Encouraging Customer Participation by Leveraging Interdependence Structure and Relationship Commitments: Empirical Evidence from Chinese Industrial Firms

Mingfei Du* & Jing Zhang

Huazhong University of Science and Technology
1037 Luoyu Road, Wuhan, PR China
*mingfeidu@hust.edu.cn

ABSTRACT

The literature suggests that integrating customers into value creation can strengthen a company’s core competencies. It is still unclear, however, how inter-firm dependence structure impacts the customer’s willingness to participate. This paper explores the impacts of two dimensions of interdependence structure between seller and buyer (total interdependence and interdependence symmetry) on customer participation via the customer’s calculative and affective commitments. It also examines in industrial marketing contexts the moderating effects of environmental dynamism, process interdependence, and technological complexity in the customer commitments and participation link. The conceptual model and research hypotheses were tested using data collected from a survey of 376 business-to-business (B2B) firms. The research findings provide insightful managerial implications for B2B firms on how to encourage customers to participate by properly leveraging interdependence structure and customers’ relationship commitments according to environmental and task-specific characteristics.

Keywords: Customer participation, interdependence structure, relationship commitments, industrial firms
1. INTRODUCTION

The marketing literature increasingly focuses on the interactions between firms and customers, especially with regard to active customer participation, in order to create offerings of greater value for both parties (Auh et al., 2007; Yi et al., 2011; Ngo & O'Cass, 2013). Customer participation refers to “the degree to which the customer is involved in producing and delivering the service” (Dabholkar, 1990, p. 484), or the “extent to which customers share information, provide suggestions, and engage in shared decision-making reflects customer effort in co-producing a service” (Lin & Chen, 2010, p. 119).

Customer participation provides customers with opportunities to create customized offerings for themselves (Firat et al., 1995), and also enables firms to use customers' talents to deliver superior products/services and to enhance productivity (Lovelock & Young, 1979). In a business-to-business (B2B) environment characterized by a more limited number of business partners and a greater breadth and depth of collaborative interaction between suppliers and customers (Beverland et al., 2007), involving customers in a firm’s business processes should be especially relevant for creating sustainable competitive advantage. A literature review by Mustak et al. (2013) found, however, among all the studies reviewed, that 77% are conducted in a business-to-consumer (B2C) setting and that only 6% examine the topic of customer participation in industrial firms.

Actual levels of customer participation are believed to be first determined by the customer’s willingness to cooperate (Wu, 2015). Co-working with customers captures activities across organizational borders; therefore, it should be influenced by inter-firm relationship factors. Very few studies, however, examine the drivers of customer participation by adopting an inter-organizational view. Ritter and Walter (2003) examined the influence of relationship management
tasks, including mutual adaptions, mutual trust, mutual commitment, and mutual relationship management, on customer involvement in new product development.

It is still not clear how interdependence structure between firms impacts the customer’s willingness to participate. Based on this fact, this paper aims to narrow the gaps in extant literature by examining how the interdependence structure between seller and buyer can impact customer participation via customer’s relationship commitments in industrial marketing contexts.

The current study will contribute to the literature on customer participation in particular and on inter-organizational relationship in general. The research findings will also have insightful managerial implications for B2B firms on how to encourage customers to participate properly by leveraging the interdependence structure and customer’s relationship commitments according to environmental and task-specific characteristics.

Section 2 of this paper presents a review of the literature. The conceptual model and research hypotheses for the current study are discussed in Section 3, and the research methodology is explained in Section 4. Section 5 presents the research results, and Section 6 provides conclusions and discusses the managerial implications and limitations of the current study.

2. LITERATURE REVIEW

This section presents a review of the literature relating to customer participation and interdependence structure.

2.1. Customer Participation

Since customer participation is believed to be a means to achieve competitive advantage (Prahalad & Ramaswamy, 2004), the logical question is: How do firms encourage customers to engage in the firm’s value-creation activities? Although many studies focus primarily on outcomes of customer participation in terms of performance indicators such as value performance (Fang et al., 2008) and innovation performance (Lin & Huang, 2012), there have been
fewer empirical studies on antecedents of customer participation (Wu, 2011). Among them, several discuss the barriers or impediments to customer participation. For instance, Schaarschmidt and Kilian (2014) presented a case study that examined impediments and barriers to three kinds of complementary customer knowledge-related learning across different stages of new product development (NPD).

An exploratory analysis of three medium-sized companies in the interior design and software industries by Ülgen and Forslund (2015) found that customization as an overall business strategy may act as a barrier to customer integration in product development.

According to the motivation-opportunity-ability (MOA) framework, extant studies examining facilitating factors can be classified into two categories; namely, explorations of antecedents in terms of the motivations (e.g., Carbonell et al., 2009; Svendsen et al., 2011; Bharti et al., 2014) and the abilities (e.g., Ngo & O’Cass, 2013; Sharma et al., 2014) of the firms involved.

