

5-15-2012

THE IMPACT OF INTERNAL AND EXTERNAL DIFFUSION ON PERFORMANCE IMPROVEMENT ACCORDING TO POWER IMBALANCE AND MUTUAL DEPENDENCE

GeeWoo Bock
Sungkyunkwan University

Sang Cheol Park
Georgia State University

Cheng Zhang
Sungkyunkwan University

Won Jun Lee
Sungkyunkwan University

Follow this and additional works at: <http://aisel.aisnet.org/ecis2012>

Recommended Citation

Bock, GeeWoo; Park, Sang Cheol; Zhang, Cheng; and Lee, Won Jun, "THE IMPACT OF INTERNAL AND EXTERNAL DIFFUSION ON PERFORMANCE IMPROVEMENT ACCORDING TO POWER IMBALANCE AND MUTUAL DEPENDENCE" (2012). *ECIS 2012 Proceedings*. 150.
<http://aisel.aisnet.org/ecis2012/150>

This material is brought to you by the European Conference on Information Systems (ECIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ECIS 2012 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

THE IMPACT OF INTERNAL AND EXTERNAL DIFFUSION ON PERFORMANCE IMPROVEMENT ACCORDING TO POWER IMBALANCE AND MUTUAL DEPENDENCE

Gee-Woo Bock, Sungkyunkwan University, Jongno-gu, Seoul, Republic of Korea,
gwbock@skku.edu

Sang Cheol Park, Georgia State University, Atlanta, Georgia, U.S.A, scpark@cis.gsu.edu

Cheng Zhang, Fudan University, Shanghai, PR China, zhangche@fudan.cn

Won Jun Lee, Sungkyunkwan University, Jongno-gu, Seoul, Republic of Korea,
leewj@skku.ac.kr

Youn Jung Kang, Sungkyunkwan University, Jongno-gu, Seoul, Republic of Korea,
ebiz@skku.edu

Abstract

This paper draws on the resource dependence theory to examine the relationship between internal/external diffusion and performance improvement within a supply chain. The results from a survey regarding 375 respondents show that two patterns of IOS diffusion – internal diffusion and external diffusion – have different impacts on a firm's performance improvement according to different power imbalances and mutual dependence.

Keywords: internal diffusion, external diffusion, power imbalance, mutual dependence, resource dependence theory, IOS

1 Introduction

A primary purpose of SCM is creation, maintenance, and real-time optimization of physical, informational and financial flows for an integrated and seamless supply chain of products and services across functions and organizations (Rangahathan et al., 2004). The use of IOS (Inter-organizational system) for integrating internal business operations and collaborating with external partners was the first step of IT-based SCM within many organizations. IOS can be defined as the information system that spans organizational boundaries (Gregor and Johnston, 2001). It provides an opportunity to realize efficiency by improving internal information sharing and processing as well as business processes through synchronized information exchange among supply chain partners (Johnston and Mak, 2000) in regards to planning, demand forecast, inventory level and so on.

Much of the prior work on IOS has focused on three main issues: 1) factors affecting the organizational adoption of IOS, 2) the impact of IOS on governance over economic transactions, and 3) the organizational consequences of IOS adoption (Robey et al., 2008). With regards to these three issues, two theories – TCE (Transaction cost economics) and relationship theory – have been adopted as main reference theories (Jap and Anderson, 2003; Mithas et al., 2008) to identify both transaction characteristics and relational characteristics. However, as you may notice from the above description on prior studies, diffusion of IOS considering dyadic relations between firms has largely been neglected despite its importance in IOS research in SCM.

First, the IOS diffusion requires two or more organizations to agree upon its implementation. Accordingly, it heavily depends on a counter party (Hart and Saunders, 1997). However, most prior studies did not take this dyadic situation into consideration simultaneously. Second, within this dyadic relationship, one company cannot help being influenced by the other company and vice versa according to resource dependence. However, in previous literature it is conceptualized as interdependence in the resource dependency theory, which has resulted in conflicting results as to why there are differences in IOS diffusion due to its ambiguity. Hence, we distinguish two distinct concepts in interdependence, power imbalance and mutual dependence, in this study according to Pfeffer and Salancik (2005) and plan to examine the difference between the two concepts. Finally, based on resource dependency theory and in the context of the dyadic situation, this study examines the relationship between internal diffusion and external diffusion for IOS and its impact on performance improvement. It is crucial to understand how different types of diffusion propel a firms' drive towards improving performance in a supply chain because some firms complain about adoption and diffusion of their IOS due to the influences of other firms' since they cannot achieve significant gains and vice versa.

