefore, it seems reasonable to

examine process rather than task characteristics. Third, to realize the strategic importance of EP, previous research has spent plenty effort to exploit barriers and facilitators. However, organizations differ greatly in their abilities to utilize the application and translate it into tangible benefit. Adopting a technology is one thing, having the capability to use it is another. Organization's own knowledge base would be a key part of business environment, but is not well discussed in previous IT alignment studies.

3. Development of the Business-IT Fit Framework

Due to the insufficiencies of previous works which are mentioned above, we aim to synthesize the previous research to develop a comprehensive framework that evaluates the impact of EP usage on firm performance under the consideration of corporate external environment, internal processes, and organizational knowledge. The proposed business-IT fit framework is shown in Figure 1.

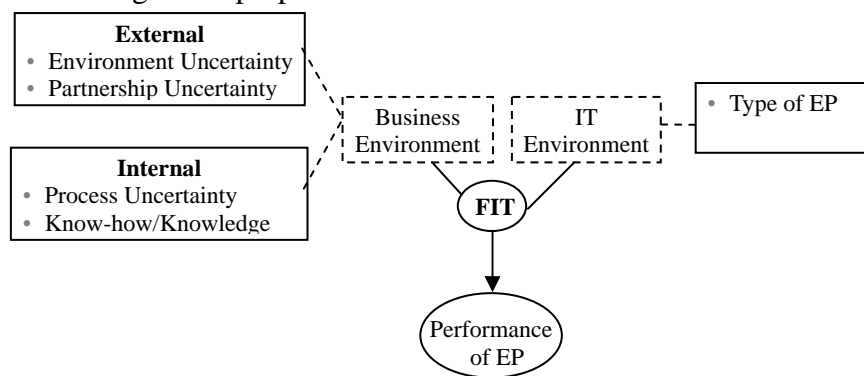


Figure 1. Research framework for the development of business-IT fit

As to the type of EP, we have summarized three different EP technologies: AP-to-AP, EC turnkey, and web-based procurement systems, each having different degrees of integration between suppliers and customers. To simplify the analysis, we categorize them into two groups: low-integrated EP and high-integrated EP.

3.1 External Uncertainty vs. IT Environment

3.1.1 Environment Uncertainty

In the procurement context, the changes in demand and supply are the major environment uncertainty that influences firm's information need (Premkumar et al. 2005). When the uncertainties are high, firms need to communicate the frequent changes of demand with their suppliers. Under such conditions, EP that provides near-real-time structure information to trading partners is preferred (Premkumar et al. 2005). On the other hand, product customization is another resource of such uncertainty (Bensaou and Venkatraman 1995). The arrangement of high-integrated EP system reduces coordination costs over those incurred in a market by eliminating the firm's effort to gather and analyze a great deal of information about different trading partners. Therefore, under high environment uncertainty, we expect that firms with tight integration between their trading partners would reduce more coordination costs and achieve better performance. Therefore, our proposition is

as follows,

Proposition 1: A highly integrated EP can lead to greater performance under higher levels of environment uncertainty.

3.1.2 Partnership Uncertainty

According to Son et al. (2005), firms and suppliers are more certain about their partnership when they have made reciprocal investments, because these investments provide a strong signal to the other party about their desire for long-term relationships (Premkumar et al. 2005). In line with reciprocal investments, trust between firms and partners is recognized as an effective mechanism to reduce the partnership uncertainty (Premkumar et al. 2005). As firms have confidence that the behavior of their suppliers conforms to their own expectation, the perception of risk associated with partners' opportunistic behavior can be highly reduced, and therefore encourages greater information sharing between both. Since both reciprocal investments and trust can promote good relationship, we can derive that, the coordination costs that take into account the costs of gathering information, negotiating contracts, and protecting against the risks of opportunistic bargaining are relatively high in an uncertain partnerships. The previous discussion points out the coordination costs can be highly reduced in the arrangement of highly integrated EP system, thereby we proposing:

Proposition 2: A highly integrated EP can lead to greater performance under higher levels of partnership uncertainty.

3.2 Internal Uncertainty vs. IT Environment

3.2.1 Process Uncertainty

According to Subramaniam and Shaw (2002, 2004), there are following types of procurement on the two ends of a continuum. At the one end is the structured procurement of which processes are highly automated and product specifications do not change frequently. At the other end is the unstructured procurement of which processes are manually initiated and the technical or design requirement for the products are difficult to predict accurately. The needs of EP systems vary in each procurement type (Subramaniam and Shaw 2004). For unstructured procurement, firms need to exchange information more frequently with its trading partners, and trading partners need to deal with several different sources of information to process procurement activities successfully (Premkumar et al. 2005). Therefore, a more integrated EP which allows firms and trading partners to access relevant information timely is preferred. Since the complexities and dynamisms of processes and underlying products are higher for unstructured procurement than structured procurement, we can propose that,

Proposition 3: A highly integrated EP can lead to greater performance under higher process uncertainty.

3.2.2 Know-how/Knowledge

Past literature recognized that the key skills and know-how of firms have persisting effects on relative performance (Kogut and Zander 1992). The theory of diffusion of innovation helps account for this statement. Rogers (1995) stated that organizations often delay adoption of complex

technologies until they obtain sufficient know-how to implement the computer innovation successfully. Chen (2004) also mentioned that a lack of technical knowledge is a barrier to IT implementation. In contrast to technical knowledge which is explicit and codifiable, managerial IT skills are tacit and often developed over longer periods of time through the accumulation of experience by trial and error learning (Mata et al. 1995, Yu et al. 2003). Mata et al. (1995) referred that in addition to technical IT skills firm needs to possess managerial IT skills to realize the full potential of EP (Mata et al. 1995). We can expect that a highly integrated EP requires more technical and managerial skills than EP at low levels of integration. Hence, we put forward the following proposition:

Proposition 4: EP usage in the form of low-integrated system can lead to greater performance under lower knowledge skills.

4. Research Analysis

4.1 Case Background

A multiple-case study is used to test our framework. We study four Taiwanese-owned Chinese companies in the Personal Computer (PC)-Notebook (NB) industry. All these four companies are suppliers to a large PC OEM and they are currently using a web-based EP system initiated by the OEM to facilitate their procurement process. A summary of these four companies is presented in Table 2.

Table 2. Cases Background

Firm 1	A mechanical supplier provides casting materials to the OEM. The casting material means the top cover and upper/bottom case of a NB.
Firm 2	A packaging supplier provides label materials to the OEM. The label material means the colorful stickers in the low case of a NB.
Firm 3	An electrical engineering supplier provides cable materials to the OEM. The cable material means all kinds of cables in a NB, such as power cable, monitor cable, USB cable, data cable and so forth.
Firm 4	Another electrical engineering supplier provides passive components to the OEM.

4.2 System Background in the Cases

Given “procurement” is an overall term; it is composed of sourcing and purchasing (Favre and Brooks, 2002). For the OEM, the operation of sourcing is done by its Headquarter in Taiwan, including activities such as strategy definition, suppliers pre-qualification, contracts negotiation, and supplier relationship management etc. The daily purchasing is done by local procurement departments, which is facilitated by the underlying EP system shown in Figure 2. Although this EP system initially attempted to automate the entire purchasing cycle (indicated as the dotted rectangular of Figure 2), its activated functions are merely ordering and shipping processes by now. Via the system, suppliers can transform purchase orders (PO) into advanced shipping notices (ASN). However, system to system integration is not available. OEM buyers need to re-key the ASN into their ERP and then generate the invoices in a monthly basis. In the circumstance of vendor-managed inventory (VMI), extra hub information is sent to the suppliers for decision making.

