Interorganizational Relationships, Interorganizational Process Redesign, and E-Integration in the Supply Chain: A Social Exchange and Transaction Cost Perspectives

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Abstract—**Supply chain is complex and dynamic in its inter-firm nature and thus, an Internet-enabled integration for supplies and customers, namely e-integration, is key to its final success. However, although there has been a high adoption rate of e-integration, the level of realized performance is low. Most firms choose to automate only the processes of that firm and its partners in an isolated manner or to automate outdated existing processes between partners. To effectively implement e-integration, interorganizational process redesign (IOPR) is necessary for the processes with both suppliers and customers. The process redesign is here defined as an important mediator for the final e-integration success. Moreover, the nature of the redefined processes is strategically founded on the structure of interorganizational relationships (IOR). Social exchange and transaction cost issues are widely used to define IOR in the supply chain. Based on these concepts, this study thus proposes a research model to examine a firm's e-integration through the mediator of IOPR with both suppliers and customers from the drivers of IOR. The important findings confirm the mediator of process redesign and the drivers of IOR.**

Keywords-Supply Chain, E-Integration; Interorganizational Process Redesign; Interorganizational Relationships; Social Exchange Theory; Transaction Cost Economics.

I. INTRODUCTION

Supply chain management (SCM) mainly concerns an integration of various key business processes between partners to effectively provide products/services that add value to customers and other stakeholders [28]. SCM is complex and dynamic in nature. The enabling role of IT, in particular for the Internet technology, is an important concern in the supply chain [36]. This results in a new concept for being able to effectively coordinate supply chain partners using this technology. Frohlich [8] referred to this new concept as "e-integration," and discussed how upstream and downstream partners could be broadly integrated in the entire supply chain using this technology. The key issue is the high adoption rate of supply chain technologies but low realized performance [35].

The major reason for this may be that most firms choose to automate only the processes of that firm and its trading partners in an isolated manner or to automate outdated existing processes between participants [6]. To effectively implement e-integration, it is necessary to first redesign the entire supply chain processes across organizational boundaries, including suppliers and customers [1]. In other words, e-integration is closely associated with interorganizational process redesign (IOPR), which is defined as an important mediator to successfully realize e-integration [5,21]. In this current study, we define IOPR to include process redesign with upstream suppliers and with downstream customers [7,8].

The nature of the redefined processes with suppliers and customers is strategically founded on the structure of interorganizational relationships (IOR) [7,24]. Supply chain relationships not only concern social exchange issues, but also involve the economic issues implied by a contract [15]. Social exchange theory (SET) has been used to examine the development of IOR from a non-profit perspective [9]. A summary for the research of SET in the IOR has identified trust, commitment, reciprocity, and power/relative dependence as the main determinants [3,16]. Transaction cost economics (TCE) intends to explain the governance structure of contractual relations for different markets by analyzing the transaction cost of trading activities from a profit perspective [37]. Such purpose for mitigating market uncertainty has been widely used as the basis of the analysis of interorganizational issues [13]. Market uncertainty is therefore the main determinant of TCE issue in IOR.

In sum, this study proposes a research model to examine a focal firm's e-integration implementation through the mediator of interorganizational process redesign from the initial drivers of IOR. However, few studies have considered the basic role of IOR to IOPR with suppliers and with customers in a supply chain.

