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THE INFLUENCE OF DEPENDENCE STRUCTURE AND RELATIONAL VALUE ON THE ADOPTION INTERNET-ENABLED SUPPLY CHAIN MANAGEMENT SYSTEMS

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Abstract:

Based on resource dependency theory, this study investigates how the two dimensions of dependence – dependence asymmetry and mutual dependence – affect the adoption of internet-enabled supply chain management systems (eSCM). Drawing from the relational view of the firm, we argue that there are two types of relational value that can be provided by eSCM: relationship extendedness and relational depth. Dependence structure will influence firms' incentive to obtain relationship extendedness and relational depth, which will in turn affect eSCM adoption. We collected data from mainland China using an online questionnaire and 212 valid samples were received. The emergent results show positive influence of dependence structure on relationship extendedness and relational depth. Positive effects of dependence structure and relationship relational depth on eSCM adoption are also found. However, the finding suggests a significant negative effect of relationship extendedness on eSCM, which is contradictory to the hypothesis. Future research is needed to interpret the counterintuitive finding.

Keywords: supply chain management systems, dependence asymmetry, mutual dependence, relational value

1. Introduction

The recent advance of the internet and web technologies has introduced companies more powerful inter-organizational information systems (IOS) to integrate supply chain processes and facilitate interfirm collaboration (Rai et al., 2006, Liu et al., 2010, Venkatesh and Bala, 2012). Among them, internet-enabled supply chain management systems (eSCM) have become increasingly popular to enable successful supply chain management (Ke et al., 2009). With eSCM, supply chain partner can exchange rich content information and integrate business processes, leading to positive synergistic effects in the supply chain (Ke et al., 2009, Chang and Shaw, 2009). Despite eSCM's purported benefits, the economic, technical, and socio-political risks associated with eSCM have greatly impeded its broader deployment (Liu et al., 2010), necessitating a better understanding of the factors affecting eSCM adoption.

Past studies have employed socio-political theories extensively to study the relationship between power and IOS adoption (Ke et al., 2009). However, the findings on the influence of power are inconsistent. While there are a number of studies indicating significant positive influence of power to facilitate IOS adoption (Chan et al., 2012, Chong and Ooi, 2008, Liu et al., 2010), other studies find insignificant relationships between power and IOS adoption (Chwelos et al., 2001, Chong et al., 2009, Huang et al., 2008). The perplexing inconsistencies in the results could be attributable to the failure to make explicit distinction between mutual

dependence and dependence asymmetry. Although dependence is a dyadic concept, most studies have focused on the dependence of one actor on the other without taking into account of the reciprocal dependence from another side of a relationship. It is argued that, in such way, these studies essentially capture the effect of mutual dependence but not the intended dependence asymmetry (Casciaro and Piskorski, 2005).

This study aims to fill the research gap by investigating how the two dimensions of dependence – dependence asymmetry and mutual dependence – affect the relational value provided by eSCM, and, in turn, affect eSCM adoption.

2. Theoretical background and hypothesis development

2.1. Resource dependency theory

It is a central proposition of Resource Dependency Theory (RDT) that the organizations survival is determined by the ability to procure scarce resources from the external environment (Pfeffer and Salancik, 1978). Due to the scarcity of resources, the market environment is highly uncertain. To reduce the uncertainty associated with the flow of critical resources, organizations will adopt a variety of strategies to reduce their dependence on other actors for resources, or, where possible, to influence the environment to increase the availability of resources. Therefore, the dependence of organizations on critical resources can influence organizational actions and behaviours. The differences in the strategies can be traced back to the differences in the dependency structures that organizations are embedded in (Hillman et al., 2009). RDT is suggested to be a general approach that has considerable explanatory power for a wide spectrum of organizational behaviours. Thus we can employ RDT as an appropriate theoretical lens to investigate organizational intentions and behaviors towards IOS adoption.

The seminal work of Emerson (1962), which lays the foundation for RDT to study power and dependence, defines dependence as a function of resource criticality and the availability of alternative resources. Emerson (1962) emphasizes the dyadic nature of dependence, which leads to two distinct concepts of dependence: mutual dependence and dependence asymmetry. (Casciaro and Piskorski, 2005). Mutual dependence refers to the level of bilateral dependence between two actors, which can be measured as the sum (or the average) of the dependence of the two actors on each other. Dependence asymmetry, on the other hand, captures the difference between the powers of the two actors. To comprehensively delineate dependence structure in dyadic relationships, it is imperative to consider both concepts at the same time (Gulati and Sytch, 2007, Casciaro and Piskorski, 2005).

