DOES POWER MATTER IN IMPLEMENTING IOS INTEGRATION? THE “TRANSALATION” AND THE OBLIGATORY PASSAGE POINT PERSPECTIVE

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Abstract

IOS integration (IOSI) is becoming a competitive necessity in an industrial environment that emphasizes competition between supply chains. In the supply chain, dominant firms often try to exert their power to influence their dependent firms to implement IOSI. Misunderstanding about how power operates will impede firms for developing IOSI. Based on the circuits of power framework and the concept of obligatory passage point (OPP), this study identifies three factors that should mediate the effect of power on the implementation of IOSI, including competitive necessity, expected benefits, and firm readiness. We accordingly develop a theoretical model with nine hypotheses. Based on a sample of 135 manufacturing firms, seven out of the nine hypotheses receive empirical support using PLS. The findings show that the flows of exercised power and potential power into IOSI indeed circulate through those mediators. The theoretical and practical implications of the results contribute a better understanding of how power operates in developing IOSI.

Keywords: IOS integration, circuits of power, translation, obligatory passage point, and actor network theory.
1 INTRODUCTION

Over past decades, inter-organizational system (IOS) implementation has attracted significant attention from both academics and practitioners because they believe using IOS can create value for firms (Narayanan et al., 2009). Recently, firms endeavor to establish deeper interconnections with the systems of their trading partners to achieve seamless sharing of information and interconnection of applications in order to gain further benefits from IOS (Rai et al., 2006; Saraf et al., 2007). This form of tightly coupled partnership is referred to as IOS integration (IOSI) (Grover & Saeed, 2007). However, the benefits from IOSI can be distributed unfairly in favor of firms with greater power in the supply chain (Subramani, 2004). More powerful firms are likely to gain greater benefits of IOSI at the expense of their dependent firms (Clemons et al., 1993), which often are forced to implement IOSI. If management misunderstands how power operates between the parties, IOSI may fail due to ineffective use of power. Thus, research on how to facilitate IOSI by power is significant in enhancing our understanding of promoting IOSI.

To clarify how power operates, we draw on the circuit of power framework (Clegg, 1989). According to the framework, to exert power successfully in a dyadic relationship, the dominant firm has to establish an obligatory passage point (OPP) for the dependent firm. The OPP is the result of “translation” after which the dependent firm has no other choice but to accept the OPP (Callon, 1986). Three major moments are within a translation: problematization, interressement, and enrolment. These moments, as mediating mechanisms, can translate the dependent firm from adopting IOS minimally into deeper IOS integration. The dominant firm, therefore, can exercise its power to influence or potentially to control the translation, thus driving the dependent firm to integrate more tightly with the dominant firm through IOS.

Accordingly, this paper seeks to understand: (1) What mechanisms are inherent in the influencing process of dominant firms’ power on dependent firms’ IOSI implementation? (2) How and why do these mechanisms mediate the effect of exercised and potential power on IOSI? We thus propose a theoretical model tested by data collected from the manufacturing companies in Taiwan and focuses on the channel relationships in the supply chain.

2 BACKGROUND LITERATURE

2.1 IOS integration

IOS integration reflects tighter linkages between trading partners’ information systems (IS) (Grover & Saeed, 2007). In this study, IOSI incorporates the concepts of database interconnection, application integration, and data syntactic and semantic integration (Saraf et al., 2007). We define IOSI as the extent to which a focal firm’s IS are tightly linked with its dominant partner’s IS as a unified whole to facilitate bidirectional information accessing and sharing (Grover & Saeed, 2007; Saraf et al., 2007).

Grover and Saeed (2007) argue that IOSI is established to support bilateral governance that requires trading partners’ joint accomplishment and mutual concern for the long-term benefit (Heide, 1994). To support such governance, the more stringent initiation process is needed. IOSI, thus, requires the partners have certain attitudes or values (Heide, 1994), mutual trust to align processes, map data elements, and invest in shared resources (Grover & Saeed, 2007), implying that directly using power to force IOSI may produce frustrating results.

1 In this paper, we term the firm with more power as the dominant firm (or powerful firm) and the firm with less power as the focal firm (powerless firm, or dependent firm). We use those terms interchangeably.
2.2 Power and IOS

According to social exchange theory (Emerson, 1976), power refers to the capability of a firm to exert influence on another firm to act on a prescribed manner (Hart & Saunders, 1997). This capability may or may not be exercised by powerful firms. Researchers distinguish between potential power and exercised power to clarify their effects (Gaski & Nevin, 1985). Potential power is that a powerful firm has the capability but does not use it to control the powerless firm. Potential power has been widely found in IOS research as dependence or interdependence. In this study, we define potential power as synonymous with dependence. Exercised power is that a powerful firm has the actual act of control in an attempt to influence the behaviors of the powerless firm. Although such two types of power are considered critical in influencing IOS implementation, prior studies neglect to deliberate the nuances of power flows and operations, resulting in mixed results (see Table 1) and thus leading us to re-explore the effect of power with a more integrated framework.