Therefore, we attempt to examine how firms' internal and external IOS diffusion influence their performance improvements depending on power imbalance as well as the degree of mutual dependence among their supply chain partners based on the revised resource dependence theory. While several theoretical explanations such as diffusion of innovation (Zhu et al., 2006), the institutional theory (Liang et al., 2007) or the resource based view (Zhang and Dhaliwal, 2009) is applied to this area of research frequently, little research has been conducted on the IOS diffusion from the perspective of resource dependence. With this in mind, we expect to gain the understanding of the effective deployment of IOS in SCM.

2 Background: The Resource Dependence Theory

The resource dependency theory introduced the concept of interdependence with no distinction between power imbalance and mutual dependence which Emerson (1962) distinguished in the exchange theory. He presented the theory to study power in complex networks which resided

implicitly in the other's dependence. Pfeffer (1972) is saying that no distinction between these two concepts adds confusion to this area of research. Hence, we try to apply power imbalance and mutual dependence to IOS diffusion in order to examine the relationship between internal and external diffusion, and performance improvement in a supply chain from the perspective of resource dependence theory.

The resource dependence theory (RDT) has its origin in the open system theory as such organizations have varying degrees of dependence on the external environment, particularly for the resources they require to operate. Within this perspective, an organization can manage increasing dependence on the environment by adapting or avoiding external demands with the following actions: 1) altering organizational interdependence through integration, merger, and diversification, 2) establishing a collective structure to form a negotiated environment, and 3) using legal, political or social action to form a creative environment (Pfeffer and Salancik, 1978).

Much of RDT is based on Emerson (1962)'s framework that power and dependence are intimate strategies to manage the external environment and discuss the conditions under which they are appropriate. RDT has been widely applied to organizational research by providing the unified theory of power at the organizational level. The main proposition of this theory is that organizational survival hinges on the ability to procure critical resources from the external environment. A tactic is unilateral, in that it bypasses the sources of constraints by reducing the interest in valued resources, cultivating alternative sources in the supply chain or forming coalitions. Another tactic restructures dependencies by directly aiming at a constraining party in the relationship. Through corporations, for instance, a dependent organization stabilizes the flow of valued resources by socializing members of a constraining organization or through the exchange of other valuable goods such as status, friendships, or information (Emerson, 1962). Within the framework of IOS in a supply chain, IOS diffusion in firms requires two or more organizations to agree upon its implementation. Since the successful realization of IOS diffusion is complicated by the fact that two or more organizations are needed in order to agree on the adoption of the interconnected systems, it can thus be essential to understand the relationship between IOS diffusion and performance improvement according to power imbalance and mutual dependence among organizations within a supply chain.

Based on the fundamentals of resource dependences, Pfeffer and Salancik (1978) presented the concept of constraint absorption. For instance, organizations can absorb constraints completely through mergers and acquisitions (Pfeffer and Salancik, 1978). Partial constraint absorption can be achieved through formal long-term contracts such as joint ventures (Pfeffer and Leong, 1977). Constraint absorption differs significantly from other reactions against resource dependencies in that it is the only tactic that gives a dependent organization direct control over valued resources. In contrast, with other tactics like cooperation, a more powerful organization obtains another valuable resource such as a seat on the board of directors of a dependent company while continuing to maintain direct control over resources critical to the dependent organization (Pfeffer and Salancik, 1978).

Prior empirical research for RDT has discovered support for a positive relationship between an organization's dependence and its ability to absorb the constraint by another organization that imposes, despite the seeming absence of incentives for the dominant organization (Pfeffer, 1972; Pfeffer and Novak, 1976; Finkelstein, 1997). While there is an apparent difference between constraint absorption and other methods of restructuring dependence relations, RDT predicts that organizations characterized by a high degree of dependence on others are more likely to absorb the sources of their dependences (Pfeffer, 1972). Based on above argument, Casciaro and Piskorski (2005) have identified four sources of ambiguity concerning the resource dependence model and proposed a reformulation of the resource dependence theory, which addresses these ambiguities.