2.2. Relational view of the firm

Extending beyond the resource-based view which asserts that competitive advantage originates from the resources housed within a single firm, the relational view of the firm contends that a firm's critical resources may span beyond organizational boundaries and may be embedded in inter-organizational processes and routines (Dyer and Singh, 1998). According to Dyer and Singh (1998), there are four types of relational rents that can be generated from interfirm relationships: 1) relationship specific assets; 2) knowledge exchange and joint learning; 3) complementary capabilities; and 4) effective governance mechanisms. IOS can provide a platform to combine these advantages and to yield *relational value* (Bensaou and Venkatraman, 1996). We focus on two types of relational value that may be derived from implementing eSCM: *relationship extendedness* which refers to the ability to sustain or extend critical relationships (Rokkan et al., 2003, Bala and Venkatesh, 2007), and *relational depth* which refers to enhanced collaboration from process alignment and

integration (Rai et al., 2006, Bala and Venkatesh, 2007).

2.3. Hypothesis development

It is suggested that the structural patterns of interdependence can influence firms' relationship specific motives. In asymmetric dependence structure where a firm is highly dependent on its partners, the firm may generate a high degree of commitment to the relationship, leading to long-term orientation (Gulati and Sytch, 2007). In addition, the weaker party may want to enhance collaboration with the important partners because of the desire to ensure the continuing access to the critical resources (Ganesan, 1994). Therefore, we propose the following hypotheses:

H1: There is a positive relationship between dependence asymmetry and a firm's expectation for relationship extendedness.

H2: There is a positive relationship between dependence asymmetry and a firm's expectation for relational depth.

In asymmetric relationships, the powerful firm can exert influence on its partners to adopt operational strategies or practices that are favorable to powerful party (DiMaggio and Powell, 1983). In regards to eSCM adoption, the powerful party can reap the benefits provided by eSCM from the weaker partners. As a result, the distribution of benefits from eSCM may be uneven that is advantageous for the powerful firm. Therefore, the powerful firm may favor eSCM as a supply chain strategy, and exercise its power to push the weaker partners to adopt eSCM. To secure market position and the access to scarce resources, the dependent partners have to comply with the requirements raised by the powerful party and adopt eSCM. Thus we propose that:

H3: There is a positive relationship between dependence asymmetry and eSCM adoption intention.

When buyers and suppliers are bilaterally dependent, the success of the relationships matters for both parties (Buchanan, 1992). Because both parties have contributed great efforts and investments to develop their relationship (Anderson and Weitz, 1989), they can be expected to sustain long-term relationship (Vijayasarathy, 2010). In addition, both parties have vested interests in the interdependent relationship, which can foster the motives to increase relationship depth bilaterally for joint payoffs (Lusch and Brown, 1996a). Therefore, mutually dependent partners would be prone to increase their relationship depth and facilitate collaboration (Dwyer et al., 1987), which can in turn encourage the adoption of eSCM as the facilitators of interfirm collaboration. Thus we posit that:

H4: There is a positive relationship between mutual dependence and a firm's expectation for relationship extendedness.

H5: There is a positive relationship between mutual dependence and a firm's expectation for relational depth.

H6: There is a positive relationship between mutual dependence and eSCM adoption intention.

Improving relational depth requires the ability to process real-time information (Jap and Ganesan, 2000), which can be resolved by the co-adoption of eSCM among supply chain parties. The benefits of solving the mismatch of information processing capabilities across different trading partners will motivate companies adopt eSCM (Magretta, 2002). In addition,

as a relationship-specific investment, eSCM can act as a form of relationship commitment for companies if they want to extend the existing relationship. Especially when the dominant partners have implemented eSCM, the weaker supply chain members will be encouraged to adopt the same IOS in order to sustain the relationship (Jap and Ganesan, 2000). Thus we propose the following hypotheses:

H7: The higher a firm's expectation for relational depth, the greater is its intention to adopt eSCM.

H8: The higher a firm's expectation for relationship extendedness, the greater is its intention to adopt eSCM.

To summarize, the conceptual model is depicted in Figure 1.