<table>
<thead>
<tr>
<th>Study</th>
<th>DV</th>
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<tr>
<td>Adoption/Intention</td>
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<td></td>
<td>External integration</td>
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<td></td>
<td>IOS (EDI)</td>
<td>Exercised Power</td>
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<td>Grover (1993)</td>
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<td>Hausman &amp; Stock (2003)</td>
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<td>Zhang and Dhaliwal (2009)</td>
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</table>

Table 1. Prior empirical studies on IOS implementation adopted power concepts

Note: S: Significant results; M: Mixed results; N: Non-significant results.

D: Direct effects; I: Indirect effects; Ne: Negative effects.

3 RESEARCH FRAMEWORK

3.1 The framework of power

Clegg (1989) proposed the circuits of power framework that represents the relational nature of power (see Figure 1). In the framework, power is a force like electricity, circulating through episodic circuit, social circuit, system circuit, and obligatory passage points (OPPs). Empirically, power may be contained within the episodic circuit or it may flow through the dispositional and facilitative routines. In this study, we focus on the episodic circuit and the OPPs to develop our theoretical model. These two concepts help us articulate power operations and enhance our understanding of the differential effects of exercised and potential power on promoting IOSI.
3.2 Research framework

Power, in the episodic circuit, emphasizes actions and changes. Episodic power is derived from the capacities of firms grounded in resource control from the perspective of resource dependence theory (RDT) (Clegg, 1989), called potential power in this study. Resources, under an appropriate standing condition as a dyadic relationship in the supply chain, can empower a firm vis-à-vis a specific scope of another firm when utilized through means that implement them (Clegg, 1989), emerging exercised power. Episodic power involves securing outcomes and securing or reproducing rules of meaning and membership. That means a dominant firm exerting its exercised and potential powers to the focal firm’s decision on IOS adoption is the outcome in the episodic circuit only. Most prior studies have corroborated this circuit (see Table 1). For further integration, the dominant firm needs to transform the focal firm’s rules that govern how it interprets the meaning of IOS; those rules may facilitate or restrict it to produce certain attitudes, common values, and common working practices on IOSI (Grover & Saeed, 2007; Heide, 1994). IOSI, as generating new techniques of discipline and production, opens up new conduits that can undermine extant entrenched rules and structures (Clegg, 1989), routines, and technology configurations (Rodon & Sese, 2010). During IOS implementation, those extant rules and structures require to be changed and realized through “translation” pushed by exercised and potential power.

The “translation” is proposed by Callon (1986). Clegg draws on this work, particularly the OPPs, to complement the episodic circuit. In an established power relation, or called a standing condition, a dominant firm seeks methods to do “translate” its dependent firm into an OPP. The OPP is the result of “translation” after which the dependent firm has no other choice but to accept the OPP as created by the dominant firm and to become a part of network. The dominant firm seeks to constitute interests and structures. “Translation” refers to the methods by which these outcomes are accomplished. There are four “moments” of translation: problematization, interessement, enrolment and mobilization (Callon, 1986). Through the former three moments, a dominant firm attempts to translate the values, beliefs, and activities of its dependent firm. The final moment, mobilization, can be considered as the final outcome of translation, reflecting the dependent firm has become a part of network. A dominant
firm can use its power to control the translation and to reshape the dependent firm’s rules and structures through the former three moments and to reach the final moment, a high level of IOSI, as the outcome of OPP. Therefore, the former three moments of translation are mechanisms that mediate the effects of power on IOSI, as depicted in Figure 2.

Figure 2. Research framework

The critical part of this study is that our theoretical foundations, particularly “translation,” are a process model. Each moment of translation involves various events, which are what key actors do or what happens to them (Van de Ven, 2007). Our purpose, however, is to identify the mediators between power and IOSI rather than to elaborate each event, actor, and action during implementing IOSI. Thus, we attempt to develop a variance model by drawing on key concepts of each moment, integrating these concepts, and mapping the concepts to relevant outcomes in the context of IOSI. The outcomes of each moment can be a mediator between exercised and potential power and IOSI. In what follows, we develop our research model.

4 MODEL DEVELOPMENT

4.1 Problematization

Problematization involves the attempt by powerful firms to enroll powerless firms to become their agency by positing the indispensability of their “solutions” for the powerless firms’ problems (Callon, 1986). During problematization, a powerful firm frames problems in its own terms, identifies powerless firms, and highlights how the problems affects them and blocks their own road to interests (Callon, 1986). Consequently, the outcome of problematization is that the powerless firms recognize the solutions as indispensable and behind the solutions a series of problems are being reflected.

