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# How IT-Enabled Supply Chain Integration Is Achieved For Supply Chain Agility: An Institutional-Political Perspective

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## **HOW IT-ENABLED SUPPLY CHAIN INTEGRATION IS ACHIEVED FOR SUPPLY CHAIN AGILITY: AN INSTITUTIONAL-POLITICAL PERSPECTIVE**

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### **Abstract**

*Although interorganizational information system can facilitate supply chain integration and supply chain agility, unintended outcomes may occur if partners possess distinct knowledge about the use of IOS. Based on Foucault's theory of power/knowledge, institutional theory and resource dependence theory, we analyze how various power relations work together to facilitate the institutionalization of IT-enabled supply chain integration. Institutional pressures are posited to increase legitimacy of IT-enabled supply chain integration, which can fix firms' disposition to use IOS for supply chain process integration. Yet, local factors still may hinder firms from doing so. We thus suggest that IT infrastructure integration for SCM can serve as a disciplinary practice for achieving this end since adopting firms tend to be self-disciplined and act according to the legitimized use of IOS. Based on a sample of 167 manufacturing firms, ten out of the eleven hypotheses receive empirical support using PLS analysis. This paper contributes to the literature by demonstrating empirically the importance of the legitimate discourse (i.e., legitimacy of IT-enabled supply chain integration) and the disciplinary practice (i.e., IT infrastructure integration for SCM) in institutionalizing an IOS-based organizing practice (i.e., supply chain process integration).*

*Keywords: IT-enabled supply chain integration, Power/knowledge, Institutional theory, Legitimacy, Disciplinary practice*

## **1 Introduction**

Agility is an important capability allowing firms to adapt or react to marketplace changes and seize market opportunities rapidly (Sambamurthy et al., 2003). For example, supply chain agility is defined as a firm-level construct capturing a firm's capability to respond or react rapidly to key supply chain measures (Swafford et al., 2006). Past research also suggests that IT-enabled business practices can facilitate agility, as digitized knowledge systems and work processes enable firms to sense and respond market changes more efficiently and quickly (Overby et al., 2006). Specifically, Rai et al. (2006) showed that IT-enabled supply chain integration (IeSCI), constituted by IT infrastructure integration for SCM (ITIIS) and supply chain process integration (SCPI), can improve firm performance. ITIIS is defined as the degree to which a focal buyer has achieved data consistency and cross-functional application systems integration in its IOS linkages with suppliers for accurate and high-velocity transfer of supply chain information within and across firms; SCPI refers to the extent to which the information flow, physical flow, and financial flow between a focal firm and its suppliers are seamlessly interconnected.

Past research, however, also points out the difficulty of diffusing and institutionalizing IT innovations (e.g., IeSCI). On the one hand, firms may interpret an IT innovation differently (Doherty et al., 2006). This may be due to lack of an organizing vision that can legitimize the innovation and engage potential adopters (Swanson and Ramiller, 2004). Hence, firms may exhibit various comprehension of or intention to adopt an IT innovation. On the other hand, IT adoption does not guarantee the reproduction of expected organizing practice (Robey and Boudreau, 1999). How an IT artefact is assimilated into work activities may be affected by how managers make sense and frame the use of it (Davidson, 2006). Managerial choice thus affects how an IT artefact actually is appropriated. Because of interpretive flexibility of an IT innovation and differentiated framing of technology by adopters, an IT-based organizing practice may be difficult to diffuse and become institutionalized across firms.

This issue is especially relevant to firms seeking to achieve supply chain integration. Typically, it is suggested that a firm should either exercise dominant power to or develop partnership with its suppliers or customers in exchange for their adoption of an IOS innovation (e.g., Hart and Saunders 1998). However, this is infeasible when partners possess more balanced power or are too small for a focal firm to develop partnerships. In this situation, the firm is incapable of influence its partners, reducing its partners' adoption of IOS innovations. Nevertheless, increasing research shows that institutional pressures also can facilitate IOS innovations (cf. Mignerat and Rivard, 2009). Coercive pressures, normative pressures, and mimetic pressures were identified as sources of such institutional effect (Powell and DiMaggio, 1983). Yet, extant studies did not explicate how institutional pressures can fix a firm's interpretation and framing of IOS innovations. Such institutional approach, therefore, is too social determinism to account for institutionalization of IOS innovations since it overlooks the role of adopting firms' agency.