4.3 Framework Application

In different environmental conditions, is the EP in this case more suitable than in other cases in terms of the system performance? How does each case company accommodate the EP to better align with its corporate environment? To answer these questions, we next interpret the cases in light of the research framework we proposed in the earlier section (Figure 2).

4.3.1 Environment uncertainty

We use product customization, demand dynamics and supply dynamics to capture the external environment uncertainty (Duncan 1972). In general, firm 1 has the lowest environment uncertainty due to few parts number (PN), rare order changes, and less coordination required during the shipment. The analysis is summarized in Table 3a.

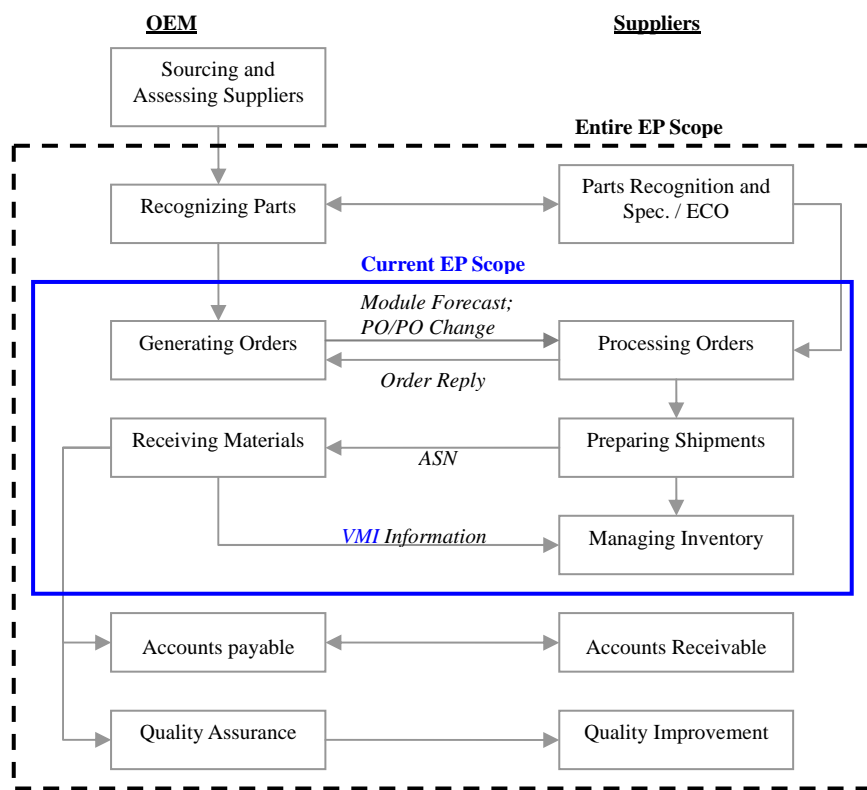


Figure 1. The EP Scope in this Study

Table 3a. Cross-case analysis results: Environment uncertainty

Model variables	Firm 1	Firm 2	Firm 3	Firm 4
<i>Product customization</i>	Low (10 PNs)	Low (20 PNs)	Medium (100 PNs)	High (1000 PNs)
In the procurement practice, each product provided by suppliers is assigned a part number (PN) by the OEM. According to the characteristics of material and the OEM's policy, each PN requires different production efforts. Suppliers who must tailor more PNs to meet the OEM's requisition have higher uncertainty in product customization.				
<i>Dynamics of demand</i>	Low (rare changes)	Medium (some emergent orders)	High (many changes)	High (many changes and over 30%)
Due to the tight cooperative design interaction, the demand for firm 1 is relatively stable. The situations of emergent order often occur for firm 2 due to its labeling material is needed at the end of production stage. Firm 3 incurs a huge gap between forecast and actual order, making them "confirm the demand every day". The informant of firm 4 reflected that "in the usual case, there is over 30% of product specifications and usage change after the order submission."				
<i>Dynamics of supply</i>	Low-medium (Goods return)	Low (Emergent PO)	High (Need Coordination of)	High (Hub delivery)

	problems)		extra support person)	
Given that casting material is not cheap and occupies enormous space, it is not possible for firm 1 to do overflow backups. The updated shipping information is therefore needed for firm 1 to handle goods returned. Firm 2 conducts direct shipping. The supply availability could be affected due to the emergent orders. The shipments of firm 3 and firm 4 are unsettled. In firm 3's circumstance, it even deploys an extra support person to stand by in the OEM's warehouse and coordinate shipment. As to firm 4, though there is no fixed shipping schedule, it must maintain approximately 10 days' inventory level in the hub.				
Environment uncertainty:	Low	Low-medium	Medium-high	High

4.3.2 Partnership uncertainty

In terms of partner uncertainty, Bensaou and Venkatraman (1995) identified three variables to capture the transaction risks—the focal firm's asset specificity, partner's asset specificity, and mutual trust, which were latter used by Premkumar et al. (2005) to represent the uncertainty in a customer-seller relationship. We use the similar conceptualization to measure partnership uncertainty but combine the focal firm's and partner's asset specificity as one single item, reciprocal investment. Firm 1 again has the lowest partnership uncertainty as it has intensive co-design activity and has long-lasting cooperation history with the OEM. The analysis is shown in Table 3b.

Table 3b. Cross-case analysis results: Partnership uncertainty

Model variables	Firm 1	Firm 2	Firm 3	Firm 4
<i>Reciprocal investment</i>	Medium (Iterative Co-design)	Medium-low (Co-design)	Low (Standard products, No R&D interaction)	Low (Standard products, No R&D interaction)
Reciprocal investment is mostly occurred at the cooperative design activities. Firm 3 and firm 4 have relatively few mutual investments than the other two firms because cable materials and passive components, which are standard products and can be reused in several models, do not need much R&D interaction with the OEM.				
<i>Trust</i>	High (Mutual trust)	Medium (Loses track of shipments)	Medium-low (Suspicion of allocation changes)	Low (Suspicion of allocation changes and Hub problem)
The informant of Firm 1 talked about a long lasting cooperation history with the OEM and held a very positive view about their efforts on this EP system development. Firm 2's trust to the OEM is moderate. A lack of a well-developed communication system to deal with order exceptions reduces the trust between Firm 2 and the OEM. For firm 3 and firm 4 the trust with the OEM is even worse. We found both firm 3 and firm 4 suspected that the procurement executives of the focal firm changed contract allocation among suppliers arbitrarily. Especially for firm 4 who delivers products through Hub, felt extremely frustrated.				
Partnership uncertainty:	Low-medium	Medium	High	High

4.3.3 Process uncertainty

Process uncertainty refers to the dynamisms and complexity of the procurement process and of the underlying products (Bensaou and Venkatraman 1995, Choudhury 1997, Subramaniam and Shaw 2002, 2004; Premkumar et al. 2005). Firm 2 has the lowest process uncertainty of all the other three firms due to its simple order management process, and special but simple products (i.e. labeling materials). More details can be referred to Table 3c.