4.1.1 Problematization mapping to IOS context

In the IOS context, the outcomes of problematization are a focal firm recognizing IOSI to be competitive necessity and an indispensable solution for gaining economic benefits. Competitive pressures can promote two firms to link each other through IOS (Teo et al., 2003). Such external pressures reflect that the focal firm’s road to benefits could be blocked by the problems of losing competitive advantages and the relationship with the dominant firm. We identify industrial competitive pressure, peer competitive pressure, and relationship maintenance (Chwelos et al., 2001; Iacovou et al., 1995; Ke et al., 2009) as the pressures behind the focal firm’s recognition of the competitive necessity of IOSI. Industrial competitive pressure refers to the degree of pressure that a focal firm experiences from its competitors who have already integrated information systems (IS) with their trading partners (Zhu & Kraemer, 2005). Peer competitive pressure refers to the degree of pressure that a focal firm feels from other peer suppliers who have already integrated IS with the
dominant firm (Teo et al., 2003). Finally, relationship maintenance reflects the extent of pressure that a focal firm feels that establishing IOSI with the dominant firm is important for maintaining the relationship. We consequently model the competitive necessity of IOSI as a superordinate construct of the three pressures (Polites et al., 2012).

4.1.2 Power and competitive necessity of IOS integration

Exercised power refers to the dominant firm exerting its influence strategy, coercive and persuasive power, on the focal firm to establish IOSI with it in support of transactions and operations (Hart & Saunders, 1998). Exercised power can channel the focal firm into problematization and reshape its interpretations of whether IOSI is necessary (Clegg, 1989). By persuasively informing the focal firm the information about competitors and peer suppliers’ IOSI implementation and coercively threatening the possibility of relationship dissolution (Frazier et al., 2009), the dominant firm can shift or bring pressures to the focal firm. These pressures reflect the dominant firm’s influences on the focal firm’s sense and decision on whether IOSI is necessary (Ke et al., 2009). Prior studies also support that a dominant firm’s exercised power increases its dependent firm’s perceived pressures (Iacovou et al., 1995; Ke et al., 2009), and thus we propose the following hypothesis.

Hypothesis 1: Exercised power by a dominant firm is positively associated with the competitive necessity of IOS integration perceived by its dependent firm.

On the other hand, we do not expect potential power has the same effect as exercised power on competitive necessity. Potential power refers to the ability of a dominant firm to get the focal firm to undertake an activity that it would not normally do (Son et al., 2005). Potential power is a function of (1) the proportion of the focal firm’s need for resources or services that the dominant firm can provide, and (2) the inverse proportion to the availability of alternative firms capable of providing the same resources or services. This study holds that these functions are unable to coerce, bring, or shift pressures on the focal firm directly.

4.2 Interessement

Interessement refers to the process of “interesting” focal firms to dominant firms’ agency. Interessement is the group of actions by which dominant firms attempt to impose and stabilize the identities of the focal firms into interesting on dominant firms’ solutions (Callon, 1986). To interest a dependent, focal firm, the dominant firm can build “devices” placed between the focal firm and all other invisible entities who want to define the focal firm’s identities; the dominant firm needs to cut or weaken all the links between the focal firm and the other entities (Callon, 1986). Therefore, the outcomes of interessement reflect the focal firm’s expected benefits from being enrolled by the dominant firm.

4.2.1 Interessement mapping to IOS context

During interessement, the dominant firm interests the focal firm and builds up their identity on which IOSI can benefit both parties. The dominant firm can build such incentive mechanisms as increasing purchasing volume to attract the focal firm (Premkumar & Ramamurthy, 1995) for consolidating their identities. By the mechanisms, the dominant firm cuts or weakens the invisible entities that may cause the focal firm to refuse IOSI, such as risks and costs. Consequently, we identify that the outcomes of interessement are the benefits of IOSI that the focal firm expects to obtain from implementing IOSI with its dominant partner.

4.2.2 Power and expected benefits of IOS integration

A dominant firm can exercise its power to impose and stabilize the focal firm’s identity by persuading the focal firm that values can be co-created for both parties through IOSI (Subramani, 2004) and the created values can be shared between them. On the other hand, exercising power to place incentive
mechanisms is another effective approach to translate the powerless firm’s attitudes and values of IOSI toward positive ones (Premkumar & Ramamurthy, 1995). We emphasize that exercised power can reshape the focal firm’s structured interpretations of IOSI and force it to go through interressement, resulting in more positive attitudes toward IOSI.