In order to fill this research gap, this paper aims to study how institutional environments influence a firm and its suppliers to institutionalize IT-enabled supply chain integration, thereby, improving a firm's supply chain agility. Specifically, we apply Foucault's theory of power/knowledge (Foucault, 1980), institutional theory (Meyer and Brown, 1977), and resource dependence theory (Pfeffer and Salancik, 1978) to analyze how institutional effects, human agency, and technology affordance work together to institutionalize IeSCI. According to the Foucaudian perspective, we argue that firms tend to adopt IOS for achieving SCPI when IeSCI is regarded as an authoritative knowledge (i.e., a legitimated truth) in their institutional field. Based on institutional theory and resource dependence theory, we further identify institutional pressures that can legitimize IeSCI institutionally and strategically (Suchman, 1995; Johnson et al., 2006). However, we stress that firms still may implement IeSCI unfaithfully due to influences of local factors (e.g., power and culture). Therefore, we suggest that ITIIS serves as a new iron cage that can discipline adopting firms to implement SCPI (Gosain, 2004). As a result, the contribution of this paper is to demonstrate empirically the importance of the legitimate discourse (i.e., legitimacy of IeSCI) and the disciplinary practice (i.e., ITIIS) in institutionalizing an IOS-based organizing practice (i.e., SCPI).

## **2 Theoretical Background and Model**

IeSCI can be seen as a collective action a focal buyer and its suppliers work together to improve supply chain performance. Without interfirm collaboration, the practice cannot become a consensual negotiated order. Based on Foucault's theory of power/knowledge, we posit that such interfirm collaboration is underpinned by the regime of truth. By incorporating institutional theory and resource dependence theory, we first analyse how institutional pressures legitimize IeSCI and make it becomes a body of authoritative knowledge (i.e., a legitimate truth claim). Based on Foucault's notion of normalizing power, we then argue that, with legitimation of IeSCI, firms are equipped with the disposition to adopting IOS for achieving SCPI. However, firms may make sense and frame the use of IOS differently. Therefore, we suggest that adoption of ITIIS is important since such use of IOS allows the authoritative knowledge to exercise disciplinary power on adopting firms, thereby, facilitating their implementation of SCPI. As a consequence, we show that SCPI is actually reproduced by interactions of multiple power relations, including the social, the organization/human, and the technological.

### **2.1 Conceptualizing Institutionalization of IeSCI as Power/Knowledge**

Foucault (1980) proposed the notion of "regime of truth" and referred it as power-constituted legitimation of knowledge that supports a social institution. Within the regime of truth, knowledge affects the inhabitant's social life through their effective performing of the prescribed actions. In social life, social discourses contest with each other for being legitimate interpretations of truth. A truth claim gains the status of authoritative knowledge when it has been legitimized and accepted as true in a community.

Foucault also posited knowledge as a political technology as it regulates practice with rational techniques as a means towards an end. For authoritative knowledge to remain legitimate, it has to dominate the community members by enabling and constraining its prescribed courses of action. Otherwise, it will encounter resistance supported by alternative truth claims that are disqualified as inadequate or naive. Legitimation of a truth claim thus involves also individuals' agency in terms of their performative actions (Foucault, 1980). As a result, knowledge and power are mutually constitutive and inseparable within the regime of truth – while the legitimacy of a truth claim emerges out of power contestations among social discourses, its truth effect also depends on the power to dominate the act of the subjugated individuals.

In this study, we posit that IeSCI needs to be institutionalized in order to produce the expected benefits (i.e., supply chain agility). According to Foucault, IeSCI has to become authoritative knowledge (a legitimized truth claim) that prescribes how firms behave. Therefore, we will examine the legitimation of IeSCI first and then discuss how legitimacy of IeSCI dominates firms' courses of action.

### **2.2 Legitimation of IeSCI**

Suchman (1995) defined legitimacy as a generalized perception that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions. The definition reveals that individuals in a group collectively grant legitimacy to a practice based on extant institutional framework.