Table 3c. Cross-case analysis results: Process uncertainty

Model variables	Firm 1	Firm 2	Firm 3	Firm 4
<i>Dynamics of process</i>	Medium (Fulfill order, return process)	Low (Fulfill order)	High (Fulfill order, contact extra support person)	High (Fulfill order, coordinate hub delivery)

<p>The major tasks of the order management process are diverse among 4 cases. For firm 1, the sales representatives are responsible of fulfilling order, coordinating and contacting RD personnel of both sides, and managing the return of defective items. In contrast, firm 2's sales people only need to manage order fulfillment and trace the design drawing in case of missing, since their RD design and reverse logistics is not as complicated as firm 1. On the other hand, the sales people of firm 3 need to spend extra efforts to manage order fulfillment. They must get contact with the procurement executives of the focal firm and their assistants there to get shipping information. Accordingly, most of their working time is spent on PO maintenance. For firm 4, the sales people pour great efforts in fulfilling order as well. However, contact subjects are slightly different. They need to coordinate with Hub personnel besides the procurement executives of the focal firm to ensure the fulfillment is done. In their opinion, the Hub personnel are too passive and insufficient in cooperation, resulting in a very poor exceptions handling. At most of the time, they still need to strive alone.</p>				
<i>Dynamics of product</i>	High (Change by every module in the form, function and structure etc.)	Low-medium (Change by every module in graph.)	Low (Standard material)	Low (Standard material)
<p>In firm 1's case, casting materials are special materials which are incompatibly across different modules. Namely, a cast only corresponds to a single NB module. Before providing such product, firm 1 need to discuss the form, the operation, the material, the function and the structure of a cast. On the contrary, firm 2, firm 3 and firm 4 have no cooperative R&D problems, given that labels are simple materials and cables as well as passive components are relatively standard materials. However, firm 2 face more frequent product change, for the context of labels is set along with the specifications of separate modules, and the specifications sometimes change with the requirements of customers or the upgrades of NB versions.</p>				
<i>Complexity of product</i>	High (Special and dedicated material)	Low (Special but simple material)	Medium (Standard material)	Low-medium (Standard material)
<p>The casting materials produced by firm 1 belong to dedicated/special materials and must go through several stages before commercial production (Lead time: 1 month; Duration of a batch production: 3~5 days). The product complexity is relatively high compared with the other three. The labeling materials provided by firm 2 are part of dedicated materials, but there is no complicated R&D or material recognition (Lead time: 1 week; Duration of a batch production: 1 day). The cable materials supplied by firm 3 are standard materials with medium technology complexity (Lead time: 1 month; Duration of a batch: 1~2 days). Firm 4 produces passive components, which are standard materials with low technology complexity (Lead time: 1~2 months; Duration of a batch production: 3days).</p>				
Process uncertainty:	Medium-high	Low	Medium	Low-medium

4.3.4 Know-how/Knowledge

Technical IT skills and managerial IT skills are used to measure the knowledge and know/how required for EP use (Lee et al. 1995, Mata et al. 1995, Yu et al. 2003). Firm 4 have the highest technical and managerial skills for its various IT connections and abundant IT implementation experience. Table 3d summarizes the result.

Table 3d. Cross-case analysis results: Knowledge/Know-how

Model variables	Firm 1	Firm 2	Firm 3	Firm 4
<i>Technical skills</i>	Medium (No difficulty with current EP)	Medium (No difficulty with current EP)	Medium (No difficulty with current EP)	High (Even has EDI and RosettaNet connection capability)
<p>Since all these four companies run the EP system smoothly, we may say that all of them have certain degree of IT capabilities. To discuss their technical skills further, we looked into their transactions with other firms. No surprisingly, they do business with others via various EP systems and some of the systems require higher level of technical skills. For instance, firm 4 has also built EDI and RosettaNet connections.</p>				
<i>Managerial skills</i>	Low (Not shown)	Medium-low (coordination skills)	Medium (on-site support)	High ("Willing" to do further via advanced system)
<p>Firm 1 didn't suffer much environmental uncertainty, so they did not show many managerial skills about current procurement practice. Firm 2 and firm 3 show apparent coordination skills in the form of their frequent interaction with the executives of the focal firm. To support delivery and transportation, firm 3 even sent an extra assistant to the focal firm's warehouse. As for firm 4, it spent great effort to coordinate procurement activity as well. In order to avoid</p>				

the due date delay firm 4 proposed a solution which directly linked the EP to their organizational system via EDI to maintain the status of order automatically. Though the proposition was denied eventually, there is no doubt that firm 4 have sufficient ability and willingness to improve the performance of procurement activities.

Know-how/Knowledge	Medium-low	Medium	Medium	High
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4.4.5 Performance

The performance of EP can be measured from several different perspectives. Mukhopadhyay and Kekre (2002) proposed a two-stage model of benefits in which IT are viewed as creating direct, first-order benefits, which in turn generate indirect, second-order benefits. According to them, the first-order benefits include: (a) direct strategic benefits typically in terms of sales gains, and (b) direct operational benefits typically in terms of process-based operational measures, such as the improvement of order-processing cycle and timeliness of payments. The second-order benefits are indirect strategic benefits that are influenced by direct benefits created by IT and accrue over an extended period of time. In our paper, we only consider the first-order benefits. Of all the case companies, firm 1 had the least complaints about the EP system and mentioned the most operational benefits related with time and error reduction. The analysis can be found in Table 3e.

Table 3e. Cross-case analysis results: EP Performance

Model variables	Firm 1	Firm 2	Firm 3	Firm 4
<i>Operational benefits</i>	High (Great benefits in term of time and error reduction and ASN)	Medium (Benefits from error reduction & ASN; (few complaints))	Low-medium (Benefits from ASN ; (many complaints))	Low (Few benefits)
Operational benefits such as time and error reductions related to payments and order confirmation and increasing accuracy of order processing are mentioned in firm 1, firm 2, and firm 3 in some extent. Given that the EP system can transform PO into advanced shipping notice (ASN) automatically, the inconsistencies between PO and shipping notice mitigate greatly. Despite these benefits, firm 2 and firm 3 mentioned more or less that current system fails to support their procurement practices, especially in firm3's case. For firm 4, their sales didn't think the EP brings much convenience to their daily operation. Instead, they complained most information provided by the system is inaccurate and out of date. And unfortunately, because of Hub delivery instruction, ASN is useless in firm 4's case.				
Performance:	High	Medium	Low-medium	Low

5. Discussion

A simple bar chart shown as following figure 3 summarizes the case analysis. As the diagram indicates, firm 1 and firm 2 belong to a low level of environmental uncertainty, while firm 3 and firm 4 belong to a high level of environment uncertainty. The need of accurate and timely forecasts and shortage information are emphasized in the cases of firm 3 and firm 4 since they have to deal with greater dynamics of demand and supply. However, the forecasts may come from various sources. EP systems which can help integrate such information from different sources should be especially beneficial to suppliers like firm 3 and firm 4.

Figure 3 also shows that partnership uncertainty increases progressively from firm 1 to firm 4. It seems that the reciprocal investment does not impact the performance much in our cases since the level of reciprocal investment is quite indiscriminate in all cases. We find that firm 2, firm 3, and firm 4 suspect that the OEM doesn't conform to its pre-determined order allocation. These

suspicious lead to low perceived benefits of the current EP system and give rise to more information need to handle the perception of risk associated with partners' opportunistic behavior.