Most of these papers take the seller’s view by discussing why firms are willing to involve customers in value-creation activities and how they are capable of doing so. Some authors discuss the motive for sellers to integrate customers (e.g., Lin & Germain, 2004; Carbonell et al., 2009; Füller et al., 2010).

In their cross-cultural study between U.S. and Chinese state-owned enterprise (SOE) manufacturers, Lin and Germain (2004) explored how environmental context (technological turbulence) and industrial context (production technology routineness and product complexity) urge firms to actively involve customers in product development.

Based on a survey of Spanish service firms, Carbonell et al. (2009) examined the positive effects of two dimensions of technological uncertainty (i.e., perceived technological novelty and technological turbulence) on customer involvement in new service development.

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Using Ajzen's theory of planned behavior, Füller et al. (2010) tried to identify managers' motivation for adopting virtual customer integration (VCI), based on a sample of 104 managers engaged in the product development process of manufacturing firms in medical technology. They found that subjective norms and attitude predict the intention of managers to use VCI. Svendsen et al. (2011) investigated the impact of three facets of a firm’s marketing strategy (product differentiation, competitor orientation, and brand-profiling emphasis) on its motive to involve customers in new product development.

The perspective of institutional arrangement is a theoretical framework that focuses on understanding why and how customers engage with other firms (Fang et al., 2008). Institutional arrangements include any type of contracting, ownership, or engagement in which firms seek to build or maintain an exchange and/or relationship with others (Davis & North 1970). This perspective suggests that firms will engage in value-creating institutional relationships with the maximization of customers who own benefits (Carson et al. 1999). The new set of joint activities implemented by the customers creates value, which affects the size of the value pie. Actually, the joint benefits are shared among relevant customers to compensate for engagement in these activities such that each partner receives a share of the value pie (Carson et al., 1999). As a collaborator, the customer shares pertinent intonations with other firms and coordinates activities and manufacturing processes with others, thus significantly improving the value of the product (Dyer & Singh 1998). The customer negotiates with the firm over the pricing, delivery, and other terms of the new products, thus affecting how the created value is shared (Jap 2001; Wemerfelt 2005).

Researchers also examine the antecedents of a seller’s competence to involve customers in the firm’s activities (e.g., Lin & Germain, 2004; Ngo & O'Cass, 2013; Sharma et al., 2014). For instance, Lin and Germain (2004) examined the effects of organizational structure on customer involvement in product development. Their results indicate that customer involvement is
positively predicted by formalization and is inversely predicted by decentralization. The reason is that collecting customer information may be more effective with a less formalized and more decentralized organizational structure, but executing customer information in product development (i.e., carrying out the decision based on information already collected) requires a more formalized and centralized organizational structure to be efficient.

Ngo and O'Cass (2013) proposed that innovation capabilities, both technical and non-technical, lead to a higher level of customer participation in service firms. Empirical evidence from 259 firms supported this proposition. Sharma et al. (2014) applied dynamic capability theory through a lens of co-creation to identify four categories of organizational capabilities that support customer participation in health care service innovations. The four categories include customer activation, organizational activation, interaction capabilities, and learning agility.

A limited number of studies of customer participation take the customer’s view. For instance, drawing on motive research, Füller et al. (2010) tested six categories of customer motivations to engage in VCI projects in a sample of 105 users of medical technology. Their research findings indicate that interest in innovation and product improvement are the most important drivers for customers, whereas monetary compensation and prestige are not significant. They also found, surprisingly that the desire to help people even has a negative impact on the participation in VCI.

Bharti et al. (2014) explored the drivers of customer participation in value co-creation among the bottom-of-the-pyramid (BOP) customers by conducting a qualitative study. They classified the drivers according to dispositional factors (e.g., training, trust, and commitment) and situational factors (e.g., monetary incentives, dependence). Wu et al. (2015) proposed a theoretical model of the antecedents of customer participation in service and supported the positive
impacts of organizational support and socialization on customers’ willingness and ability to participate.

2.2. Interdependence Structure

“Management scholars use the term interdependence to suggest [that two or more parties] are dependent on each other to achieve their desired outcomes” (Wicks et al., 1999, p. 104). According to Kumar et al. (1995), the interdependence structure of a dyadic relationship encompasses two aspects: total interdependence and interdependence asymmetry. Total interdependence is the sum of both firms’ dependence, whereas interdependence asymmetry is the difference between the firm’s dependence on its partner and the partner’s dependence on the firm. In this study, we use interdependence symmetry, which is in the opposite direction from interdependence asymmetry.