As a collective construction of social reality, legitimacy has both a cognitive dimension that constitutes the practice as valid (i.e., *validity*) and an evaluative dimension that represents the practice as right (i.e., *propriety*) for actors (Johnson et al., 2006; Zelditch, 2006). The former is associated with spread of the knowledge about a practice and the congruence of this knowledge with the institutional framework. Since the institutional framework is the coordination plane, the mechanism of validity produces what we call "institutional legitimacy." The latter pertains to individual actors' evaluation of the practice about its contribution to the culturally valued ends salient to them.

From a strategic viewpoint, Suchman (1995) indicated that legitimacy comes about through a process of construing a new practice as congruent with the institutional framework (Oliver, 1991). This process is driven by symbolic work on the part of practice entrepreneurs who produce legitimating accounts linking the practice to the institutional framework (Suddaby and Greenwood, 2005). Legitimacy thus is granted

strategically by the entrepreneurs' use of various legitimation strategies. This type of legitimacy is called "strategic legitimacy."

### **2.2.1 Institutional Theory and Institutional Legitimacy of IeSCI**

Institutional theory posits that organizational actions are influenced by rationalized myths prevailing in an institutional environment (Meyer and Brown, 1977). Rationalized myths are institutionalized rules that emerge as solutions to widely perceived problems of organizing. Such rules act to both shape and constrain how organizations behave and interpret social activities. IeSCI can be seen as a rationalized myth if it is institutionally legitimized or valid in light of the wider institutional framework in the field (Johnson et al., 2006). This situation occurs when institutional pressures for IeSCI are present.

Mimetic pressures arise when IeSCI is widely adopted by competitors and when competitors who have adopted IeSCI are perceived to be successful (Teo et al., 2003). Because the competitors are positioned structurally equivalent to a focal buyer in the economic networks, they serve as a convenient source of practices that the firm can use to economize on search costs and experimentation costs and to avoid risks of being the first movers. The buyer (and its partners) thus construes IeSCI as necessary for competition since its adoption by large competitors reifies its taken-for-grantedness in the field. Further, the success of adopting competitors provides a plausible account explaining why IeSCI is adopted widely (Kaganer et al., 2010). These competitors prove that the adoption of IeSCI makes sense by means of their success. IeSCI in turn becomes meaningful and understandable to a focal buyer and its partners and hence possesses cognitive legitimacy. Since such cognitive legitimacy is shaped institutionally, we propose the following hypothesis.

*H<sub>1</sub>: Mimetic pressures have a positive impact on institutional legitimacy of IeSCI.*

Normative pressures arise when a focal buyer's suppliers, customers and professional organizations it participates widely adopt IeSCI (Teo et al., 2003). The influence through direct or indirect ties with network members allows the buyer (and its partners) to learn about the benefits/costs of IeSCI. The buyer and its partners thus tend to make positive evaluation of IeSCI when the practice is consonant with moral norms and values prevalent in the field (Kaganer et al., 2010). IeSCI thus possesses normative legitimacy since the buyer and its partners regard it as the right thing to do (Suchman, 1995). Because normative legitimacy of IeSCI is assessed based on its propriety in relation to the normative institutional framework, it can be seen as a kind of institutional legitimacy (Zelditch, 2006). We therefore propose:

*H<sub>2</sub>: Normative pressures have a positive impact on institutional legitimacy of IeSCI.*

Coercive pressures arise when a focal buyer perceives that its suppliers and customers who have adopted IeSCI are more dominant (Teo et al., 2003). Typically, the dominant partners tend to threat or reward the firm to adopt IeSCI for increasing their own benefits (Pfeffer and Salancik, 1978). The focal buyer hence need to make self-interested calculations in order to secure the partners or prevent itself from possible punishment. Therefore, the buyer and its partners tend to conceive IeSCI as pragmatically legitimated since it involves the assessment of expected values/risks or subtle motives of pursuing shared interests and goals with its dominant partners (Kaganer et al., 2010; Suchman, 1995). Accordingly, we argue that:

*H<sub>3</sub>: Coercive pressures have a positive impact on institutional legitimacy of IeSCI.*