The situation of process uncertainty is more complicated. In previous literature, as we have seen, the complexity of procurement process is highly related to the products upon them. However, we find that they are negatively related in these four cases. Specifically, the less specific and dynamic the materials are, the more suppliers competed in the market. Therefore, each supplier has smaller power and is asked to follow the rule made by the buyer. Suppliers in such circumstance need to pay additional efforts to process the transaction successfully. In fact, firm1, firm3 and firm4 do express that the current EP system can't support them to process order fulfillments successfully.

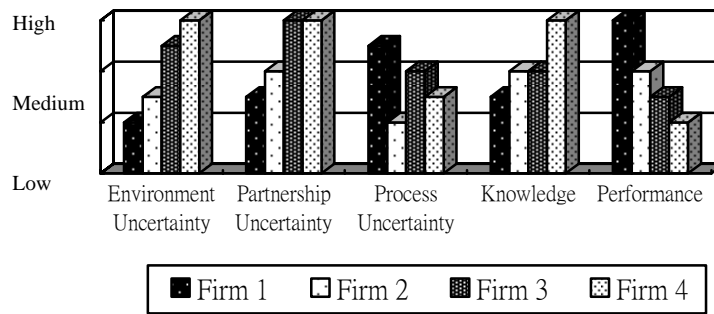


Figure 3. Case results of the four dimensions and performance

Finally, the level of knowledge skills is higher in firm3 and firm4. Firm 4 who shows the most mature capability in both IT and managerial skills has better know-how in technology. But for other suppliers, they do not have such strong knowledge bases as firm 4. Besides, the OEM, in our case, spends few efforts training the suppliers using the EP systems. Most of the suppliers admit that they grope for the system's function on their own. We also find that even with lower knowledge skills, firm 1 and firm 2 still view the current web-based EP system simple enough for them to get familiar in the short run.

In summary, these four suppliers can be roughly divided into two groups. Firm 1 and firm2 have relatively lower external uncertainty and higher internal uncertainty. Firm 3 and firm 4 are in the contrary. Our case study shows that the low integrated web-based EP system drives better performance in suppliers like firm 1 and firm 2, which is consistent with our propositions. Nevertheless, firm 3 and firm 4 show sufficient capability and willingness to reduce their uncertainties and improve performance eventually. Though a simple basic EP system can not live up to expected benefits in complex and dynamic environment, a powerful highly integrated EP system can not fit all suppliers neither. Firms may prefer to maintain a unique EP system due to cost consideration and other concerns. However, we argue that companies should align their EP with different suppliers just like they provide several versions of their products for different customers to get maximum profits. Fit between business environment and technology can produce win-win situation and best profits to both buyer and sellers.

6. Conclusion

Through the empirically case study, we find the firms' external and internal factors can affect the performance of EP. That is, EP usage in the form of low-integrated system may lead to greater performance under lower environment, partnership, or process uncertainty, and lives up to more benefit under lower knowledge skills. We also observe that lack of fit between procurement practices and EP system produces extra burdens and costs to companies. Such costs are reflected in the performance of both buyer side and supplier side. Therefore, companies should align their EP with different trading partners to get maximum efficiency and benefits. The IT context of this case study focuses on low-integrated systems which are the most popular means of e-commerce transaction in Taiwan manufacturing industry and leaves highly-integrated EP an unsettled subject. In the future we can design more quantifiable measures to further validate the result derived from the case study.

7. References

1. Baron, J.P., Shaw, M.J., and Bailey, Jr., A.D. "Web-based e-catalog systems in B2B procurement," *Communications of the ACM* (43:5), 2000, pp. 93-100.
2. Bensaou, M., and Venkatraman, N. "Configurations of interorganizational relationship: A comparison between U.S. and Japanese automakers," *Management Science* (41:9), 1995, pp. 1471-1492.
3. Chan, J.K.Y., and Lee, M.K.O. "SME e-procurement adoption in Hong Kong—The roles of power, trust and value," The 36th Hawaii International Conference on System Sciences (HICSS'03), Big Island, HI, 2003, pp. 179-188
4. Chen, H., Themistocleous, M., and Chiu, K.H. "Approaches to supply chain integration followed by SMEs: An exploratory case study," *The 10th Americas Conference on Information Systems (AMCIS2005)*, New York, NY, 2004, pp. 2610-2620.
5. De Boer, L., Harink, J., and Heijboer, G. "A conceptual model for assessing the impact of electronic procurement," *European Journal of Purchasing & Supply Management* (8) 2002, pp. 25-33
6. Duncan, R.B. "Characteristics of organizational environments and perceived environmental uncertainty," *Administrative Science Quarterly* (17:3), 1972, pp. 313-327.
7. Favre, D. and Brooks, J. "E-sourcing: procurement's leading edge," *ASCET* (4), 2002, pp. 74-76.
8. Gebauer, J., and Segev, A. "Assessing internet-based procurement to support the virtual enterprise," CALS Expo International and 21st Century Commerce: Global Business Solutions for the New Millennium, Long Beach, CA, 1998
9. Grant, R.M. "Prospering in dynamically-competitive environment: Organizational capability as knowledge integration," *Organizational Science* (7:4), 1996, pp. 375-387.
10. Gribbins, M.L., Subramaniam, C., and Shaw, M.J. "The impact of process and technology factors on user's assessment of the fit of e-procurement with the procurement process," *The 3rd Workshop on E-Business (WeB2004)*, Washington, DC, 2004.
11. James I. Cash, J., and Konsynski, B.R. "IS redraws competitive boundaries," *Harvard Business Review*, 1985, pp. 134-142.

12. Kalakota, R., and Robinson, M. *E-Business: Roadmap for Success* Addison-Wesley, MA, 1999
13. Lee, D.M.S., Trauth, E.M., and Farwell, D. "Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation," *MIS Quarterly* (19:3), 1995, pp. 313-340.
14. Luftman, J., and Brier, T. "Achieving and sustaining business-IT alignment," *California Management Review* (42:1), 1999, pp. 109-122.
15. Mata, F.J., Fuerst, W.L., and Barney, J.B. "Information technology and sustained competitive advantage: A resource-based analysis," *MIS Quarterly* (19:4), 1995, pp. 487-505.
16. Mukhopadhyay, T., and Kekre, S. "Strategic and operational benefits of electronic integration in B2B procurement processes," *Management Science* (48:10), 2002, pp. 1301-1313.
17. Premkumar, G., Ramamurthy, K., and Saunders, C.S. "Information processing view of organizations: An exploratory examination of fit in the context of interorganizational relationships," *Journal of Management Information Systems* (22:1), 2005, pp. 257-294.
18. Son, J.-Y., Narasimhan, S., and Riggins, F.J. "Effects of relational factors and channel climate on EDI usage in the customer-supplier relationship," *Journal of Management Information Systems* (22:1), 2005, pp. 321-353.
19. Subramaniam, C., and Shaw, M.J. "A study of the value and impact of B2B e-commerce: The case of web-based procurement," *International Journal of Electronic Commerce* (6:4), 2002, pp. 19-40.
20. Yu, S., Mukhopadhyay, T., and Slaughter, S. "Organizational capabilities and the assimilation of electronic procurement in service industries," *The 24th International Conference on Information Systems (ICIS2004)*, Seattle, WA, 2003, pp. 975-981.