The rest of this article is organized as follows. First, a review of literature provides the basis for defining the research model. Next, we describe the research design for measurements and sample design. We then discuss hypotheses testing. After that, findings and discussions are presented. Finally, this article provides conclusions and suggestions from the results.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Based on the above discussion, Figure 1 provides a pictorial depiction of this research model. The followings sections discuss the theoretical foundation of this model and the development of hypotheses.
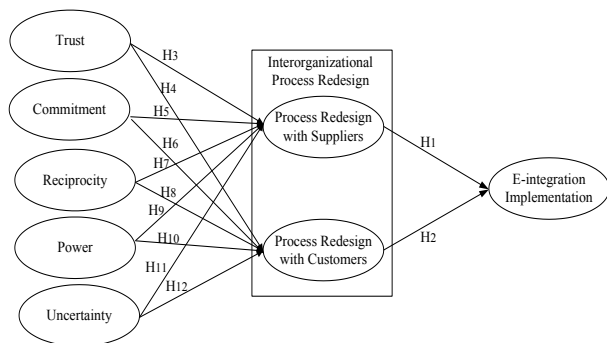

Figure 1 Research model

A. IOPR and E-integration

Many studies on the e-integration issue have questioned whether or not the Internet-enabled supply chain actually improves partners' performance [8]. The evidence suggests that there is a need for this to be accompanied by a fundamental organizational change of suppliers and customers so as to be consistent with the focal firms' business processes [29]. In other words, there is a need for the focal firms to first redesign the entire supply chain processes with their suppliers and customers to effectively implement e-integration [13]. Afterward, the IT automation is further deployed to enable the new processes rather than the old ones [12].

Earlier studies have revealed that EDI together with reengineering of the interorganizational processes can improve the initiatives of participated external firms and the benefits of all firms in the overall supply chain [10]. Further studies have also noted that EDI must involve organizational changes in partners' business processes to realize the potential efficiency provided by this technological innovation [33]. Additional studies have also argued that those who have already implemented the SCM philosophy with EDI would have to follow a path of BPR and indeed reengineer the interorganizational processes with their partners [30].

The following develops relevant hypotheses. Researchers indicated that it is important for organizations implementing e-integration as a means of creating a more integrated supply chain to be associated with the need for a structural change of their processes in a cross-organizational level, including upstream suppliers and downstream customers [22,29]. Supplier integration with their processes is especially important in terms of a long replenishment's lead-time, frequent deliveries, and reduced buffer inventories with trading partners [8,24]. Next, tight integration with customer-side processes, such as organizational buyers or channels,

shows the importance of connecting to many potential benefits, such as sale forecasting, production planning, and customer relationship management. Studies have showed how the inventory replenishment, customer service, and delivery costs can all be improved significantly by redesigning the processes of the distribution channel partnerships [2]. Accordingly, two hypotheses are proposed.

H1: The process redesign with suppliers has a positive effect on e-integration implementation.
H2: The process redesign with customers has a positive effect on e-integration implementation.

B. IOR and IOPR

Many scholars have argued that implementing SCM generally must be associated with an important concern with IOR across trading partners [3,13]. In particular, the main activity for implementing SCM lies in process redesign/integration among partners [15]. Since IOPR is dynamic and complex in nature, analysis of the redefined processes with suppliers and customers requires an understanding of the fundamentals of IOR. IOR not only incorporates social exchange issues, but also involves the economic elements explicated in a contract [15,34].

SET in the supply chain has been defined differently for various research purposes. Some studies have proposed two elements in SET, trust and commitment, that are needed for maintaining relational stability in the supply chain alliance [16,39]. Other studies have modeled how justice/reciprocity and power/relative dependence in SET affect long-term orientation and relational behaviors toward partners [9]. Additional studies have focused on mutual adaptation between partners for developing strategic alliance based on trust and power in SET [11]. Given these theoretical foundations of SET in the supply chain, we thus comprehensively define four main dimensions in IOR, trust, commitment, reciprocity, and power.

Further, TCE has been considered to examine the economic issues in building supply chain relationships [38]. TCE refers to the concept of what kind of institution (firms, markets, franchises, etc.) minimizes the transaction costs of producing and distributing a particular good or service. Often these relationships are categorized by the kind of contract involved. TCE constitutes two situational conditions (i.e., asset specificity and uncertainty), two beliefs about human behavior (i.e., opportunism and bounded rationality), and one transactional condition (i.e., frequency) [37]. Since this study mainly concerns IOR building for the partners, we thereby consider two situational conditions for their connection and importance to this issue, that is, asset specificity and uncertainty.