First, the original discussion for constraint absorption did not clearly discriminate between the two dyadic power constructs (e.g. power imbalance and mutual dependence) that emerged from Emerson's (1962) exchange theory. In original formulation of resource dependence, these two constructs were combined in the concept of interdependence. Second, resource dependence would be a normative

theory in that an organization's motivation to manage external dependencies does not necessarily coincide with its ability to do so. A key factor regarding such an ability is the extent to which the dependence to be managed is mutual or imbalanced. Mutual dependence which creates both the incentive and the ability to absorb constraints becomes increasingly successful as the mutual dependence between two organizations increases. Conversely, under power imbalance conditions, a dependent organization is likely to be more motivated but less able to absorb constraints. Thus, in contrast with the predictions advanced in the original formulation of the resource dependence theory, power imbalance should actually act as an obstacle to constraint absorption (Casciaro and Piskorski, 2005). Third, they also argued that the boundary conditions for the resource dependence theory were ambiguous. Their study specified the boundary conditions for the contrasting effects of power imbalance and mutual dependence by making distinctions among constraint absorption, other interorganizational operations aiming at restructuring dependencies, and operations aiming at using power given the dependence structure. Finally, although the resource dependence theory is dyadic, prior research on constraint absorption has largely focused on the dependence of one actor on the other without considering the reciprocal dependency.

Since the impacts of power imbalance and mutual dependence require simultaneous consideration in a single construct (Pfeffer and Salancik, 2005), Casciaro and Piskorski have mentioned both power imbalance and mutual dependence simultaneously to explain inter organizational action. Since successful realization of IOS diffusion is complicated by the fact that two or more organizations are needed to agree on the adoption of the interconnecting IOS, it is essential to understand the relationships between IOS diffusion and performance improvements depending on power imbalance and mutual dependence among organizations within a supply chain.

3 Research Model and Hypotheses

Premkumar et al. (1994) also selected four variables based on the stage model of diffusion such as adaptation, internal diffusion, external diffusion, and implementation success. We attempt to consider both internal diffusion and external diffusion as an ambidextrous IOS diffusion in a supply chain. In our study, we have defined internal diffusion as the extent to which IOS are used in key internal organizational activities in the supply chain function whereas, external diffusion refers to the extent to which a firm has integrated its supply-chain partners by using IOS to perform transactions with them. Assimilation and diffusion, taken together, represent the infusion stage in the process of innovation diffusion (Premkumar et al., 1994). With this in mind, once it has adopted and adapted a technology, a firm begins to use technology in a comprehensive and integrated manner to support organizational work and transfers of technology both inside and outside the organization.

Following the definition of Casciaro and Piskorski (2005)'s work, power imbalance in our study has been defined as the difference between a specific partner's dominance and my firm's dominance (e.g. *who dominates the relationship between a partner and your firm?*) while mutual dependence has been defined as the sum of partner dependence on my firm (e.g. *how much a partner is dependent on my firm?*) and my firm's dependence on my partner (e.g. *how much my firm is dependent on the partner?*)

3.1 Research Model

While resource dependence theory is dyadic, relevant research has largely dealt with the dependence of one actor on the other without considering the reciprocal dependency. According to Casciaro and Piskorski (2005)'s argument, although some research discussed the distinct effects of power imbalance and mutual dependence, it is possible for power imbalances to exist under different levels of mutual dependence.

The simultaneous presence of power imbalance and high mutual dependence exerts two competing forces on the relationship between actors. For instance, a firm with a higher power is reluctant to constraint absorption since doing so would eliminate its power advantage while the higher-power firm can remain dependent on its partner firm having a lower-power and then is motivated to somewhat stabilize the flow of IOS resources provided by the power-disadvantaged partner. Since the effect of power imbalance requires simultaneous consideration of dependence and its reciprocal, we, therefore, need to explain theoretically and empirically justify the effect of power imbalance under the different levels of mutual dependence simultaneously.