Foucault's theory of power/knowledge suggests that IeSCI acquires the status of authoritative knowledge when it possesses institutional legitimacy (Avgerou and McGrath, 2007). As an institutional constituent, a focal buyer is subject to the legitimate power of IeSCI. Such power is founded by authorization and endorsement in a hierarchical system of social control (Dornbusch, 1975). The former refers to support by peers or superiors of the focal firm; the latter refers to support coming from peers of the buyer's subordinated partners. In this study, IeSCI is authorized by the buyer's competitors (peers, cognitive legitimacy) as well as dominant customer adopters and supplier adopters (superiors, pragmatic legitimacy). The practice also is endorsed by the buyer's other customer adopters and supplier adopters (peers of the firm's subordinated partners, normative legitimacy). Due to such social control, the buyer expects that other institutional constituents will act in accord with IeSCI and that it will be negatively sanctioned for noncompliance (Zelditch, 2006). Therefore, it becomes a duty and is prudent for the buyer and its partners to comply with and enforce IeSCI. As a result, we suggest that:

*H<sub>4</sub>: Institutional legitimacy of IeSCI has a positive impact on IT infrastructure integration for SCM.*

*H<sub>5</sub>: Institutional legitimacy of IeSCI has a positive impact on supply chain process integration.*

## **2.2.2 Resource Dependence Theory and Strategic Legitimation of IeSCI**

In addition to environmental influence, resource dependence theory stresses a firm's active choice to act (Oliver, 1991). The theory posits that firms are inevitably dependent upon others to obtain scarce resources. Hence, they need to cope with problematic interdependencies in order to survive. They can choose from a range of strategic adaptations so as to secure a stable inflow of vital resources (Pfeffer and Salancik, 1978). As such, a focal buyer needs to manage its relationships with the more powerful suppliers and customers that have adopted IeSCI (i.e., ITIIS and SCPI). Although the buyer has variant adaptive choices for coping with coercive pressures faced, acquiescence is the most probable strategic response (Oliver, 1991). Conformance displays a symbolic meaning and signals buyer's commitment to its dominant counterparts. The action also demonstrates the buyer's fitness to do business with them (Teo et al., 2003). The buyer thus can acquire strategic legitimacy that serves as an operational resource for reducing uncertainty caused by dominant suppliers or customers (Suddaby and Greenwood, 2005). Accordingly, under coercive pressures for IeSCI, we suggest that ITIIS and SCPI serve as rituals that are ceremonially adopted by the focal buyer.

*H<sub>6</sub>: Coercive pressures have a positive impact on IT infrastructure integration for SCM.*

*H<sub>7</sub>: Coercive pressures have a positive impact on supply chain process integration.*

## **2.3 IeSCI and the expected benefits**

As a higher-order IT-enabled capability, SCPI may not be materialized if the underlying information assets of trading partners are not well integrated. This is because most activities in the information, physical, and financial flows are information processing tasks in nature. Relevant information dispersing across trading partners needs to be transferred and processed in real-time in order to integrate these flows. In distributed database systems, however, incompatible terminologies, lack of integrity constraints, and non-standardized data semantics often make the same data hosted by distinct partners inconsistent or interpreted differently. Besides, IT application systems for SCM (e.g., supply chain planning and supply chain execution) usually execute transactions or manage supply chain activities cutting across multiple functional areas between firms. They thus need to interface with numerous functional and transaction processing systems (e.g., ERP) across firms so as to retrieve, process, and update information seamlessly. With data consistency, trading partners can collect coherent supply chain information based consistent data schemes without incurring additional processing costs. By leveraging cross-functional application integration, they become easier to synchronize information processing activities and thus acquire greater supply chain visibility. We hence argue that ITIIS fulfills these requirements and can facilitate SCPI.

*H<sub>8</sub>: IT infrastructure integration for SCM has a positive impact on supply chain process integration.*

Sensing and responding have been identified as key components of agility (Overby et al., 2006). Digital options constituted by a set of IT-enabled capabilities are pivotal enablers for firms to act rapidly and flexibly (Sambamurthy et al., 2003). It is suggested that IT-enabled process coupling and knowledge exploitation/exploration capabilities provide a firm with digital options for achieving agility (Nazir and Pinsonneault, 2012). We thus argue that SCPI, represented by information, physical, and financial flow integration, offers the needed IT-enabled capabilities for a focal buyer to increase supply chain agility.