**Hypothesis 2a: Power exercised by a dominant firm is positively associated with the expected benefits of IOSI integration perceived by its dependent firm.**

The potential power of the dominant firm can enhance the focal firm’s expected benefits of IOSI, since it controls important resources that can stimulate the focal firm to maintain the relationship in order to reduce the uncertainty of accessing the resources (Casciaro & Piskorski, 2005), providing strong incentive for the focal firm to ensure that the relationship prospers over time (Lusch & Brown, 1996). As relationship-specific investment, integrating with the dominant firm through IOSI is a good means for the focal firm to consolidate the relationship and secure future access to the resources. Consequently, the focal firm is less likely to deny those potential benefits that can be obtained by IOSI. Those benefits meanwhile can offset the potential costs and risks of IOSI, similar to the invisible approaches suggested by Callon (1986).

**Hypothesis 2b: Potential power of a dominant firm is positively associated with the expected benefits of IOSI integration perceived by its dependent firm.**

**4.2.3 Competitive necessity and expected benefits of IOSI integration**

Recognizing the competitive necessity of IOSI, reflecting the perception of various pressures, lead the focal firm to expect that IOSI can bring benefits for it, as evidenced by the successful cases of IOSI by its competitors and peer suppliers (Zhu, Kraemer, Gurbaxani, et al., 2006). Such effect is similar to network effects (Katz & Shapiro, 1985). Prior studies (Yao et al., 2007) also demonstrate that sociopolitical influences, such as pressures of other firms, affect the perception of the benefits that can be derived from the use of IOS.

**Hypothesis 4: A dependent firm’s perceived competitive necessity of IOSI integration is positively associated with its expected benefits from IOSI integration.**

In fact, former two moments emphasize on changing the focal firm’s attitudes and perceived values of IOSI. Next two moments are to influence the focal firms actually being enrolled into IOSI.

**4.3 Enrolment**

Enrolment is the process through which powerful firms seek to construct alliances and coalitions with powerless firms (Callon, 1986). During enrolment, powerless firms accept the roles of the alliances and coalitions defined for them, wherein powerful firms are trying to convince powerless firms to play the roles. Thus, enrolment involves multilateral negotiations (Callon, 1986), wherein powerful firms are ready to make any kinds of concessions in order to lure and consolidate the powerless firms into their trap (Callon, 1986). If powerless firms are enrolled, they must be willing to involve in the network of powerful firms. Consequently, the results of enrolment should reflect that the powerless firms willingly engage in the activities of the alliances and coalitions.

**4.3.1 Enrolment mapping to IOSI context**

It should be appropriate to consider dependent firms’ firm readiness for IOSI the outcomes of enrolment, as Callon (1986) describes that enrolment is more certain when an actor is willing to engage in a network. We define firm readiness for IOSI as the extent to which a focal firm is willing and ready to implement IOSI (Barua et al., 2004; Chwelos et al., 2001). Top manager support, financial resources, process alignment, and technology alignment characterize firm readiness for IOSI (Chwelos et al., 2001; Iacovou et al., 1995; Robey et al., 2008). Top management support is defined as the extent to which a focal firm’s top management provides necessary resources, attitude, and
involvement in assisting IOSI with the dominant firm (Wang et al., 2006). Financial resources is defined as the extent to which a focal firm invests financial resources in IOSI as a proportion of total firm resources (Chwelos et al., 2001; Zhu et al., 2004). These two construct reflect that a powerless firm is willing to reallocate its resources and engage in implementing IOS. Process alignment refers to the extent to which a focal firm coordinates interfirm activities and optimizes operations with its dominant firm (Rai & Tang, 2010). Technology alignment refers to the degree to which a focal firm coordinates technology configurations of its information systems with the dominant firm. Technology configurations include data elements, application interfaces, and network protocols (Giachetti, 2004). These two kinds of alignments reflect that the powerless firm is willing to make certain actions to engage in IOSI with its powerful firm. Consequently, we model firm readiness for IOS integration as a second order construct with the four dimensions discussed above.

4.3.2 Power and firm readiness for IOS integration

Exercised power can force the focal firm to engage in the activities required for IOSI implementation. IOSI is likely to demand changes in cooperating firms’ extant routines, technology configurations, and tangible and intangible resources (Grover & Saeed, 2007; Rodon & Sese, 2010). However, changing these extant practices and reallocating resources is difficult (Rodon & Sese, 2010). Most firms tend to maintain the enduring sediments of previous practices (Clegg, 1989; Rodon & Sese, 2010). Thus, exercised power would be useful, and sometimes necessary, in forcing the focal firm to change extant practices and resource allocations through coercion or persuasion. Also, a powerful firm may also provide resources to incentivize the focal firm to enter into readiness for IOSI (Kumar & van Dissel, 1996; Riggins & Mukhopadhyay, 1994).

Hypothesis 3a: Power exercised by the dominant firm is positively associated with the readiness for IOS integration of its dependent firm.