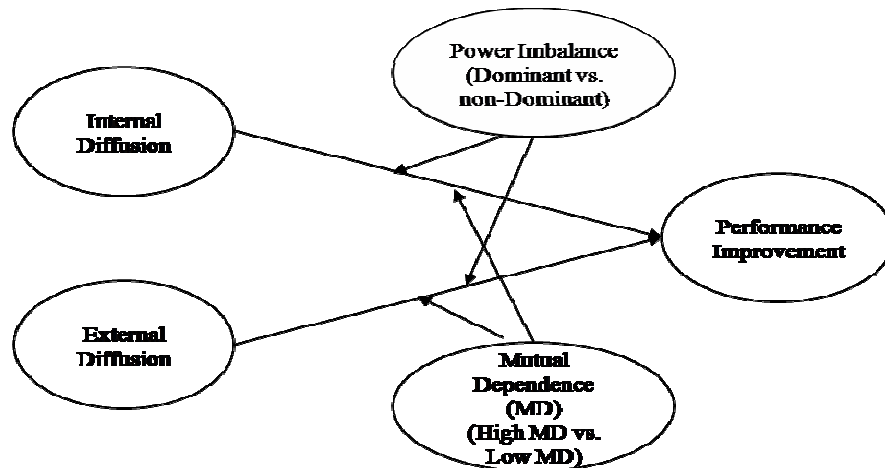


Figure 1. A Proposed Research Model

Figure 1 illustrates our proposed model, which consists of two constructs derived from the innovation diffusion theory that can explain the relationships between internal/external diffusion and performance improvement. Furthermore, based on the resource dependence theory (Casciaro and Piskorski, 2005), we present the contingent variables – power imbalance (e.g. dominant firms vs. non-dominant firms) and mutual dependence (high mutual dependence and low mutual dependence) in order to examine the relationship between the two types of diffusion for IOS and performance improvement.

3.2 Research Hypotheses

As mentioned earlier, power imbalance captures the difference between the dependencies of two actors’ while mutual dependence captures the sum of actor i’s dependence on actor j and actor j’s dependence on actor i’s. Given two possible levels of dependencies for each actor on the other, we present a 2 X 2 matrix as shown in Figure 2. Both power imbalance (dominant and non-dominant) and mutual dependence (high and low) are considered to examine the relations among internal/external IOS diffusion and performance improvement within a supply chain.

		Mutual Dependence		
		High MD	Low MD	
	Dominant	N=123	N=67	Power Imbalance
	Non-Dominant	N=104	N=81	

Figure 2. Configuration of Power Imbalance and Mutual Dependence

For instance, dominant firms typically exhibit greater resources that catalyze their ability to invest in innovations (Nohria and Gulati 1996). Furthermore, these firms may have greater inertia (i.e., willingness to maintain status quo – current market share and profits) that may inhibit their motivation to invest in innovations that can potentially disrupt their existing practices or routines (Tushman and O'Reilly 1996). Previous work on IOS adoption (e.g., Webster 1995) and relationship marketing (e.g., Jap and Ganesan 2000) has suggested that dominant partners often require non-dominant partners to make significant relation-specific investments (e.g., IOS implementation) to improve inter-organizational coordination. These studies commonly propose that standard development tends to be controlled by dominant firms that often impose their own standards on their non-dominant counterparts (Jacobs 2000). In a typical supply chain, there are power imbalances between partners for several reasons such as assets, investments, market share differences, profits, and resource & revenue dependencies (Chandy et al. 2003, Corsten and Kumar 2005, Sorescu et al. 2003). For these reasons, we expect that the types of diffusion of IOS (e.g., internal diffusion and external diffusion) in the context of the supply chain will unfold differently for dominant versus non-dominant firms. Thus, we conceptualize firm dominance, which can be explained by power imbalance, as the degree to which a focal firm is considered dominant over its trading partner in a given supply chain relationship.

On the other hand, in Emerson's exchange framework (1962), mutual dependence is the function of resource criticality and the availability of alternative providers for critical resources. Actor *i* is dependent upon actor *j* (1) in proportion to *i*'s need for resources that *j* can provide and (2) in inverse proportion to the availability of alternative actors capable of providing the same resources to *i*. Conversely, the dependence of actor *j* on actor *i* varies (1) in proportion to *j*'s need for resources that *i* can provide and (2) inversely with the availability of alternative actors capable of providing the same resources to *j*.

While RDT has largely dealt with the dependence of one actor on the other without considering the reciprocal dependence, Casciaro and Piskorski (2005) have empirically demonstrated that power imbalance could exist under different levels of mutual dependence. Therefore, power imbalance and mutual dependence need to be considered simultaneously in order to produce a theoretically exhaustive portrayal of the power and mutual dependence structure within a dyad. Therefore, we present the following hypotheses on the relationships between two types of IOS diffusions, internal and external diffusion, and performance improvement depending on power imbalance and mutual dependence:

Hypothesis 1. When a firm is in a low mutual dependence and non-dominant situation, performance improvement of the firm is more likely to be influenced by external diffusion than internal diffusion of IOS.

Hypothesis 2. When a firm is in a low mutual dependence and dominant situation, performance improvement of the firm is more likely to be influenced by internal diffusion than external diffusion of IOS.