Information flow integration allows a buyer to assess its suppliers' private information (vice versa). The buyer thus can plan and control supply chain activities more easily, facilitating accurate responses to environmental changes. The buyer and its suppliers also can exploit the increased interfirm information processing capacity to coordinate business processes more efficiently. The more coordinated business processes manifest in terms of physical flow integration and financial flow integration. Physical flow integration can reduce wastes and non-value adding activities. It is achieved by rationalizing and interconnecting interfirm activities based on advanced visibility offered by more seamless information flows. Financial flow integration is achieved by streamlining financial transactions (Rai et al., 2006). A

buyer and its suppliers can rely on event-based workflow to trigger credit record inquiries, invoicing, billing and payment activities. Their financial process hence can be accelerated, facilitating fast working capital turnover and improved cash flow. Accordingly, a buyer with greater extent of SCPI should be more capable of making adjustments for responding to changing demand.

*H<sub>9</sub>: Supply chain process integration has a positive impact on supply chain agility.*

## **2.4 ITIIS as performative action**

Although institutional legitimacy is posited to influence a focal buyer's SCPI, the buyer's suppliers may resist to the initiative and thus reduce the extent of implementation (Robey and Bourdeau, 1999). Foucault's theory of power/knowledge suggests that firms tend to act reflexively in order to shape their life experiences according to authoritative knowledge (Foucault, 1980). In the institutional field, therefore, a buyer and its suppliers would problematize SCPI as carrying aesthetic values to them when IeSCI possesses institutional legitimacy. Because of its facilitating capabilities for achieving SCPI, ITIIS also would be seen as a reflexive practice for them to achieve normalization. Once the buyer and its partners engage ITIIS reflexively, the effect of informational panopticon can control while empowering them to adopt SCPI (Sia et al., 2002). In this way, ITIIS serves as a practice that permits institutional environments to exercise disciplinary power on them to institutionalize SCPI. Therefore, we propose:

*H<sub>10</sub>: Institutional legitimacy of IeSCI has a positive effect on supply chain process integration through leveraging IT infrastructure integration for SCM.*

As argued above, a focal buyer tends to adopt IeSCI under coercive pressures. Yet, suppliers may not share the same belief with the buyer who sees the practices as right (Zelditch, 2006). They thus may resist to the buyer's legitimation actions, especially the implementation of SCPI. As argued above, implementation of ITIIS permits a buyer to control while empowering its suppliers to adopt SCPI due to its effect of informational panopticon. Therefore, this study posits that ITIIS also mediate the influence of coercive pressures on SCPI.

*H<sub>11</sub>: Coercive pressures have a positive effect on supply chain process integration through leveraging IT infrastructure integration for SCM.*

## **3 Method**

### **3.1 Data Collection**

A cross-sectional mail survey was administered for collecting data from manufacturing firms in Taiwan. A draft survey was developed largely based on measures identified in the literature as suitable for the current study. After compiling the English version of the questionnaire, the survey items were first translated into Chinese by a bilingual research associated and then verified and refined for its translation accuracy by two MIS professors. Two thousand manufacturing firms randomly selected from the directory of 2009 Top 5,000 Corporations in Taiwan published by China Credit Information Services, Ltd. serves as the samples for this study. The final questionnaire was distributed to the IS and procurement managers of these firms. Totally 178 surveys were returned, with 167 having completed data available for subsequent analysis. Since there were twenty-six surveys undeliverable, the effective response rate of this study is 8.4%. Although the response rate is lower than expected, it is still acceptable and comparable to other studies in the SCM literature.

The characteristics of the responding firms are depicted in Table 1. Eighty nine, ninety three, and ninety percent of the responding firms, respectively, have assets of greater than NTD 80 million, annual sales of greater than NTD 100 million, and over 50 employees. This indicates that our samples represent medium to large companies in Taiwan. In terms of industry distribution, the computer and electronics industry category accounts for 30 percent of the responding firms. This category is greater than the proportion of the other industry categories, ranging from 5 to 18 percent of the responding firms.