Resource-based View of the Inter-organizational Information System Capability: A Field Study in Taiwan PC Industry

Abstract

Facing today's highly competitive market and changed business environment, whether the company has the capability to implement successful inter-organizational information systems (IOS) becomes a significant issue. To fulfill this need, this research aims to develop a framework for measuring the IOS capability. Founded by the resource-based theory and company interviews, we proposed four IOS resources: (1) physical IT assets, (2) path dependency, (3) relational intangibles (trust and complementary resources), and (4) market power, and argued that firms with these IOS resources can have higher IOS usage, which in turn creates greater IOS performance. A general survey was then conducted in Taiwan PC industry to validate our proposed framework. The results indicate that physical IT assets and relational-specific intangibles are positively related with IOS usage. On the other hand, path dependency and market power do not have significant impact on IOS usage. We further explore the relationships between the IOS usage and firm performance. The result indicates firms with more IOS usage are more likely to achieve better firm performance. These results can further be examined in a more industry-wide survey in the future. The researchers can also build upon this model to further examine the factors that are discovered.

Keyword: inter-organizational information systems, resource-based theory, IT capability, IT-enabled supply chains, business value of IT

1. INTRODUCTION

Confronting today's highly competitive global market, increasing customer power, and changing needs lead to a demand of more efficient supply chain management (SCM). Firms must link their internal activities, such as sales forecasting, product design, inventory management, together with their outside business partners, so all the parties in the supply chain can facilitate their processes, collaborate with each other, and reduce transaction costs, etc. However, to effectively integrate with supply chain partners is not an easy task. Firms need to develop a wide range of IT capabilities, such as speed, accessibility, and visibility, to acquire information among several organizations. These capabilities always center around a successful implementation of interorganizational information systems (IOS), which provide a framework for electronic cooperation between businesses by allowing the processing, sharing and communication of information (Haiwook, 2001; Williamson et al., 2004).

According to Grant (1991), a capability is the capacity for a team of resources to perform some task or activity. Based on that, we define IOS capability as a capacity for a team of resources which organizations own to develop a successful IOS. Many scholars used the resource-based view (RBV) to measure the IT capability and set up a clear link between IT resources and sustained competitive advantage (SCA) (Bharadwaj 2000; Santhanam and Hartono 2003). For instance, Bharadwaj (2000) used RBV to define a firm's IT capability as categories of IT infrastructure, human IT resources, and IT-enabled resources, presenting the linkage between firm's IT capability and financial performance. These scholars treated IT as an internal resource of the firm, and thus their defined IT capability focused only on IT resources within firms. However, an IOS not only interrelates the internal IT or IS resource, but also involves with multiple external resources and varying environment. Therefore, traditional RBV is not sufficient to derive IOS capability.

Some more current resource-based theory studies found that, facing the increasing complex and dynamic environment, the successful market players had rapid and flexible capabilities to respond the changing business environment. They defined the ability to achieve new forms of competitive

advantage as “dynamic capabilities” (Teece et al. 1997). Besides the dynamic resource-based view, some scholars extended the RBV to relational view while arguing that a firm’s critical resources may extend beyond firm boundaries, and the benefits often link to the relational network that the firm is embedded (Dyer and Singh 1998).

Derived from the relational and dynamic RBV mentioned above, IOS capability should involve the maintenance of specific IOS to link with trading partners, so as to reduce transaction and negotiation costs, improve relationships with customers, keep a long-term contracts and stable transaction volumes and so on. In comparison with IT capability, IOS capability need to consider more aspects from internal to external factors. As past IS/IT capability studies using the RBV have not typically looked at dynamic and relational resources (Wade and Hulland 2004), we think they only capture firms’ internal IT capability. Therefore, our purpose of this study is to apply different views of RBV, especially the relational and dynamic view, to develop a framework that fully captures the components that form the firm’s IOS capability.

This research investigates the IOS capability that today’s corporations have to obtain for better IOS usage and performance. The questions addressed can be summarized as follows:

1. What are the important IOS resources that firms need to obtain to improve their IOS performance?
2. How can we measure these IOS resources?

Through answering these questions, the study seeks to better explain:

1. The IOS capability framework from different views of RBV, especially including the dynamic and relation view.
2. The key resources that can lead to significant IOS usage and better IOS performance, so that managers can decide which specific constructs of IOS resources should be taken into more consideration in order to improve their current IOS or to built a better future IOS.

2. LITERATURE REVIEW

In this study, we will use the resource-based view to propose a measurement system for evaluating a firm’s IOS capability and to examine its association with firm performance. Before describing our proposed model, we introduce the basic concepts of resource-based view as follows.

2.1 The Resource-based Theory

First of all, we focus our attention on the initial RBV in the traditional strategic management field. The initial resource-based theory argued that competitive advantages of a firm resulted from specific resources and capabilities possessed by the firm (Learned et al. 1969; Porter 1981; Barney 1991; Grant 1991). Some researchers viewed capabilities as one of significant firm resources, and others distinguished the capabilities from the resources by arguing that resources were the source of the capabilities, and a capability was the capacity for a team of resources to perform some task or activity (Grant 1991). But all agreed that a firm could appraise its potential of competitive advantages by means of identifying its internal resources and capabilities and selecting a suitable strategy to reduce resource gaps (Grant 1991).

However, identifying and appraising resources and capabilities is a major handicap. One useful way is to classify them by looking for those attributes which have potential of competitive advantages. Overall, Barney (1991) and Grant (1991) classified resources as six categories: financial, physicals, human, technological resources, reputation, and organizational resources.

What we mentioned above concentrates on tangible resources. Hall (1992, 1993) argued intangible resources such as reputation should also play an important role in strategic management process,

and therefore he extended the initial RBV model to identify the intangible resources which are the feedstock to the capability differential. He classified intangible resources as assets such as patents, copyright, contracts, trade secrets, etc., or as skills/competencies such as know-how of employees, suppliers, and distributors; and culture.

2.2 The Dynamic View of Resource-based Theory

Some researchers found that the successful market players do have some capabilities that enable them to face complicated and changing environment, such as the capability of timely responsiveness, rapid and flexible product innovation, and the management capability to effectively coordinate and redeploy internal and external competences (Teece et al. 1997). In order to capture these capabilities, researchers extended the traditional RBV, which mostly focused on dealing with internal resources, to define a new set of capabilities, 'dynamic capabilities.' The focal point of dynamic capabilities is to hold the timing and then to adapt, integrate, and reconfigure internal and external resources and competences to respond the rapid technological change and changing business environment.

2.3 The Relational View of Resource-based Theory

The resource-based view (RBV) of the firm argues that differential firm performance is fundamentally due to firm heterogeneity rather than industry structure, and focus on those resources that are housed within the firm. In fact, the advantages and disadvantages of the firm often link to relationship of industry network in which the firm is embedded. So, a firm's critical resources and capabilities may extend beyond the organization boundaries, or even extend to the interfirm routines and processes (Dyer and Singh 1998).

The ownership of rent-generating resources mentioned above is collective with outside trading partners, contrasting with the RBV focusing on how individual firms generate benefits from resources within firms, and the dynamic view emphasizing on the capabilities to reconfigure resources to response environment. We must appraise relational resources and capabilities as important sources of the competitive advantages of the firm embedded in industry.