Potential power can motivate the focal firm to invest resources in initial activities for IOSI. As the main premise of RDT (Pfeffer & Salancik, 2003), firms seek to reduce uncertainty and manage dependence by purposely structuring their exchange relationships (Heide, 1994), such as making transaction-specific investments and enhancing the status in the relationship (Ganesan, 1994). Firm readiness, all aspects involving mutual investments in changing extant practices, stabilizes the relationship between the dyad and enhances the focal firm’s status within the relationship. Moreover, according to the power framework, if the focal firm wants certain resources from the dominant firm, it would have to do certain things and adopt certain practices (Clegg, 1989), such as those activities necessary for achieving IOSI.

Hypothesis 3a: Potential power of the dominant firm is positively associated with the readiness for IOS integration of its dependent firm.

4.3.3 The effects of competitive necessity and expected benefits on firm readiness for IOS integration

The focal firm is likely to engage in initial activities for implementing IOSI when recognizing the competitive necessity of IOSI. Competition drives the focal firm to maintain a competitive edge or to survive at least (Zhu, Kraemer, & Xu, 2006). Competitive necessity of IOSI reflects the focal firm recognizes the problems from the pressures discussed above. The pressures lure the focal firm to change its extant practices in order to be ready for IOSI. Moreover, recognizing competitive necessity of IOSI implies that the focal firm has changed its attitudes and perceived values toward favoring IOSI during problematization. Changed attitudes and values are likely to facilitate actual behaviors.

Hypothesis 5a: A dependent firm’s perceived competitive necessity of IOS integration is positively associated with its firm readiness for IOS integration.

With respect to expected benefits, as the term suggested, they will not be realized unless the focal firm has actually enrolled into the network of IOSI (Callon, 1986). Expected benefits thus also provide
certain incentives for the focal firm to change extant practices that are enduring sediments in the focal firm (Clegg, 1989; Rodon & Sese, 2010).

Hypothesis 5b: A dependent firm’s expected benefits of IOS integration are positively associated with its firm readiness for IOS integration.

4.4 Mobilization

Mobilization refers to the set of methods that powerful firms use to ensure that the representations of interest that powerless firms make are in fact themselves fixed (Callon, 1986; Clegg, 1989). Callon argues that this term emphasizes a definite physical reality is materialized and stabilized through all the necessary displacements accomplished (Callon, 1986; Law, 1986). Therefore, the network results in a single actor, which can be treated as a black-box (Latour, 1987).

4.4.1 Mobilization mapping to IOS context

In the IOS context, this study holds that the outcomes of mobilization reflects the extent of IOSI achieved when all the necessary displacements have been accomplished such as aligning processes, mapping data elements, and investing in shared resources (Grover & Saeed, 2007; Ramamurthy et al., 1999). High levels of IOSI also represent a stable and a tighter coupling alliance and coalition between two firms for a durable time (Grover & Saeed, 2007).

4.4.2 Firm readiness and IOS integration

Firm readiness have been demonstrated to be critical in facilitating IOS usage (Chwelos et al., 2001; Zhu, Kraemer, & Xu, 2006). To achieve a high level of IOSI, firms inevitably face a variety of difficulties caused by the obstacles of top management, lack of financial support, and divergent processes and technologies resided in the individual firms (Chwelos et al., 2001; Rodon & Sese, 2010; Zhu, Kraemer, & Xu, 2006). Resolving those difficulties means that the focal firm is likely to take certain actions in order to be enrolled in IOSI. When all the different facets of readiness are materialized and stabilized, the focal firm should be more likely to be included in the network of IOS and achieve a higher level of IOSI with the dominant firm.

Hypothesis 6: Firm readiness for IOS is positively associated with IOS integration.

4.5 Control variables

First, we control for the effects of internal integration on IOSI. Internal consistencies of configurations and procedures are likely to enable IOSI with external trading partners (Zhao et al., 2011). Second, we control for the effects of organizational and transactional characteristics on IOSI. Firm size is included because larger firms should have greater resources, capabilities, and intention to deploy IOSI (Grover & Saeed, 2007). High frequency of sales with the dominant firm is likely to influence the desire of implementing IOSI (Grover & Saeed, 2007). Further, the length of association may lead dyadic firms to establish IOSI.

5 RESEARCH METHODOLOGY

5.1 Questionnaire design

We operationalized the constructs using multi-item reflective measures with a seven-point scale. Questionnaire was designed for suppliers (focal firms) in channel relationships (Hart & Saunders, 1998). The recipient was asked to select an important customer that has connected its IS with the recipient’s systems. Any types of systems and any levels of connection are acceptable because, based on innovation diffusion theory (Rogers, 1995), IOSI is at the stage of assimilation and most trading partners should already adopt IOS to perform at least some simple data exchange. This approach
should make the survey more suitable for our research purpose (Wu & Chuang, 2010). All constructs are carefully operationalized based on our theoretical definitions, and the items are mainly adopted or adapted from the relevant literature. The questionnaire is available upon the request from the corresponding author.