	Percentage of Firms (%)
<b>Industry</b>	
Automobile	7
Chemical	18
Computer & electronics	30
Machine & tool	10
Metal	12
Textile	5
Food	5
Others	13
<b>Total Assets (NT\$)</b>	
Less than \$0.08 Billion	11
\$0.08 - \$0.5 Billion	48
\$0.5 - \$1 Billion	20
\$1 - \$5 Billion	15
\$5 - \$10 Billion	3
\$10 - \$50 Billion	2
Over \$50 Billion	1
<b>Annual Sales (NT\$)</b>	
Less than \$0.1 Billion	7
\$0.1 - \$1 Billion	57
\$1 - \$5 Billion	24
\$5 - \$10 Billion	7
\$10 - \$100 Billion	4
Over \$100 Billion	1
<b>Number of Employees</b>	
Less than or equal to 50	10
51 - 200	52
201 - 1,000	31
1,001 - 5,000	7
Over 5,000	1

Table 1: Demographics of the responding firms (n=167)

We further checked the representativeness of the samples by performing non-response bias analysis (Armstrong and Overton, 1977). The respondents were divided into two halves based on the dates of return. The comparison between these two groups in terms of industry types, total assets, annual sales and number of employees were analyzed by a series of  $\chi^2$  tests. The results showed no significant differences between these two groups, indicating that non-response bias should not be a major concern in this study.

### 3.2 Measures

**Institutional pressures.** The construct consists of coercive pressures, mimetic pressures, and normative pressures (DiMaggio and Powell, 1983). Following Teo et al. (2003), coercive pressures were operationalized as a formative construct consisting of perceived dominance of customer adopters and perceived dominance of supplier adopters. Mimetic pressures were formed by perceived success of competitor adopters and perceived extent of adoption by competitors. Normative pressures also were measured as a formative construct with three dimensions: extent of adoption among customers, extent of adoption among suppliers, and extent of firm’s participation in industry, trade, or professional bodies. Measurement items for this scale were adapted from Teo et al. (2003). Each item was measured by a five-point Likert scale anchored from 1 “strongly disagree” to 5 “strongly agree.”

**Institutional legitimacy of IT-enabled supply chain integration.** This construct was operationalized as a formative construct constituted by cognitive legitimacy, normative legitimacy, and pragmatic legitimacy (Suchman, 1995). Cognitive legitimacy measured the extent of comprehensibility and taken-for-grantedness of IeSCI; its scale was developed based on (Foreman and Whetten, 2002). Normative legitimacy measured the extent of consonance of IeSCI with the moral norms and values, and its scale was designed by referring to (Handelman and Arnold, 1999). Pragmatic legitimacy measured the extent to which IeSCI was evaluated as favorable, useful, and satisfactory; the scale for this dimension was developed based on (Handelman and Arnold, 1999; Foreman and Whetten, 2002). All items were rated on a five-point Likert scale anchored from 1 “strongly disagree” to 5 “strongly agree.”

**ITIIS.** This construct was operationalized as a formative construct formed by two dimensions: data consistency and cross-function application integration (Rai et al., 2006). Data consistency was measured

using three items and cross-function application integration was measured with four items. These items were all on a five-point Likert scale anchored from 1 “strongly disagree” to 5 “strongly agree.”

SCPI. This construct was operationalized as a formative construct with three dimensions: physical flow integration, financial flow integration and information flow integration (Rai et al., 2006). The measures for physical flow integration and information flow integration were primarily based on Rai et al., (2006). We developed a more complex pattern of financial flow integration since extant measures only focus on event-based integration of account receivable and payables. We additionally measured whether or not capital control, financing, accounting, invoicing, and payment are streamlined seamlessly. Thus, there were totally seventeen items for this scale. Item were rated on a five-point Likert scale anchored from 1 “strongly disagree” to 5 “strongly agree.”

Supply chain agility. Supply chain agility was operationalized as a firm level construct capturing a firm’s capability to react rapidly to key supply chain measures (Swafford et al., 2006). Twelve supply chain processes were identified to measure the extent to which a firm can make adjustment rapidly, such as manufacturing lead time, product development cycle time, new product introduction, etc. The items were rated on a five-point scale anchored from 1 “very slow” to 5 “very quick.”

## **4 Results**

This study performed structural equation modeling to validate both the measurement and structural model. A partial least square technique was utilized since it is appropriate for modeling latent constructs with small- to medium-size samples (Chin, 1998). SmartPLS 2.0 (M3) Beta was adopted as the tool for relevant analysis (Ringle et al., 2005).

### **4.1 Common Method Bias**

We adopted a single-informant approach to collect data, and, therefore, the possibility of common method bias should be assessed (Podsakoff et al., 2003). Harman’s single factor test was employed to examine whether a significant amount of common variance exists in the data. All the measurement items were cast into principal components factor analysis. The result yielded twelve factors with eigenvalues greater than 1.0, which accounted for 73.6% of the total variance. The first factor captured only 29.3% of the variance in the data. These results indicated the absence of a substantial amount of common method variance in the data. Therefore, common method bias should not be a serious problem in the study.