3. DEVELOPMENT OF THE IOS CAPABILITY FRAMEWORK

3.1 Research Framework

The past literature summarizes the key resources and capabilities that help firms gain sustained competitive advantages. Combined the RBV with the dynamic and relational view, we summarize twelve resources to form the IOS capability and link it to IOS usages and performance: (1)physical IT assets, (2)financial assets, (3)inter-relation specificity assets, (4)integration, (5)learning, (6)path dependency, (7)contracts, (8)interfirm knowledge sharing, (9)complementary resources, (10)policy, (11)market power, and (12) people skills. The first three address company's tangible IOS resources, the following eight are related with the intangible IOS resources, and the last one are dependent on people skills.

Three criteria have adopted to filter our variables. First, we remove the factors for which data is hard to acquire. Financial investment on IOS is thus dropped as the interviewing firms expressed the difficulty to isolate this information from the overall IT budget. Among the tangible resources, we chose physical assets as our testing variables since our pilot firms all agreed it is the most important tangible resource for IOS development and it can represent general condition on tangible resources.

Second, some variables that do not apply Taiwan PC industry are eliminated. Therefore, the reciprocal investment is dropped because component suppliers in Taiwan PC industry don't have the chance doing that because almost all of them are small and medium sized enterprises (SMEs). We also exclude IOS integration because system integration has been well recognized and justified

as an important factor for IOS implementation in those companies. Interfirm knowledge sharing is removed due to a very little practices have done in our sampling pool, although the pilot firms agree that they are a significant driver of IOS usage. Policy is dropped as well, because the data may lack variety in view that our sampling is in the same region which applies the same policy. The pilot firms also indicated that all of suppliers had training courses about using IOS and could use IOS to handle routine work in a short period time. It reveals that the human IT skill differentials are also small in these suppliers. For this reason, we exclude the people-based skills from our model.

The third reason is about questionnaire scope. Learning capabilities include various issues about knowledge management cycle. We decide to test it latter as a future extension. We chose path dependency as our testing variable considering its novelty and conceptual simplicity.

Finally, we propose a simplified research framework that includes four resources to form the IOS capability and link it to IOS usages and performance (Figure 1): (1)physical IT assets, (2)path dependency, (3)relational intangibles, and (4)market power.

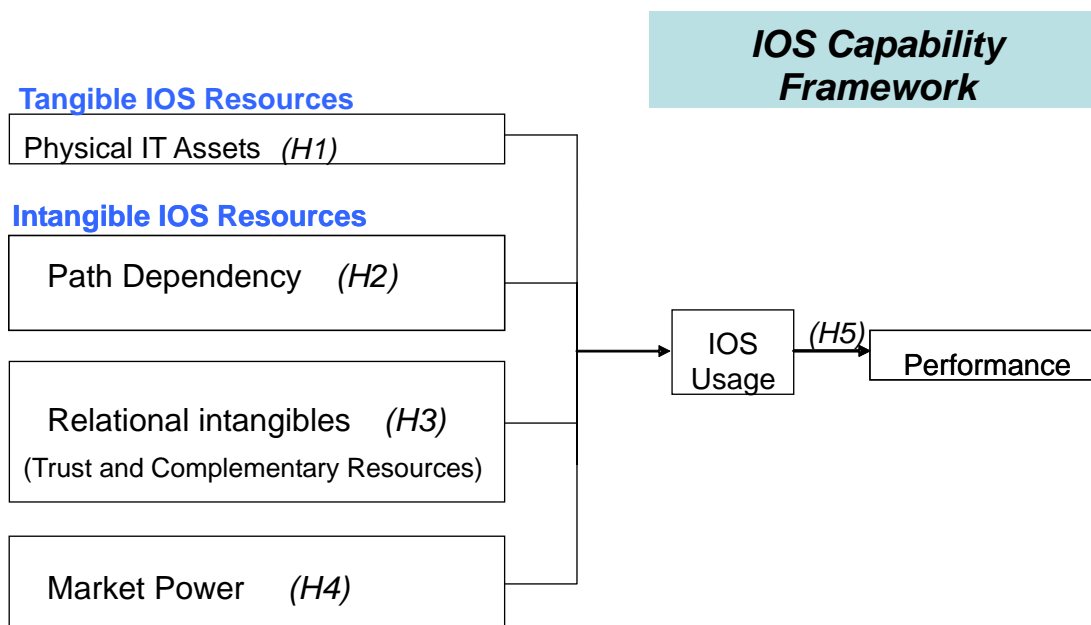


Figure 1. Research Framework

3.2 Hypothesis

3.2.1 Tangible IOS Resources

Physical resources like IT infrastructure are the basic resources of the IOS capability. Many IOS studies argue that firms with more flexible IT infrastructure are more able to develop successful IOS. For instance, Ramamurthy and Premkumar (1995) referred that IS sophistication would be positively related to EDI's internal and external diffusion, and it included hardware and software resources to support IOS systems. Recently, Zhu and Kraemer (2005) had asserted technology competence such as technology resource and IS capability as sources of e-business usage and value. Hence, we have the following hypothesis:

Hypothesis 1. Firms with more physical assets related to IOS technology are more likely to achieve a greater IOS usage.

3.2.2 Intangible IOS Resources

Three intangible IOS resources are discussed here: path dependence, relation-specific intangibles, and market power.

Path dependence. A firm's ability and incentive to adopt newer technology are largely a function of its level of related experience with period technologies (Cohen and Levinthal 1990, Zhu et al. 2006). Previous studies have found that firms with EDI experience can foster the skills for next generation IOS implementation and develop a better understanding about the economic and organizational impacts of IOS (Lyytinen and Robey 1999, Zhu et al. 2006). These firms may have a lower adoption costs because they tend to have a better understanding of true costs, and they know the difficult of process change while implementing. So we suppose path dependency about IOS technologies leads to successful IOS implementation. The following hypothesis is set forth:

Hypothesis 2. Firms with previous IOS experience are more likely to achieve a greater IOS usage.

Relation-specific intangibles. Two intangibles are discussed here: trust and complementary resources. A contract is a concrete form to create trust and cooperation relationship between IOS partners. Based on Dwyer, Schurr, and Oh (1987), trust is defined as "the belief that a party's word or promise is reliable and the party will fulfill his/her obligations in an exchange relationship". Therefore, trust is an important concept in understanding expectations for cooperation and planning in a relational contract. According to Hart and Saunders (1998), trust is an important factor of EDI use because it can mitigate the uncertainty related to these vulnerabilities coming from the increase in the volume of exchanges and diversity of transaction sets for an EDI partner. Besides trust, previous research also recognized the significance of the complementarity of technology. Dyer and Singh (1998) defined complementary resource endowments as distinctive resources of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner. Similarly, Bensaou (1997) argued that compatibility in goals and technological capabilities reduce the uncertainty about the partner's inclination and potential intentions for opportunistic behavior and therefore invite cooperation. Over and above, firms are looking for complementary partners continuously and then developing and implementing IOS with these partners because firms expect to generate more IOS usage, which cannot be generated by either firm in isolation. Eventually, Tan and Raman (2002) argued that strong complementarity, which is meant to both the firm and the partner have adequate IT sophistication and financial resources to jointly undertake the IOS implementation, has positive impact on IOS adoption. So, the following hypothesis is set forth:

Hypothesis 3. Firms with greater relational intangibles with trading partners are more likely to achieve a greater IOS usage.