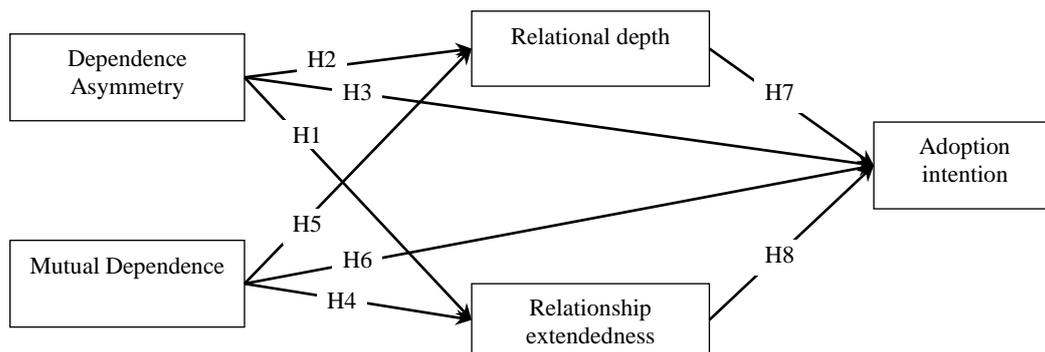


Figure 1: Conceptual model

3. Methodology

3.1. Data Collection

We designed an online questionnaire to collect data from mainland China to test the proposed hypotheses. We distributed the questionnaire to the member companies of the Shenzhen Anti-Counterfeiting Association (SACA). SACA is a government-initiated association As a government founded organization consisting of members with various backgrounds, which can ensure the representativeness of the sample regarding firm size, industry, and ownership. In total we have received 212 valid samples for analysis. The demographical information is presented in Table 1.

| | Count | Percentage | | Count | Percentage |
|---|-------|------------|---------------------------|-------|------------|
| Turnover | | | Industry | | |
| Less than 1 million | 7 | 3.30% | Architecture/Engineering | 7 | 3.30% |
| 1 - 5 million | 28 | 13.21% | Business services | 3 | 1.42% |
| 5 - 10 million | 30 | 14.15% | Chemicals | 11 | 5.19% |
| 10 - 50 million | 50 | 23.58% | Retail/Trading | 33 | 15.57% |
| 50 - 100 million | 23 | 10.85% | Computer/IT related | 7 | 3.30% |
| 100 million - 1 billion | 57 | 26.89% | Manufacturing | 129 | 60.85% |
| larger than 1 billion | 17 | 8.02% | Others | 22 | 10.38% |
| Organization Type | | | Number of Employee | | |
| Multi-national | 69 | 32.55% | Less than 100 | 116 | 54.72% |
| State-owned (fully/partly owned) | 14 | 6.60% | 100 - 300 | 47 | 22.17% |
| Local private owned | 118 | 55.66% | 300 - 500 | 18 | 8.49% |
| Local company with foreign ownership (JV) | 11 | 5.19% | 500 -1000 | 9 | 4.25% |
| | | | 1000 - 5000 | 15 | 7.08% |
| | | | larger than 5000 | 7 | 3.30% |

Table 1: Sample demographics

3.2. Construct Measurement

We adapted all the variables from past literature. All the independent variables are measured by seven-point Likert scale with 1 representing strongly disagree and 7 representing strongly agree.

The definitions and measurement items of all the constructs are described in Table 2.