### **4.2 Measurement Model**

Item reliability, convergent validity, and discriminant validity serve to evaluate measurement properties in PLS. Individual item reliability can be examined by observing the item-to-construct loadings, and a factor loading of .71 and above indicates 50 percent or more of the variance in the item is shared with the latent construct. Based on the above criteria, we purified the measurement model and dropped some items due to the smaller factor loadings. We also found that the factor loadings of some items were less than .71. But, they were nevertheless kept for subsequent analyses due to maintaining content validity.

Convergent validity can be assessed in terms of reliability of construct (Cronbach’s alpha) and average variance extracted (AVE) by constructs (Fornell and Larcker, 1981). The former measurement property is interpreted as acceptable with a score of .70 or above. AVE reflects the variance captured by indicators, and a score of .50 or above is desirable, meaning that the variance captured by indicators is greater than the measurement errors. In this study, the results of both Cronbach’s alpha and AVE test met the criteria of convergent validity with values no less than .82 and .61, respectively.

Discriminant validity can be assessed by observing the factor loading of indicators to verify whether the measures of constructs are different from each other. Discriminant validity is assured when (1) each item’s correlation with its own construct is greater than its cross-correlation with other constructs, (2) the value of the square root of the AVE of each construct is larger than the correlations of this construct with all other constructs, and (3) correlation between pairs of constructs is below .90 (Gefen and Straub, 2005). Our analyses showed that the above criteria for discriminant validity hold.

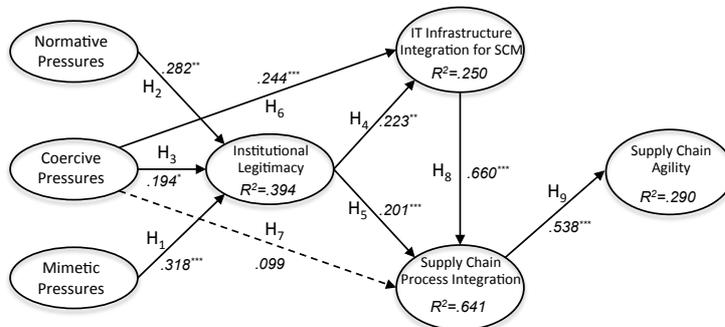
### 4.3 Structural Model

In our PLS structural model, all the research constructs were modeled as formative factors, with either measurement items or factor scores of the dimensions set as indicators. This study adopted a bootstrap procedure with 200 resamples to generate t-statistics and standard errors of path coefficient estimates. Path coefficients are interpreted as standardized beta weights in a regression analysis, and their values and the extent of significance can be utilized to assess whether research hypotheses gain empirical support. Figure 1 shows the path coefficients and explained construct variances of our PLS structural analysis.

As shown in Figure 1, the *R-square* values of institutional legitimacy of IeSCI, ITIIS, SCPI and supplier chain agility range from .25 to .64. The results indicate that the variances of the endogenous variables are well explained by the proposed antecedents. In addition, eight of the nine hypotheses positing a direct effect gain support from the PLS structural analysis. Except that coercive pressures do not have a significant effect on SCPI (H<sub>7</sub>, parameter estimate=.099, p>.1), all the other hypotheses receive significant empirical support (H<sub>1</sub> to H<sub>6</sub> and H<sub>8</sub>, H<sub>9</sub>).

We further performed mediation analysis to test H<sub>10</sub> and H<sub>11</sub> (Baron and Kenny, 1986). We first compared two sets of research models (fully mediated models) against their competing, partially mediated models (incorporating additional direct paths between institutional legitimacy and SCPI as well as coercive pressures and SCPI). We then evaluated the increased explanatory power of newly introduced paths by (1) calculating the *f*<sup>2</sup> statistic in terms of  $(R^2_{\text{partial mediation}} - R^2_{\text{full mediation}}) / (1 - R^2_{\text{partial mediation}})$ , and (2) computing a pseudo *F*-statistic (Chin et al., 2003). The results showed that the added explanatory power of the path from institutional legitimacy to SCPI is significant ( $f^2 = .095$ ,  $F_{1, 159} = 15.01$ ) while the path from coercive power to SCPI is not ( $f^2 = .011$ ,  $F_{1, 159} = 1.738$ ).