5.2 Sampling and data collection

A cross-sectional mail survey was administrated for collecting data from selected large and medium-sized manufacturing firms in Taiwan. We selected Top 2000 manufacturing firms from the Year 2012 directory of the Top 5000 Largest Firms in Taiwan, published by China Credit Information Services Ltd. We ruled out the firms with inadequate data, resulting in 1971 manufacturing firms. We distributed our survey to the IS executives of these firms because the IS function plays a critical role in implementing and managing IS and its senior managers should have a good understand of the past history and current status of their IOS.

After one follow-up mailing, 196 surveys were returned in total, with 18 undelivered and invalid mailing, yielding a response rate of 10.04%. Of the responses, 47 came from the firms never use any IOS with their key customers were then dropped. Due to missing values, the sample size was reduced to 134 for subsequent analysis. Table 2 exhibits the characteristics of the sample.

### DATA ANALYSIS AND RESULTS

PLS was conducted for validating measures and testing hypotheses. We used SmartPLS 2.0 M3 (Ringle et al., 2005) to estimate the parameters in the outer and inner models with a path weighting scheme (Hair et al., 2012). We used bootstrapping with 2,000 replications and construct level changes to obtain the estimates (Wetzels et al., 2009). We constructed the second-order constructs following the guidelines suggested by Wetzels et al. (2009).

#### Table 2. Profile of the respondents (N=134)

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<tr>
<td>1,001-2,000</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>&gt;2,000</td>
<td>18</td>
<td>13</td>
</tr>
</tbody>
</table>

6.1 Measurement validation

The mean and standard deviation of each construct are reported in Table 4. The CRs are above 0.9 for all constructs and the AVEs for each construct exceed 0.6 (Hair et al., 2012), indicating convergent validity of first-order constructs. Discriminant validity is established when the square root of the AVE for each construct is larger than the inter-construct correlations as shown in Table 3 (Hair et al., 2012). We note that the cross-loadings of all the individual items are less than their construct-specific loadings, supporting the discriminant validity of the first-order constructs. Table 4 gives the CRs and
AVEs of the second-order constructs, showing all the CRs are greater than 0.9 and the AVEs greater than 0.6. The loadings of the first-order constructs on the second-order constructs exceed 0.85, except for financial resources underlying firm readiness. All loadings are significant at \( p < 0.01 \) level.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Mean</th>
<th>Std.</th>
<th>CR.</th>
<th>AVE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IOS integration</td>
<td>11</td>
<td>3.46</td>
<td>1.68</td>
<td>0.95</td>
<td>0.63</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Exercised power</td>
<td>3</td>
<td>3.75</td>
<td>1.87</td>
<td>0.96</td>
<td>0.89</td>
<td>0.63</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Potential power</td>
<td>6</td>
<td>4.71</td>
<td>1.50</td>
<td>0.96</td>
<td>0.81</td>
<td>0.15</td>
<td>0.32</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Industrial competitive pressure</td>
<td>5</td>
<td>4.49</td>
<td>1.39</td>
<td>0.95</td>
<td>0.80</td>
<td>0.63</td>
<td>0.59</td>
<td>0.26</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Peer competitive pressure</td>
<td>4</td>
<td>4.02</td>
<td>1.43</td>
<td>0.97</td>
<td>0.89</td>
<td>0.44</td>
<td>0.47</td>
<td>0.22</td>
<td>0.66</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td>6. Relationship maintenance</td>
<td>3</td>
<td>4.50</td>
<td>1.51</td>
<td>0.96</td>
<td>0.89</td>
<td>0.55</td>
<td>0.61</td>
<td>0.33</td>
<td>0.72</td>
<td>0.63</td>
<td>0.94</td>
</tr>
<tr>
<td>7. Expected benefits</td>
<td>8</td>
<td>4.88</td>
<td>1.15</td>
<td>0.95</td>
<td>0.69</td>
<td>0.43</td>
<td>0.41</td>
<td>0.36</td>
<td>0.57</td>
<td>0.41</td>
<td>0.54</td>
</tr>
<tr>
<td>8. Process alignment</td>
<td>4</td>
<td>4.16</td>
<td>1.50</td>
<td>0.96</td>
<td>0.87</td>
<td>0.69</td>
<td>0.56</td>
<td>0.31</td>
<td>0.64</td>
<td>0.53</td>
<td>0.65</td>
</tr>
<tr>
<td>9. Technology alignment</td>
<td>3</td>
<td>3.75</td>
<td>1.70</td>
<td>0.98</td>
<td>0.94</td>
<td>0.69</td>
<td>0.63</td>
<td>0.15</td>
<td>0.65</td>
<td>0.54</td>
<td>0.61</td>
</tr>
<tr>
<td>10. Financial resources</td>
<td>2</td>
<td>4.40</td>
<td>1.46</td>
<td>0.83</td>
<td>0.71</td>
<td>0.42</td>
<td>0.33</td>
<td>0.04</td>
<td>0.50</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>11. Top management support</td>
<td>5</td>
<td>4.62</td>
<td>1.36</td>
<td>0.96</td>
<td>0.82</td>
<td>0.60</td>
<td>0.43</td>
<td>0.28</td>
<td>0.57</td>
<td>0.46</td>
<td>0.60</td>
</tr>
<tr>
<td>12. Internal integration</td>
<td>8</td>
<td>5.41</td>
<td>1.12</td>
<td>0.96</td>
<td>0.73</td>
<td>0.33</td>
<td>0.13</td>
<td>0.17</td>
<td>0.22</td>
<td>0.16</td>
<td>0.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Mean</th>
<th>Std.</th>
<th>CR.</th>
<th>AVE</th>
<th>Correlations of among constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Expected benefits</td>
<td>83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Process alignment</td>
<td>51</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Technology alignment</td>
<td>52</td>
<td>76</td>
<td>97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Financial resources</td>
<td>35</td>
<td>59</td>
<td>48</td>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Top management support</td>
<td>58</td>
<td>71</td>
<td>73</td>
<td>46</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>12. Internal integration</td>
<td>38</td>
<td>36</td>
<td>32</td>
<td>33</td>
<td>43</td>
<td>85</td>
</tr>
</tbody>
</table>