Basically, asset specificity refers to the extent to which a party is "tied in" in terms of its investment made in a two-way or multiple-way business relationships. From this definition, asset specificity is similar to the power/relative dependence in SET. This line of thinking for reducing market uncertainty with suppliers has been widely used as the basis of the analysis of interorganizational activities [13]. Specifically, many studies have pointed out that market uncertainty prompts firms to establish and manage

relationships in order to achieve stability, predictability, and dependability in their relations with partners [29,39]. We thus define market uncertainty as an important dimension in IOR.

The following defines the five dimensions of IOR and relevant hypotheses. Trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustee, irrespective of the ability to monitor or control the other party" [19].

Specifically, in a buyer-supplier relationship, high trust facilitates more open communication and the willingness to take risks between partner firms, thereby generating greater knowledge and appreciation for each other's contribution to the relationship [16]. Trust with suppliers exerts a positive effect on supply chain proximity, that is, suppliers are really concerned with the success of buyer firms [25]. Accordingly, trust would drive partner firms with upstream suppliers and downstream customers to redesign their business processes in a consistent way to reach the common goal [15]. Therefore, two hypotheses are proposed.

H3: Trust has a positive effect on the process redesign with suppliers.

H4: Trust has a positive effect on the process redesign with customers.

The concept of commitment from Morgan and Hunt [23] is defined as "an exchange belief of partners that an ongoing relationship with another is so important as to warrant maximal efforts at maintaining it; that is, the committed party believes that the relationship endures indefinitely". Several studies have argued that commitment can improve communications and better coordinate buyer-supplier relationships [14,26]. This literature has given impetus to the deployment of BPR in supply chain, that is, between upstream suppliers and between downstream customers, for assuring commitment in their alliance [13,17]. Accordingly, two hypotheses are proposed.

H5: Commitment has a positive effect on the process redesign with suppliers.

H6: Commitment has a positive effect on the process redesign with customers.

Social relationships are formed and maintained because the partner firms offer reciprocal benefits to one another over time [18]. More importantly, the motives of this reciprocity emphasize cooperation, collaboration, and coordination of key business activities among partners for their common goals [9]. Moreover, reciprocity in the supply chain relationships can facilitate information sharing between trading partners [13]. For the upstream side, reciprocity can help suppliers to build virtual business networks, so suppliers can have better access to up-to-date information. Similarly for the downstream side, customers/buyers can acquire better customer services, purchase more easily, and obtain the newest product information. Accordingly, two hypotheses are proposed.

H7: Reciprocity has a positive effect on the process redesign with suppliers.

H8: Reciprocity has a positive effect on the process redesign with customers.

Power is indicative of a dependent relationship on its focal firm in a partnership. In IOR, there is an emphasis on the necessity for mutual and symmetric dependence structure to foster long-term relationships, whereas asymmetric relationships are associated with less stability and more conflict [3]. When there is greater power symmetry in the IOR, there is more interdependence between suppliers and buyers. To be able to exercise a power relationship in the supply chain, especially within the symmetry structure, the redesign of interorganizational processes is an important precursor to assure that the supply chain is taken as a whole, as a set of interrelated activities rather than as pair-wise activities [7]. Therefore, two hypotheses are proposed.

H9: Power has a positive effect on the process redesign with suppliers.

H10: Power has a positive effect on the process redesign with customers.

Since SCM aims at building a mutual understanding of a partnership to facilitate the exchange of various components and products with suppliers and customers, the partnership is clearly in the position to reduce uncertainty within an unpredictable market [28]. Moreover, the firms facing market uncertainty have a greater incentive to adopt IOS for improving information exchange and collaboration between their trading partners [28]. The motivation for reducing market uncertainty suggests that an attempt to integrate supply chain activities by using Internet technology to support collaborative behaviors must be accomplished by re-engineering interorganizational business processes [29]. Thus, two hypotheses are proposed.