Hypothesis 3. When a firm is in a high mutual dependence and non-dominant situation, performance improvement of the firm is more likely to be influenced by both internal diffusion and external diffusion of IOS.

Hypothesis 4. When a firm is in a high mutual dependence and dominant situation, performance improvement of the firm is more likely to be influenced by internal diffusion than external diffusion of IOS.

4 Data Analysis and Results

The survey was administered to managers in Chinese companies which have implemented IOS in their supply chain. We requested a market research firm to randomly distribute our questionnaire to IT managers or directors from a variety of Chinese companies. All survey items regarding the constructs in our model were measured on a seven-point Likert scale, which ranged from “strongly disagree” (1) to “strongly agree” (7). Our data analysis proceeded in three stages. The first stage involved a descriptive analysis of our dataset and the test of our data quality, the second stage was directed at testing the psychometric properties of our measurement scales, and the third stage focused on hypotheses testing and model analyses. Our data was analyzed using regression technique, using the SPSS 18.0 software.

4.1 Descriptive Analysis

From an initial sampling frame of 400 respondents, usable responses were obtained from 375 respondents after screening missing values (an overall response rate of 93.75%). The sample had a heterogeneous representation in terms of industry categories. The firms in the sample were fairly distributed across different industry groups in manufacturing and service-related sectors (e.g. manufacturing/engineering: 83(22.40%), computer/ IT: 45(12%), business service: 40(10.67%) among others). About two-thirds had annual revenues in excess of \$50 million (e.g. 5.1-10 million: 194 (51.73%), 10.1-50 million: 64(17.07%), 50.1 million-100 million: 76(20.27%), more than 100 million : 11(2.93%)). Since the research sought to assess the benefits of IOS deployment in SCM, data were obtained about the period in which the firm deployed it. All the firms in the final sample had already implemented IOS in SCM. Nearly half of the firms in the sample had deployed IOS less than two years before the survey was administered, and the others had deployed it much earlier. The CIO or the senior IT executive responded in most cases.

4.2 Construct validity and Reliability

Before testing construct validity and reliability, we initially evaluated the quality of each scale to determine whether measurement scales on mutual dependence, which are manipulated by both partner dependence and my firms' dependence, could be accurately explained. Note: that it was not applicable for including the power imbalance to conduct a factor analysis since it was a single item. Therefore, we conducted principle component factor analysis regarding a partner's dependence and my firm's dependence by using varimax rotation and then extracted the factors over an eigenvalue of 1. The eigenvalue criterion results in two factors; the factor loadings range from .772 to .869, which exceed the acceptable level of .50. In addition, the values of item reliability exceed the acceptable value of 0.7 (e. g. partner dependence: 0.834, my firm's dependence: 0.783), which was within the accepted range.

Having established construct validity for mutual dependence, we again employed factor analysis including all constructs. The factor loadings are from 0.864 to 0.681, which exceed the acceptable level of 0.50 (Hair et al., 1998) as shown in Table 1. We also tested the reliability of the scales using Cronbach alpha values, all of which turned out to be above 0.7, indicating the commonly accepted range (Hair et al., 1998). In particular, the mutual dependence was manipulated by the sum of partner dependence and my firm's dependence. The reason for the gap between the Cronbach's alpha regarding three of four factors and the fourth factor was based on such manipulations while this Cronbach's alpha of the fourth factor was within the acceptable range.

Constructs	Items	Factor 1	Factor 2	Factor 3	Factor 4	Cronbach alpha
Internal diffusion	ITD7	0.819	0.217	0.193	-0.076	0.945
	ITD6	0.780	0.213	0.184	0.022	
	ITD5	0.762	0.323	0.172	-0.040	
	ITD10	0.757	0.215	0.143	-0.002	
	ITD9	0.754	0.265	0.230	-0.090	
	ITD4	0.754	0.275	0.126	-0.057	
	ITD3	0.739	0.278	0.162	-0.094	
	ITD11	0.725	0.329	0.180	0.063	
	ITD2	0.713	0.284	0.193	-0.076	
	ITD1	0.681	0.323	0.253	-0.041	
Performance Improvement	OI3	0.299	0.823	0.161	-0.090	0.939
	OI2	0.304	0.822	0.185	-0.085	
	OI4	0.309	0.821	0.168	-0.005	
	OI6	0.379	0.747	0.191	0.017	
	OI5	0.375	0.746	0.264	0.010	
	OI1	0.371	0.720	0.260	-0.034	
External diffusion	EXD2	0.287	0.275	0.864	0.002	0.938
	EXD3	0.319	0.287	0.834	-0.040	
	EXD1	0.346	0.290	0.823	-0.059	
Mutual Dependence	MD2	0.039	-0.051	-0.032	0.744	0.734
	MD3	-0.028	0.010	0.021	0.719	
	MD1	-0.129	-0.040	-0.045	0.685	