Market power. Market power is another important environmental factor to impact the IOS usage. According to Hart and Saunders (1998), relative dependence in a dyadic relationship between customer and supplier is a determinant of power. Power affects EDI use because the transaction or procedures for handling data exchanges frequently required investments that an EDI partners may not want to make (Hart and Saunders 1998), and thus some large customer firms with dominant market share have often exerted their bargaining power to influence the IOS-related decision in initial stage (Son et al. 2005). Prior studies showed that power exercised by large trading partners has a positive effect on initial adoption (Chwelos et al. 2001, Iacovou 1995, Son et al. 2005) and usage (Ramamurthy et al. 1999, Son et al. 2005) of EDI in organizations. Consequently, our hypothesis here is:

Hypothesis 4. Firms with greater market power between IOS trading partners are more likely to achieve a greater IOS usage.

3.2.3 IOS Usage and Firm Performance

It has long been recognized that the high level of IOS usage can contribute the supply chain performance. For example, Bensaou and Venkatraman (1995) proposed that the greater the multiplicity of channels and the frequency of information exchanges, the greater the information processing capabilities of the dyad. Similarly, Riggins and Mukhopadhyay (1994) suggested that the great volume of business communications for which the firm uses EDI and the high degree to which the firm becomes immersed in EDI of doing business as the efficient ways to maintain partner relationship. Recently, Subramani (2004) argued that higher supply chain management systems (IOS) use leads to competitive performance of suppliers. The hypothesis is as follows:

Hypothesis 5. Firms with more IOS usage are more likely to achieve better firm performance.

The operationalization of the dependent and independent variables is shown in Table 1:

Table 1. Item Measures for IOS Capability

Independent Variables		
Items		Measures of Tangible IOS Resources (TR)
Physical Assets	TR1	Degree of technology investment in IOS (Riggins and Mukhopadhyay 1994)
	TR2	Establishment of IT infrastructure (Bensaou and Venkatraman 1995, Iskandar, Kurokawa, and LeBlanc 2001)
	TR3	Establishment of applications to support tasks (Bensaou and Venkatraman 1995)
Items		Measures of organization specific intangibles (OI)
Path Dependency	OIS	Prior use of EDI (Zhu et al. 2006)
Items		Measures of relational specific intangibles (RI)
Trust	RI1	Existed undergoing supply chain collaboration projects (Bensaou 1997)
	RI2	Establishment of clear norms for business behavior (Bensaou 1997, Dyer and Singh 1998)
	RI3	Sharing confidential or proprietary information (Angeles and Nath 2000, Dyer and Singh 1998, Soliman and Janz 2003)
	RI4	Open and frequent communications (Angeles and Nath 2000)
Complementary Resources (CR)	RI7	Similar IT infrastructure (Konsynski and McFarlan 1999, Kumar and van Dissel 1996)
	RI8	Compatible company culture (Dyer and Singh 1998)
	RI9	Similar decision processes to handle transactions (Kumar and van Dissel 1996)
	RI10	Providing similar support of cooperative firms by top management (Angeles and Nath 2000, Bensaou 1997)
Items		Measures of industry specific intangibles (II)
Market power	II3	To what extent did the target customer influence EDI adoption (Hart and Saunders 1998)
	II4	The force behind company's EDI adoption (Hart and Saunders 1998)
Dependent Variables		
Items		Measures of IOS Usage (IU)
IOS usage	IU1	Percentages of transaction by IOS links (Bensaou and Venkatraman 1995, Riggins and Mukhopadhyay 1994)

Items		Measures of Firm Performance (FP)
Firm performance	FP1	Strategic benefits (Subramani 2004)
	FP2	Operational benefits (Subramani 2004)

4. RESEARCH METHODOLOGY

In preparation for large-scale data collection, the resulting questionnaire was pilot-tested by six executives that are directly responsible of IOS to handle routine work with a focal Taiwan PC OEM during winter 2005. These executives come from the companies that are the upstream trading partners of the OEM. Our resulting questionnaire had been pilot-tested by these executives, and the MIS manager of the OEM reviewed our questionnaire for the final refining. After pilot test, we conducted a general survey in Taiwan PC industry to validate our proposed framework. Data were collected using a questionnaire instrument. We coordinated with six Taiwan PC firms, three of which have participated in our pilot-test. For each firm, a purchasing and/or engineering senior manager at the central division was first asked to select a set of suppliers under his or her responsibility. Then for each of the selected suppliers these senior managers helped identify the purchasing agent and/or engineer to whom we could send the questionnaire. The respondents were asked to answer the questions on a seven point Liker scale. The total data set constitutes a representative sample of $n = 557$. Among all returned questionnaires, 87 were found to be complete and usable; this represented a response rate of 15.619 percent.

A multi-trait/multi-method (MTMM) is used for convergent and discriminant validity of the model (Campbell and Fiske 1959, Mahmood and Soon 1991). The results of convergent and discriminant validity provide sufficient confidence to consider these items as valid measures of the constructs. After convergent and discriminant validity, the reliability of the constructs was assessed using Cronbach's alpha. The results indicate that all the constructs have reasonably good alpha values and therefore can be considered to exhibit sufficient reliability. In summary, the framework with an overall reliability of 0.825 represents good instrument validity.

5. RESULTS and DISSUCTION

5.1 Results

Multiple linear regression was used for testing the hypotheses. First, we test the impact of various capabilities on IOS usage. The results of the regression analysis are shown in Table 2. The F distribution is used to test the null hypothesis that there is no relationship between the dependent variable and predictors, and the model is significant at $p < 0.001$.

The results indicate that two factors — physical assets and relational intangibles — significantly lead to better IOS usage in organizations (p value is 0.018 and 0.024 respectively), and their standardized coefficients are 0.304 and 0.302, thereby supporting hypothesis 1 and 3. On the other hand, the significant value of path dependency and market power is 0.788 and 0.713 respectively, thereby leading to the rejection of hypothesis 2 and 4.

Table 2. Model Summary and Coefficients: The Impact of Various Capabilities on IOS Usage

Model Summary	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
	.483(a)	.233	.195	2.03232	.233	6.224	4	82	.000
Coefficients (b)									
Model	Unstandardized Coefficients		Standardized Coefficients		T	Sig.			
	B	Std. Error	Beta						
(常數)	-.977	1.195			-.818	.416			

Physical Assets	.554	.229	.304	2.419	.018
Path Dependency	-.055	.205	-.037	-.270	.788
Relational Intangibles	.622	.271	.302	2.294	.024
Market Power	-.069	.188	-.041	-.369	.713

a Predictors: (Constant), Market Power, Physical Assets, Relational Intangibles, Path Dependency

b Dependent Variable: IOS Usage

Second, we examine the relationship between IOS usage and IOS performance, and the result is shown in Table 3. The F test shows the model is significant at $p < 0.001$. The results also indicate that IOS usage significantly leads to better firm performance (the p value is less than 0.001), thereby supporting hypotheses 5.