H11: Uncertainty has a positive effect on process redesign with suppliers.

H12: Uncertainty has a positive effect on process redesign with customers.

III. RESEARCH DESIGN

A. Instrument

A survey was conducted to collect empirical data, and the research design is described below.

1) Basic Information: This part collects information about organizational characteristics including industry type, annual revenue, number of employees, and experience on process redesign and e-integration, as well as respondent characteristics including work experience, education level, gender, and position.

2) Elements of IOR: This part consists of five elements:trust, commitment, reciprocity, power, and uncertainty. Moreover, IOR is defined with two target dimensions for this study, relationships with upstream suppliers and downstream customers. The measurement items for trust are adapted from the instrument developed by [16,39], including five items for each dimension. The measurement items for reciprocity are adapted from the instrument developed by [13,27], including four items for

each dimension. The measurement items for power are adapted from the instrument developed by [31], including four items for each dimension. The measurement items for uncertainty are also adapted from the instrument developed by [31], including four items for each dimension.

3) IOPR: The IOPR for the entire supply chain signifies the integration of key business processes between a focal firm and both its upstream suppliers and its downstream customers. IOPR has two dimensions with both upstream suppliers and downstream customers. The measurement items for IOPR are adapted from the instrument defined by [8], each containing four items. The processes for the upstream suppliers include procurement, scheduling, inventory, and demand. The processes for the downstream customers consist of marketing, order, service, and demand.

4) E-integration Implementation: The e-integration implementation is defined as the extent to which a focal firm establishes IT capabilities for the consistence of data and the rapid transfer of supply chain related information across trading partners. There are two dimensions for this instrument, data consistency and cross-functional applications integration. The measurement items for them are adapted from the instrument defined by [32], including three items and four items respectively.

B. Sample design

To qualify for this study, firms must have extensive experience with technology investments and the management of supply chain systems. Thus, it is assumed that larger firms would be more likely to have these types of experience. We selected a study sample of 1200 manufacturing firms, including high-tech and traditional manufacturing, and 300 service firms, including retailing, banking, and software service, from the 2012 list of firms published by the Taiwan Stock Exchange Corporation. Top managers, including CIOs or supply chain executives, are the persons most likely to be familiar with these issues. Both executives were therefore selected as the respondents.

C. Scale Validation

Initially, a pretest was conducted for the scale. The scale was carefully examined by selected practitioners and academicians in this area of research including translation, wording, structure, and content. These comments were used to revise the scale in order to guarantee initial reliability and content validity. Once the questionnaire had been finalized, we sent 1500 questionnaires to sample subjects. A total of 285 questionnaires were returned, and after deleting incomplete and invalid responses, there was a sample size of 269 responses - an overall response rate of 17.93 percent. CIO and supply chain executives are the main respondents for this survey and occupy a larger proportion, 37.92% and 27.88%, respectively. Among them, 72.5 percent of sample firms are high-tech manufacturing and 26 percent are service industries, including retailing, banking and so on. Sample respondents indicate 37.9 percent of CIOs and 27.9 percent of supply chain executives.

D. Measurement Model

Partial Least Square (PLS) is a structural equation modeling (SEM) technique that uses a nonparametric and component-based approach for estimation purposes. PLS has a minimal demand for sample size and residual distribution [4]. We used PLS for this analysis. Firstly, a measurement model is defined to assess reliability, and convergent and discriminant validity for the scale. Further, a structural model is used to perform path analysis.

The testing results are below. Cronbach' α values are all larger than 0.8. Item loadings range from 0.71 to 0.86 and are significant at the 0.01 level. Composite construct reliabilities range from 0.84 to 0.95 and average variances extracted (AVE) range from 0.57 to 0.67. The results indicate that all constructs have high degrees of reliability and convergent validities. The square root of AVE for each construct is larger than its correlations with all the other constructs. Thus, all constructs also meet the criteria of discriminant validity.