Table 3. Inter-construct correlations and reliability measures for first-order constructs (N=134)

Note: Square roots of average variance extracted are shown on the diagonal.

<table>
<thead>
<tr>
<th>Construct</th>
<th>CR.</th>
<th>AVE</th>
<th>First-order constructs</th>
<th>Loadings</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive necessity of IOS integration</td>
<td>0.96</td>
<td>0.67</td>
<td>Industrial competitive pressure</td>
<td>0.91</td>
<td>84.7%</td>
</tr>
<tr>
<td>Peer competitive pressure</td>
<td>0.86</td>
<td>74.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship pressure</td>
<td>0.87</td>
<td>74.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm readiness for IOS integration</td>
<td>0.96</td>
<td>0.61</td>
<td>Top management support</td>
<td>0.91</td>
<td>81.7%</td>
</tr>
<tr>
<td>Financial resources</td>
<td>0.62</td>
<td>42.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process alignment</td>
<td>0.92</td>
<td>83.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology alignment</td>
<td>0.89</td>
<td>79.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Second-order constructs and its association with first-order constructs

6.2 Safeguards against and assessment of common methods variance (CMV)

Harmon’s single-factor test was used to assess common method bias (Podsakoff et al., 2003). Since the first factor accounts for just 40.7% the variance, CMV should not be a major concern of the study. However, we nevertheless incorporated the measured latent marker variable (MLMV) approach in our survey (Chin et al., 2012). We adopted the items for measuring “trying new features” in Microsoft Office (Sun, 2012) and then conducted the construct level correction (CLC) approach to partial out the CMV effects at the structural model in our data analysis (Chin et al., 2012).
6.3 Structural model

The results of testing the structural model are reported in Figure 3. The full model has an $R^2$ of 54.9 for IOS integration. That all the $Q^2$ values are larger than zero indicates predictive relevance. Figure 3 shows that only the path from exercised power to expected benefits (H2a) and the path from potential power to firm readiness (H3b) fails to be significant at the 0.05 level. All control variables are not significant.

Note: We hidden the MLMV constructs and control variables in order to simplify the figure. All coefficients have been ruled out CMV effects by CLC approach.

* $p<0.05$; ** $p<0.01$

**Figure 3. Research model with path coefficients, $t$ value, $R^2$, and $Q^2**

6.4 Testing indirect effects

We followed the guidelines suggested by Zhao et al. (2010) for justifying full or partial mediation and conducted the mediation regression method with percentile bootstrap approach for examining the significance of indirect paths (Hayes et al., 2011; Zhao et al., 2010). Such method is more powerful than Sobel test (1982) on Type I error rates (MacKinnon et al., 2002; MacKinnon et al., 2004) because the assumption of a normally distributed sampling distribution for the indirect effect is not easily justified (Hayes et al., 2011; MacKinnon et al., 2004), particularly in small samples (Bollen & Stine, 1990), resulting in higher possibility of bias. We then adopted the simple mediation model (Preacher & Hayes, 2004). Because these approaches are regression based, we used PLS algorithm to obtain unstandardized latent scores of the research constructs as inputs (Bradley et al., 2012) for performing the mediation regression method with second-order exact solution and 5,000 resampling on SPSS macros provided by Preacher and Hayes (2004). Based on these procedures, all indirect paths can be tested reliably and validly.