Table 3. Model Summary and Coefficients: The Impact of IOS Usage on Performance

Model Summary	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
	.376(a)	.142	.131	1.147	.142	13.869	1	84	.000
Coefficients (b)									
Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.			
	B	Std. Error	Beta						
(常數)	4.240	.278			15.278	.000			
IOS Usage	.206	.055	.376		3.724	.000			

a Predictors: (Constant), IOS Usage

b Dependent Variable: Performance

5.2 Summary of Findings

Several findings are derived from the results and discussed below.

Finding 1

Path dependency didn't have a significant impact on IOS usage. Company's high IT staff turnover might be an intervening factor.

Path dependency was not significant in our regression model. It means that prior experience of IOS implementation is not an IOS usage differentiator for both suppliers and original equipment manufacturers (OEMs) in Taiwan PC industry. The possible reason is that, although most respondents consider previous experience in developing IOS can help implement other IOS in the future, there are still 40% of surveying companies had low level of successful experience (lower than 4 point of 7 scales). Most of them are small suppliers who don't have real implementation experience to help more advanced IOS implementation. Also, we find that the turnover of IT staff is high from the information of our interview pool. It means that important IOS experience maybe lost accompanied with fast employee turnover. However, the result may have bias. Because this survey doesn't distinguish failure implementation experience from no experience, but failure experience may improve IOS usage as well.

Finding 2

表 Y04

The impact of market power is significant at IOS adoption stage, but not at IOS post-adoption stage.

Market power is not significant in our regression model. The possible reason is that most of the suppliers in Taiwan PC industry are small and medium-sized enterprises (SMEs), and their trading and negotiation power are small contrasted with focal companies. The result shows that over 60% of our respondents considered their decision to implement IOS was impacted by the trading partners (over 5 point of 7 scales). Another test also shows that most of the companies rely heavily on their own key trading partners. Besides, although most literature mentioned that market power impacts IOS adoption at initial implementation stage, our result shows its impact is not so significant at IOS post-implementation stage. It means the influence of market power maybe decreased with the system development time. Focal companies can force the suppliers to adopt the IOS, but cannot exercise the same power to coerce the following usage. This finding is consistent with the industry observation that a buyer-biased IOS often has a high adoption rate initially, but fails with a low usage rate.

Finding 3

A well development of physical IT assets leads to better IOS usage.

Our study confirms the resource-based view that IT assets play a significant role in IOS usage. Firms that have developed better IT assets in terms of IT infrastructure, IT investment, and IT applications are more able to conduct transactions via IOS.

Finding 4

With mutual trust and complementary resources, firms are more able to have high IOS usage.

Besides physical IT assets, relational intangibles are important IOS resources as well. Our study shows that companies are more willing to use more IOS with their trading partners if there is an open and frequent communication channel in which confidential information can be stably shared. The result also points out, similar IT infrastructure in terms of the IT availability, maturity, compatibility, and reliability, compatible company culture (e.g., business mission or value), and similar decision processes to handle transactions (e.g. having similar procedures to handle order change) would support the IOS usage.

6: CONCLUSION

This thesis seeks to uncover the critical company-owning resources that can contribute to the IOS implementation and firm performance. Founded by resource-based theory, we propose four IOS resources that are most related with Taiwan PC industry environment: (1) physical assets, (2) path dependency, (3) relational intangibles, and (4) market power. To further test the model, we conduct a general survey with main Taiwanese PC firms during spring 2006. After checking the validity and reliability, we empirically validate the relationship between the IOS capabilities, IOS usage, and firm performance by a regression analysis. The result shows that path dependency and market power didn't appear an effective impact on IOS usage, but IT infrastructure and relational specific intangibles are significant resources which can positively affect IOS usage. Therefore, we can conclude that a successful inter-organizational electronic collaboration needs long-term relationship, mutual trust and resemblance between firm's process, and supportive IT assets indeed.

The factors of IOS capability and the measurement instrument developed in this study through RBV framework provide a good starting point for further investigations of the IOS capability. Validated IOS capability measures can help managers better gauge the characteristics of the collaborations. IT researchers can build upon the model developed in this study through further examination of the

factors that are discovered. The survey data utilized in this study are collected from firms in the Taiwan PC industry; further research can be conducted by the cross-industry or cross-country survey in the future to verify these results.

References

1. Barney, J. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1) 1991, pp 99-120.
2. Bharadwaj, A.S. "A resource-based perspective on information technology capability and firm performance: An empirical investigation," *MIS Quarterly* (24:1) 2000, pp 169-196.
3. Byrd, T.A., and Turner, D. E. "Measuring the Flexibility of Information Technology Infrastructure: Exploratory Analysis of a Construct," *Journal of Management Information Systems* (17:1) 2000, pp 167-208.
4. Campbell, D. T. and Fiske, D. W. "Convergent and Discriminant Validity by the Multitrait-Multimethod Matrix," *Psychological Bulletin* (50), 1959, pp 81-105.
5. Churchill, G.A. "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research* (16:1) February 1979, pp 64-73.
6. Dyer, J.H., and Singh, H. "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage," *Academy of Management Review* (23:4) 1998, pp 660-679.
7. Grant, R.M. "The Resource-Based Theory of Competitive Advantage: Implications for Strategic Formulation," *California Management Review* (33:3) 1991, pp 114-135.
8. Haiwook, C. "The effects of interorganisational information systems infrastructure on electronic cooperation: An investigation of the "move to the middle"," 2001.
9. Hall, R. "The Strategic Analysis of Intangible Resources," *Strategic Management Journal* (13:2) 1992, pp 135-144.
10. Hall, R. "A framework linking intangible resources and capabilities to sustainable competitive advantage," *Strategic Management Journal* (14:8) 1993, pp 607-618.
11. Keringer, K.N., and Kaya, E. "The construction and factor analytic validation of scales to measure attitude toward education," in: *Attitude Measurement*, Chicago: Rand McNally, 1970.
12. Kerlinger, K.N. *Foundations of Behavioral Research* New York: Holt, Rhinehart, and Winston, 1973.
13. Learned, E.P., Christensen, C. R., Andrews, K. R., and Guth, W. *Business policy* Homewood, IL: Irwin, 1969.
14. Mahmood, M.A., and Soon, S. K. "A Comprehensive Model for Measuring the Potential Impact of Information Technology on Organizational Strategic Variables," *Decision Sciences* (22:4) Sep/Oct 1991, pp 869-897.
15. Porter, M. "The contributions of industrial organization to strategic management," *Academy of Management Review* (6) 1981, pp 609-620.
16. Ramamurthy, K., and Premkumar, G. "Determinants and Outcomes of Electronic Data Interchange Diffusion," *IEEE Transactions on Engineering Management* (42:4) 1995, pp 332-351.
17. Santhanam, R., and Hartono, E. "Issues in linking information technology capability to firm performance," *MIS Quarterly* (27:1) 2003, pp 125-153.
18. Teece, D.J., Pisano, G., and Shuen, A. "Dynamic capabilities and strategic management," *Strategic Management Journal* (18:7) 1997, pp 509-533.
19. Wade, M., and Hulland, J. "Review: The resource-based view and information systems research: review, extension, and suggestions for future research," *MIS Quarterly* (28:1) 2004, pp 107-142.
20. Williamson, E.A., Harrison, D. K., and Jordan, M. "Information systems development within supply chain management," *International Journal of Information Management* (24) 2004, pp 375-385.