PLS does not provide a significance test or confidence interval estimation. We re-sampled 1000 times with Bootstrapping analysis to obtain a stable result for these analyses. Next, path coefficient (β) was used to indicate the relationships between variables and coefficient of determination (R^2) for endogenous variables was calculated to assess the predictive power of this model.

IV. HYPOTHESIS TESTING

Figure 2 shows the testing results of the structural model. Most hypotheses (11 hypotheses) are significantly supported at p<0.05 or 0.01. In contrast, Hypothesis 10 is not significantly supported. Specifically, both the process redesign with suppliers and with customers played a critical role in determining e-integration implementation (p<0.01, β=0.40 and 0.35). They jointly explained 36% of variance for e-integration implementation (R^2 =0.36). Thus, hypothesis 1 and 2 are supported. Trust had a positive effect on the process redesign with suppliers (p<0.01) and with customers (p<0.01) (β=0.34 and 0.33). Thus, hypothesis 3 and 4 are supported. Commitment was a notable determinant of the process redesign with suppliers (p<0.05) and with customers (p<0.01) (β=0.20 and 0.24). Thus, hypothesis 5 and 6 are supported.

Reciprocity was reported as an important antecedent of the process redesign with suppliers (p<0.01) and with customers (p<0.01) (β=0.26 and 0.29). Thus, hypothesis 7 and 8 are supported. Power showed a positive impact on the process redesign with suppliers (p< 0.01), but a non-positive impact on the process redesign with customers (β=0.30 and 0.10). Hypothesis 9 is supported, but Hypothesis 10 is not supported. Uncertainty had an influential role in determining the process redesign with suppliers (p<0.05) and with customers (p<0.01) (β=0.19 and 0.26). Thus, hypothesis 11 and 12 are supported. Moreover, these IOR related variables jointly explained 42% and 44% of variance for the process redesign with suppliers and with customers, respectively (R^2 =0.42 and 0.44).

Next, we examined the argument of the mediating effect of IOPR in the research model. We can compare the results by testing the original research model against a competing model with the addition of two extra direct relationship structures for suppliers and customers from IOR to e-integration implementation, each relationship structure including five paths (five variables in IOR) [32]. The difference between the R^2 values was non-significant. This indicates an important mediating role of process redesign in influencing e-integration implementation from the initial driver of IOR.
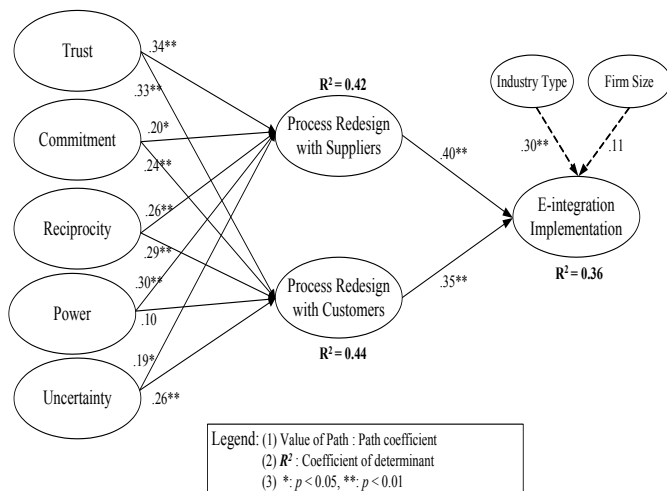

Figure 2. Result of the structure model

V. FINDINGS AND DISCUSSIONS

According to Figure 2, five defined variables in IOR are all important precursors of the process redesign with suppliers. However, four defined variables in IOR have the same important role in determining the process redesign with customers but the power variable does not have this role. In general, IOR has a high predictive power on both the process redesigns with suppliers and with customers (R^2 =42% and 44%). The reasons behind this are discussed below.