Table 1. Principle component analysis and reliability

Having established construct validity and reliability, we explored the role of power imbalance and mutual dependence to determine what type of moderator it might be, as this information was necessary to determine the appropriate analysis approach (Sharma et al., 1981). We followed the moderated regression model (MRR) procedure outlined by Sharma et al. (1981), and determined that power imbalance and mutual dependence were not pure moderators or quasi-moderators, but rather act as homologizers. The approach procedure to prove this particular type of moderation is to conduct a subgroup analysis (Sharma et al., 1981).

According to Allison et al. (1992), homologizer effects occur whenever the strength, or magnitude, concerning the association between variables X and Y depends on the level of Z, where Z is the suspected homologizer/moderator variable. The key difference between this approach and that of evaluating significant multiplicative interaction terms is that multiplicative interactions only provide data bearing on the extent to which the slope of the regression line of Y on X changes as a function of Z. In contrast, significant homologizer effects indicate that the magnitude of the correlation between X and Y varies across levels of Z. It is possible to examine potential homologizer effects by categorizing the sample into two (or more) subgroups on the basis of Z (Aguinis et al., 2005). Therefore, we conducted the subgroup analysis.

4.3 Hypotheses Testing

To evaluate the hypotheses, the statistical significance of the loadings (R^2) and path coefficients were assessed. The results of the linear regression model can be seen in Table 2. The model demonstrates

very good fit ($F=223.039$, $p<0.001$) and a high R^2 value of 0.545. Moreover, the coefficients for internal diffusion and external diffusion are significant at the $P<0.01$ level. The path between internal diffusion and performance improvement ($\beta=0.530$, $p<0.01$) and the path between external diffusion and performance improvement ($\beta=0.285$, $p<0.01$) are all significant in Table 2.

Model 1	Standardized coefficients		t-value	Sig.	R^2
	Beta	Std. Error			
Internal diffusion	0.530**	0.048	12.004	0.000	0.545
External diffusion	0.285**	0.039	6.454	0.000	
Dependent variable: performance improvement					** , $p < 0.01$

Table 2. Results of regression analysis ($n=375$)

In order to test contingent effects of power imbalance and mutual dependence, we performed a subgroup analysis using the regression. To perform this analysis, we split the sample into four groups: a high mutual dependence group, a low mutual dependence group, dominant firms, and non-dominant firms. With the measurement model appearing to be stable and adequate across subgroups, we proceeded to conduct subgroup analysis using the linear regression technique. The results of the linear regression model for each subgroup are shown in Table 3.

	Results of subgroup analysis			
	H 1	H 2	H 3	H 4
Low MD & Non-Dominance (n=81)				
ITD → PRI	0.344(3.670)**			
ETD → PRI	0.452(4.826)**			
Low MD & Dominance (n=67)				
ITD → PRI		0.677(6.808)**		
ETD → PRI		0.078(0.786)**		
High MD & Non-Dominance (n=123)				
ITD → PRI			0.618(8.024)**	
ETD → PRI			0.202(2.262)**	
High MD & Dominance (n=104)				
ITD → PRI				0.447(4.958)**
ETD → PRI				0.381(4.230)**
R^2	0.470	0.515	0.584	0.585
F-value	34.605**	34.101**	84.371**	71.291**
Significance: * $p<0.05$, ** , $p<0.01$				
Legend: ITD: Internal diffusion, ETD: External diffusion, PRI : Performance Improvements				
Beta (t-value) *, $p<0.05$ **, $p<0.01$				

Table 3. Results of each subgroup analysis

5 Findings and Discussions

Our results, as shown in Table 3, reveal that the strength of the relationship between ETD and PRI ($\beta=0.452$, $p<0.01$) is significantly greater than the relationship between ITD and PRI ($\beta=0.344$,

$p < 0.01$) in the low mutual dependence and non-dominant situation, supporting H1. This implies that external diffusion (ETD) has greater influence on performance improvement when a firm is in a non-dominant and low dependent situation. Hence, the firm is more likely to be affected by ETD by other firms in the industry.