Table 5 shows the results of the simple mediation models. As suggested by Zhao et al. (2010), we first examined the significance of indirect effects. The results indicate that all indirect effects are significant at $p<0.01$ level since zero is excluded in the 99% confidence interval (see Table 5). We then examined the significance of direct effect from independent variable to dependent variable with the mediator controlled in order to justify full or partial mediation (see column $c'$ in Table 5). Consequently, three of the five mediated paths are full mediation and the rest are partial mediation with all positive indirect effects.

**Table 5. Significance of single-mediator paths**
<table>
<thead>
<tr>
<th>Row</th>
<th>Graphical representation</th>
<th>$c$</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$c'$</th>
<th>$\alpha\beta$</th>
<th>Sobel $Z$</th>
<th>Symmetric 95% CI</th>
<th>Bootstrap 95% CI</th>
<th>Bootstrap 99% CI</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>0.81 (0.00)</td>
<td>0.75 (0.00)</td>
<td>0.74 (0.00)</td>
<td>0.26 (0.026)</td>
<td>0.55</td>
<td>5.79</td>
<td>0.36, 0.74</td>
<td>0.37, 0.76</td>
<td>0.31, 0.83</td>
<td>Partial mediation</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.62 (0.00)</td>
<td>0.68 (0.00)</td>
<td>0.92 (0.00)</td>
<td>-0.00 (0.000)</td>
<td>0.62</td>
<td>6.27</td>
<td>0.43, 0.82</td>
<td>0.40, 0.88</td>
<td>0.35, 0.97</td>
<td>Full mediation</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0.42 (0.00)</td>
<td>0.43 (0.00)</td>
<td>0.60 (0.00)</td>
<td>0.16 (0.002)</td>
<td>0.26</td>
<td>6.00</td>
<td>0.18, 0.35</td>
<td>0.18, 0.35</td>
<td>0.16, 0.38</td>
<td>Partial mediation</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0.25 (0.00)</td>
<td>0.43 (0.00)</td>
<td>0.47 (0.00)</td>
<td>0.04 (0.045)</td>
<td>0.20</td>
<td>4.84</td>
<td>0.12, 0.29</td>
<td>0.11, 0.32</td>
<td>0.09, 0.36</td>
<td>Full mediation</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>0.23 (0.002)</td>
<td>0.27 (0.000)</td>
<td>0.65 (0.000)</td>
<td>0.05 (0.012)</td>
<td>0.17</td>
<td>3.70</td>
<td>0.08, 0.26</td>
<td>0.08, 0.28</td>
<td>0.04, 0.32</td>
<td>Full mediation</td>
</tr>
</tbody>
</table>

Note: $c$ = the total effect of independent variable on dependent variable; $\alpha$ = the effect of independent variable on mediating variable; $\beta$ = the effect of mediating variable on dependent variable when controlled independent variable; $c'$ = the effect of independent variable on dependent variable when controlled mediating variable; p values shown in parenthesis

7 CONCLUSIONS

Our results provide three insights to the IOS literature. First, exercised power and potential power produce different paths of influence on IOSI. While exercised power is able to influence a dependent firm’s perceived competitive necessity and firm readiness, potential power only affects its expected benefits. Second, exercised power can promote IOSI through three potential indirect paths: (1) only through firm readiness; (2) through two mediators – competitive necessity and firm readiness; (3) through three mediators – competitive necessity, expected benefits, and firm readiness. Third, if a dominant firm expects its potential power to enable IOSI with its dependent firm, expected benefits and firm readiness of the dependent firm tend to be higher due to the mediating effects of the two factors in the interessement and enrollment stages. These results highlight that the frequently posited contributions of power effect on IOS usage might not be so obvious and direct, and thereby require further investigation.

This study advances our understanding of the effect of exercised and potential power and the role of the mediating mechanisms derived from the theory in achieving IOSI. Most of the studies in this domain treat power and IOS usage as direct association rather than scrutinize how power operates and identify the potential mediators between power and IOS usage, resulting in mixed results of the effect of power. We develop a model to elaborate the effect of power on IOSI based on the concept of translation, which includes the moments of problematization, interessement, enrollment, and finally to mobilization. Accordingly, we have identified and empirically demonstrated that competitive necessity, expected benefits, and firm readiness are critical in mediating the effects of exercised and potential power on IOSI. This study thus contributes to the cumulated stream of research on IOS adoption and usage.
REFERENCES


communication research: Methods, measures, and analytical techniques (pp. 434-465). New York: Routledge.