In an interorganizational relationship, a high level of trust would foster open communication and the willingness to take risks for a focal firm and its trading partners, thereby generating greater information sharing for each other's contribution to the relationship. This, in turn, would facilitate the need for the process redesign with suppliers and with customers for information flow integration.

Relational commitment in alliances brings about mutual respect for buyers and suppliers and reduces the need for competition from rivalries, that is, integrating processes and activities for trading partners to sustain collaborative relationship. Thus, commitment would drive focal firms to integrate and redesign information, physical, and financial flows with suppliers and customers.

Reciprocal benefit is a motivator or facilitator for cooperation, collaboration, and coordination among trading partners [27]. This would create the need for a focal firm to integrate and redesign processes and activities with its trading partners. In particular, trading partners will be more likely to enjoy information sharing if focal firms share information with their suppliers and customers (information feedback).

In contrast, power is related to the process redesign with suppliers and is not related to the process redesign with customers. Customers (channels or business buyers) are always in a position to take advantage of the buyer-side market to select their partners. Thus, focal firms have less bargaining power over their customers and the dependency relationship between them is imbalanced. It is opposite for upstream suppliers. This can cause upstream suppliers to develop a high level of information sharing with focal firms.

Uncertainty in interorganizational interactions is much greater since two organizations that have different business objectives and stakeholders are involved in a transaction. Focal firms need to develop long-term relationships with suppliers and customers to minimize market/environmental uncertainty. Accordingly, uncertainty can create a need for focal firms to integrate and redesign their business process with suppliers and customers to minimize the transaction costs.

Next, both the process redesigns have a critical role in determining the implementation of e-integration with a high explanatory power (36%). The process redesign with suppliers and with customers can create a unique form of alliance that is difficult to copy or imitate for competitors and eventually develop superior firm performance in terms of a successful implementation of e-integration. Indeed, previous studies have argued for the importance of business processes as a mediator to drive business performance regarding IS-related deployments such as knowledge management. This finding is particularly significant in the supply chain.

VI. CONCLUSIONS AND SUGGESTIONS

Firstly, when focal firms and their partners are planning to implement e-integration, the development of IOR should be the initial step for building a conceptual agreement. Important considerations for the dimensions of IOR with upstream suppliers are, listed in the order of their effect: trust, power, reciprocity, commitment, and uncertainty. Important considerations for the dimensions of IOR with downstream customers are, listed in the order of their effect: trust, reciprocity, uncertainty, and commitment. Further, interorganizational process redesign is the next step in preparation for building new processes that facilitate cross-partnering IT deployment.

There are also implications for researchers. First of all, we approached e-integration implementation by defining two distinct process redesigns, that with suppliers and that with

customers. Few previous studies have proposed a similar structure for implementing e-integration. This approach can provide differentiated understanding for different types of trading partners regarding focal firms in executing their BPR. The process redesign with suppliers and with customers could thus be solved more clearly and effectively. Further, we comprehensively considered the dimensions of IOR from the perspectives of SET and TCE. This would increase the explanatory power of IOR for the mediator of interorganizational process redesign. Both of these unique features are thoroughly discussed in the research model.

Although this research has produced some interesting results, a number of limitations may be inherent. Firstly, the response rate is lower than desirable, despite the various efforts to improve it. This may be because the respondents lack relevant work experience in the interorganizational process redesign and e-integration implementation. However, the response sample demonstrates no systematic non-response bias. Next, the questionnaires were distributed only to focal firms, which must answer many questions about the status of their suppliers and customers. However, the answers to these questions would be more reliable if the suppliers and customers could provide the answers themselves. Finally, since senior managers of larger firms are always busy, some of the questionnaires may have been completed by subordinates, and so the data may have some biases or inaccuracies.

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