Next, in regards to the low mutual dependence and dominant situation, the relationship between ITD and PRI ($\beta = 0.677$, $p < 0.01$) is significant while the relationship between ETD and PRI is not ($\beta = 0.078$, $p = 0.435$), supporting H2. This means when a firm is in a low mutual dependence and dominant situation, performance improvement of the firm is more likely to be influenced by internal diffusion rather than external diffusion of IOS. This makes sense in the sense that a firm could improve its performance by inventing their own internal business activities rather than interacting with their business partners since it is dominant, while similar resources and partners are easily available in the industry.

In the high mutual dependence and non-dominant situation, ITD had a significant effect on PRI ($\beta = 0.618$, $p < 0.01$), as did ETD, supporting H3. This implies that a firm in a high mutual dependence situation realizes the fact that both parties can benefit from IOS diffusion regardless of dominance. However, since the firm is not in the dominant position, it puts more emphasis on innovating internal operations than external collaboration. This is why there is a big difference in beta coefficients between ITD and ETD.

Finally, in the high mutual dependence and dominant situation, ITD had a greater impact on PRI ($\beta = 0.447$, $p < 0.01$) than that of ETD on PRI ($\beta = 0.381$, $p < 0.01$), supporting H4, but to a lesser degree. It seems that a dominant firm with high mutual dependence in a supply chain tends to be in balance in terms of IOS diffusion.

Despite very intriguing findings within our study, the results should be interpreted in light of the following limitations: First, since the data was collected only from Chinese firms, we may need to consider unique inter-organizational practices in China if any exist. In order to deeply drill down the unique practices in Chinese firms, future research needs to pay more attention on carefully interpreting power imbalance and dependence by considering the characteristics of industry types in China to strengthen generalization of the results in our study. Second, there are, of course, other antecedents for internal diffusion and external diffusion, which are beyond the scope of this study. Due to the theoretical perspective and research focus in question, we only focused on the relationship between two types of IOS diffusion (e.g. internal diffusion and external diffusion) and performance improvement.

5.1 Implications for Research

First, based on the resource dependence theory and Emerson's work, we have distinguished power imbalance and mutual dependence from interdependence which has brought confusion and contrasting results into this area of research. Next, we empirically tested these two different types of dependence towards IOS diffusion research in order to test its usefulness. By displaying different impacts of internal and external diffusion on performance improvement in a supply chain, this study supports the usefulness of this distinction and fills the theoretical gap in regards to the resource dependence theory. Secondly, while previous studies have focused mainly on how an organization adopts IOS at the initial stage of diffusion, this study addresses the issues pertaining to the later phase of IOS diffusion. Lastly, previous studies on IOS diffusion did not differentiate internal diffusion and external diffusion. Instead they used the term "diffusion" to represent the multiple stages through which IT pervades organizational routines and processes. By clarifying two distinct concepts of IOS diffusion, we can gain a better understanding for the effective deployment of IOS in the organizational SCM functions

5.2 Implications for Practice

First, managers should be aware that the way to implement IOS is different under various circumstances such as power imbalance and mutual dependence. It is not always as simple as we have previously thought. For instance, a dominant firm always enforces a non-dominant firm to implement its IOS and so on. IOS implementation requires a concerted effort by all parties involved. Therefore, a dominant firm may consider providing technical and financial support to non-dominant partners while non-dominant firms need to carefully consider the relational benefits of IOS as well as regulations and competition from other competing supply chain networks. When it comes to high mutual dependence, both parties recognize mutual benefits and may accept successful technology and/or best-practices from partners in a fast-changing environment (Cui et al., 2006). Next, managers in organizations need to understand a two-pronged internal diffusion/ external diffusion strategy in dealing with IT challenges posed by IOS, since both of these types of diffusion can improve their own performance. Understanding such types can assist them in designing an appropriate diffusion strategy for success and benefit in a supply chain. Finally, establishing a linkage with a trading partner by adopting IOS is an important managerial decision. Our findings could help predict the outcome of the implementation of IOS decisions to some extent. Managers of firms in a supply chain could benefit from our findings by establishing a clear view on their firms' position in the supply chain when implementing IOS.