We then assessed the two sets of mediation effect by examining the magnitude and the significance level of the effect. The magnitude of the effect is computed as the product of the standardized path coefficients of the mediated path. The standard error of the mediated path is computed using the formula – square root of  $p_1^2 s_2^2 + p_2^2 s_1^2 + s_1^2 s_2^2$ , where *p* represents the path coefficient and *s* represents the standard deviation. Based on the two statistics, the yielded *z*-statistics (2.021 and 2.230, respectively) indicated that the two examined mediation effects are significant at *p* < 0.05. Consequently, the overall mediation analysis suggested that H<sub>10</sub> and H<sub>11</sub> were supported.



Note : \*, \*\*, \*\*\* indicates significant at *p* <0.1, *p* <0.05, *p* <0.01 (two-tailed test)

Figure 1. PLS Result

## 5 Discussion

First, we argue that the knowledge of IeSCI can be rationalized by institutional influences. This is supported by our results that institutional legitimacy of IeSCI is significantly affected by mimetic pressures, normative pressures and coercive pressures (H<sub>1</sub> to H<sub>3</sub>). Further, we posit that firms possessing authoritative knowledge would act in accordance with its prescription, reflecting the effects of the legitimated discourse on institutionalization of IeSCI. This is also evidenced by the significant influence of institutional legitimacy of IeSCI on ITIIS and SCPI (H<sub>4</sub> and H<sub>5</sub>).

Second, we argue that implementation of SCPI can be hindered by interfirm conflict since a focal buyer and its suppliers may possess distinct interests. We thus suggest that ITIIS serve the dual roles of a technology of empowerment and a technology of power for a buyer to implement the work practice together with its suppliers. The former role is formulated in terms of H<sub>8</sub>, which manifests the influence of technical agency in facilitating work practices and receives empirical support. The latter role is reflected in H<sub>10</sub>, and our mediation analysis confirmed that ITIIS indeed allows a focal buyer to exercise power over its suppliers in terms of implementing SCPI.

Third, implementation of IeSCI can also be construed as a focal buyer's strategic legitimation action that aims to manage its coercive pressures. We thus propose H<sub>6</sub> and H<sub>7</sub> to reflect such proposition, in which only the former receives empirical support. The insignificance of H<sub>7</sub> echoed our postulation that SCPI may suffer from resistance of suppliers. A focal buyer thus needs a technology of power for enforcement, which is reflected in H<sub>11</sub>. The finding that ITIIS fully mediates the effect of coercive pressures on supply chain integration, again, corroborates our viewpoint that IT serves the dual roles of control and empowerment.

Last, our analysis showed that SCPI has a strong positive effect on supply chain agility (H<sub>9</sub>). This finding is consistent with previous work examining the effect of IT-enabled practices on agility.

## **6. Conclusions**

This study draws on multiple theories (theory of power/knowledge, institutional theory, and resource dependence theory) to formulate a model of institutionalization of IeSCI and validate the posited effects of various power relations empirically. The research findings largely supported the hypotheses of our study.

Our paper contributes to the literature in twofold. First, we found that IeSCI can be legitimized by institutional pressures institutionally or strategically. Second, potential supplier resistance may decrease a buyer's extent of SCPI even though it is legitimate for the buyer to do so. Since ITIIS allows a buyer to facilitate and control its supplier to implement SCPI, the buyer tends to leverage the practice to achieve SCPI. These findings showed that IeSCI is actually a sociomaterial practice, constituted by the influences of social power as well as technological agency. Our findings inform practice entrepreneurs that shaping favorable institutional pressures for IeSCI and promoting the disciplinary/facilitating benefits of ITIIS are helpful to legitimize IeSCI and hence produce the anticipated benefits.

This study has several limitations. First, the generalization of our findings should be cautious since the samples of this study are primarily medium to large firms. Second, the response rate of our survey is relatively low (8.4%). Although we have shown that nonresponse error should not be a problem, the representativeness of our sample still is reduced. Third, this study has included firm size and IT capability as control variables (not illustrated due to space limitation). But, there are still other exogenous variables that need to be considered in the future research, such as social capital or group cohesiveness.

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