| Construct Definition | Measurement Items | Adapted from |
|--|--|--|
| Respondent Dependence: How dependent a firm is on its major suppliers/customers | RD1: We are dependent on our major suppliers. RD 2: Our major suppliers would be difficult to switch away. RD3: Our major suppliers would be costly to lose. | Lusch and Brown (1996b) and (Vijayasathay, 2010) |
| Partner Dependence: How dependent a firm's major suppliers/customers are on it. | PD1: Our major suppliers are dependent on us. PD2: Our major suppliers would find it difficult to switch away from us. PD3: Our major suppliers would find it costly to lose us. | Lusch and Brown (1996b) and Vijayasathay (2010) |
| Relational Depth: The expectation of a firm to facilitate the collaboration with existing partners through coordinating and optimizing shared supply chain activities. | DEP1. We expect to closely coordinate interdependent processes with our suppliers. DEP2. We expect that the interdependent operating procedures and routines (e.g., manufacturing, bar coding, packaging, shipping, etc.) can be highly visible among our suppliers and us. DEP3. We expect that related operating processes are jointly optimized with our suppliers. DEP4. We expect that the exceptions and errors that occur during daily operations are shared with our supplier in a timely manner. | Malone and Crowston (1994), Subramani and Venkatraman (2003) and Tang and Rai (2012) |
| Relationship Extendedness: The expectation that the collaborating relationships with the existing partners will continue in the future. | EXT1. We expect our relationship with our suppliers to last a long time. EXT2. We assume that renewal of agreements with our suppliers will generally occur. EXT3. We plan for the continuance of our relationship with our suppliers, and not only for individual orders. | Heide and Miner (1992), Lusch and Brown (1996b), and Rokkan et al. (2003) |
| Adoption Intention: The intention to adopt eSCM in foreseeable future. | INT1: We are contemplating to adopt eSCM. INT2: It is likely that our firm will take some steps to adopt eSCM in the future. INT3: How soon do you think that your firm will adopt eSCM? 1) Less than 6 month; 2) 6 – 12 months; 3) 12 – 18 months 18 to 24 months; 4) More than 24 months; 5) No plan | Son and Benbasat (2007) and Liu et al. (2010) |

Table 2. Construct definition and measurement items

4. Data analyses and hypothesis testing

4.1. Measuring dependence structure

Following Casciaro and Piskorski (2005), we measure dependence asymmetry (DA) and mutual dependence (MD) using partner dependence (PD) and respondent dependence (RD) based on the equations below:

$$DA = \text{Absolute}(RD - PD)$$

$$MD = (RD + PD) - DA$$

As indicated by Vijayasathay (2010), MD is adjusted for the skewness of dependencies by deducting DA.

4.2. Hypothesis testing

Using conventional methods such as an OLS might create endogeneity concerns as extendedness (EXT) and relational depth (DEP) are both dependent and independent variables (Salvador et al., 2014). Therefore, the three-stage least squares (3SLS) approach was employed to analyze the system of equations (1) and (2). First, as specified in Eq. (1), we regressed against DA and MA to obtain predicted values of EXT and DEP. Next, the predicted scores from this regression are used for estimating regression parameters in Eq. (2).

$$DEP = \gamma_0 + \gamma_1 * DA + \gamma_0 * MD + v_i$$

$$EXT = \lambda_0 + \lambda_1 * DA + \lambda_0 * MD + \delta_i$$

$$\text{To obtain } DEP_{resid} = DEP - DEP_{predicted}, \text{ and } EXT_{resid} = EXT - EXT_{predicted} \quad (1)$$

$$ADT = \beta_0 + \beta_1 * DEP_{resid} + \beta_2 * EXT_{resid} + \beta_{control} * Controls + \varepsilon_i \quad (2)$$

4.3. Emergent finding

Our preliminary results (Table 3) show supports for most of the proposed hypotheses except

for H8. While H8 assumed a positive relationship between relationship extendedness and eSCM adoption, the results show contradictory finding suggesting a significant negative relationship. When a firm expect to extend the relationships with its supplier, it would be less likely to adopt eSCM. Future research is required to interpret this counterintuitive finding.

| | Relationship extendedness (1) | Relational depth (2) | Adoption Intention (3) |
|---------------------------|----------------------------------|-------------------------|---------------------------|
| Dependence asymmetry | 0.167** | 0.145** | 0.239** |
| Mutual dependence | 0.0763*** | 0.0997*** | 0.120*** |
| Relational depth | | | 0.521*** |
| Relationship extendedness | | | -0.269** |
| Turnover | | | -0.0535 |
| employee | | | 0.125 |
| operation | | | -0.0891 |
| Industry dummy | | | 0.193 |
| Ownership dummy 1 | | | 0.275 |
| Ownership dummy 2 | | | 0.179 |
| R^2 | 0.039 | 0.065 | 0.133 |
| adj. R^2 | 0.030 | 0.056 | 0.090 |

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. 2SLS estimation

5. Conclusion and future research

This study investigate the relationships between dependence structure, relational value and eSCM adoption. The emergent results show supports for the influence of dependence structure on relational value and eSCM adoption. However, relationship extendedness is found to be negatively related to eSCM adoption, which is contradictory to our hypothesis. We suggest future research to explain the counterintuitive finding. In addition, directions for future research also include to investigate the role of external uncertainty to enhance the existing conceptual model.

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