References

- Aguinis, H., Beaty, J.C., Boik, R.J. and Pierce, C.A. (2005). Effect size and power in assessing moderating effects of categorical variables using multiple regression: a 30-year review. *Journal of Applied Psychology*, 90(1), 94-107.
- Allison, D.B., Heshka, S., Pierson, R.N.Jr., Wang, J. and Heymsfield, S.B. (1992). The analysis and identification of homologizer/moderator variables when the moderator is continuous: an illustration with anthropometric data. *American Journal of Human Biology*, 4(6), 775-782.
- Casciaro, T. and Piskorski, M.J. (2005). Power imbalance, mutual dependence, and constraint absorption: a closer look at resource dependence theory. *Administrative Science Quarterly*, 50, 167-199.
- Chandy, R. K., Prabhu, J. P. and Antia, K. D. (2003). What will the future bring? dominance, technology expectations, and radical innovation, *Journal of Marketing*, 67(3), 1-18.
- Corsten, D. and Kumar, N. (2005). Do suppliers benefit from collaborative relationships with large retailers? An empirical investigation of efficient consumer response adoption. *Journal of Marketing* 69(3), 80-94.
- Emerson, R.M. (1962). Power-dependence relations. *Administrative Sociological Review*, 27, 31-40.
- Finkelstein, S (1997). Interindustry merger patterns and resource dependence: a replication and extension of Pfeffer (1972), *Strategic Management Journal*, 18, 787-810.
- Gregor, S. and Johnston, R.B. (2001). Theory of interorganizational systems: industry structure and processes of change, In proceedings of 34th Hawaii International Conference on Systems Sciences, Hawaii, 1-9, Hawaii.
- Hart, P. and Saunders, C. (1997). Power and trust: critical factors in the adoption and use of electronic data interchange. *Organization Science*, 8(1), 23-42.
- Johnston, R.B. and Mak, H.C. (2000). An emerging vision of internet-enabled supply chain electronic commerce. *International Journal of Electronic Commerce*, 4(4), 43-59.
- Jap, S. D. and Ganesan, S.(2000). Control mechanisms and the relationship life cycle: Implications for safeguarding specific investments and developing commitment. *Journal of Marketing Research*, 37(May), 227-245.
- Liang, H., Saraf, N., Hu, Q. And Xue, Y.(2007). Assimilation of enterprise systems: the effect of institutional pressure and the mediating role of top management. *MIS Quarterly*, 31(1), 59-87.

- Nohria, N. and Gulati, R. (1996). Is slack good or bad for innovation? *Academy of Management Journal*, 39(5), 1245–1264.
- Pfeffer, J. (1972), Merger as a response to organizational interdependence. *Administrative Science Quarterly*, 17, 218-228.
- Pfeffer, J., and R Novak (1976) Joint ventures and interorganizational interdependence. *Administrative Science Quarterly*, 21, 398-418.
- Pfeffer, J., and Leong, A. (1977), Resource allocation in united funds: examination of power and dependence. *Social Forces*, 55, 775-790.
- Pfeffer, J., and Salancik, G.R. (1978). *The external control of organizations: a resource dependence perspective*. New York: Harper and Row.
- Piskorski, M. J., and Casciaro, T. (2005) When more power makes actors worse off: turning a profit in the American economy. Working paper. Graduate School of Business, Stanford University.
- Premkumar, G. Ramamurthy, K. and Nilakanta, S. (1994). Implementation of electronic data interchange: an innovation diffusion perspective. *Journal of Management Information Systems*, 11(2), 157-186.
- Robey, D., Im, G., Wareham, J.D. (2008). Theoretical foundations of empirical research on interorganizational systems: assessing past contributions and guiding future directions, *Journal of the Association for Information Systems*, 9(9), 497-518.
- Sharma, S. Durand, R.M. and Gur-Arie, O.(1981). Identification and analysis of moderator variables. *Journal of Marketing Research*. 18(3), 291-300.
- Sorescu, A. B., Chandy, R.K. and Prabhu, J.C.(2003). Sources and financial consequences of radical innovation: insights from pharmaceuticals. *Journal of Marketing*, 67(4), 82–102.
- Tushman, M. L. and O'Reilly, C. (1996). Ambidextrous organizations: managing evolutionary and revolutionary change. *California Management Review*, 38(4), 8–30.
- Webster, J. (1995) Networks of collaboration or conflict? Electronic data interchange and power in the supply chain. *Journal of Strategic Information Systems*, 4(1), 31–42.
- Zhu, K. Kraemer, K.L. and Xu, S. (2006) The process of innovation assimilation by firms in different countries: a technology diffusion perspective on e-business. *Management Science*, 52(1), 1557-1576.