Kumar et al. (1995) examined the effects of total interdependence on the development of long-term relationships and found that it positively impacts inter-firm commitments, without distinguishing the different types of these commitments. Customer relationship commitment refers to the degree that a customer is willing to maintain long-term relationships with suppliers (Morgan & Hunt, 1994). The term includes calculative commitment and affective commitment (Ganesan et al., 2010). Calculative commitment refers to recognition of the interests and costs of the exchange relationship, as well as the willingness to maintain relationships in order to satisfy their needs. Affective commitment represents one party's affect for, and obligation to, the other party and a disposition to continue the pleasant and lasting relationship because of a demonstrated consistency in the business philosophies, goals, and values of the two firms. In short, affective commitment is the extent to which partners like to stay in existing relationships, whereas calculative commitment is the degree to which they need to stay (de Ruyter & Bouwman, 2012).
3. CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

The conceptual model and research hypotheses are depicted in Figure 1 and are explained in the following sections.

![Conceptual Framework for the Current Study](image)

**Figure 1. Conceptual Framework for the Current Study**

3.1. Impacts of Interdependence Structure on Relationship Commitments

According to Gilliland and Bello (2002), *interdependence structure* is constraint-based relationship maintenance, whereas *relationship commitment* is dedication-based relationship maintenance. We believe that total interdependence affects both the calculation commitment and affective commitment of customers for three reasons.

1. In the case of high inter-firm dependence, coordination and cooperation become especially important as the two parties pursue long-term orientation by investing time, effort, and money into the relationship (Morgan & Hunt, 1994). Firms that regard cooperation as a long-term process of effective and efficient information exchange use non-coercive power more often, are less likely to exploit their partner or
cancel the cooperation unexpectedly, and are more willing to behave in favor of their partners' long-term interests. As a result, the customer’s relationship commitment, both calculative and affective, is increased (Bello et al., 2003). The literature also provides empirical evidence supporting the argument that the level of total interdependence affects the overall relationship commitment (e.g., Lusch & Brown, 1996; Gelb & McKeever, 1997; Kasper & Hans, 2006; Ryu et al., 2009).

2. Calculative commitment is developed by assessing investment in and earnings from existing relationships, as well as by assessing potential termination costs. In other words, customers decide whether they should maintain the relationship by comparing the earnings and returns they can acquire from the relationship with the costs and losses they will incur from establishing a new relationship. Both parties know the shortcomings of the other and try to improve their own performance by using the other party’s resources. A high level of total interdependence implies high relationship benefits and high termination cost. Customers, therefore, tend to sustain business relationships with firms because of economic concerns to increase revenues and reduce losses.

3. The literature indicates that a higher level of total interdependence leads to frequent inter-organizational and interpersonal communications, mutual understanding, and stronger trust (Kumar et al., 1995). All of these factors are influential antecedents of customer loyalty and affective commitment (Bloemer et al., 2013). Therefore, we propose the following hypotheses:

$H_{1a}$: Total interdependence positively impacts the customer’s calculative commitment.

$H_{1b}$: Total interdependence positively impact thes customer’s affective commitment.
Interdependence (a) symmetry impacts customer relationship commitment in a complex way. The literature on inter-organizational relationship shows that power and dependence, arising from the possession and control of key resources, are critical for realizing coordination and cooperation between business partners. In a relationship with asymmetric dependence, the stronger firm is more likely to use its powers to obtain compliance from and to increase relationship commitment from its partner (Kumar et al., 1995). However, the use of powers might damage its partner’s autonomy, and the resultant negative emotions will restrain the partner from developing a long-term relationship, which definitely has a negative effect on the firms’ relationship commitment (Aulakh et al., 1996). It could be argued that interdependence (a) symmetry impacts two kinds of relationship commitments in quite different ways.

On the one hand, interdependence is determined by the firms’ resources and powers. Firms with fewer resources or powers attach more importance to the relationship because of their greater dependence on partners. Accordingly, they are more likely to calculate profits and losses arising from termination of the relationship. Therefore, the less powerful firm tends to develop a higher level of calculative commitment (Gilliland & Bello, 2002). In addition, interdependence symmetry influences a firm’s perceived relational risks (Teimoury et al., 2010). Liu et al. (2008) defined relational risk as the potential for one party's loss arising from its partner's cheating, stealing information or key employees, or shirking or not fulfilling commitments and tasks. Teimoury et al. (2010) indicated that interdependence symmetry will reduce relational risks perceived by partners and finally promote inter-firm trust. Improvement of inter-organizational trust reduces the level of the firms’ calculative commitment. Based on these observations, we propose the following hypothesis:

**H2a**: Interdependence symmetry negatively impacts the customer’s calculative commitment.
On the other hand, dialogue, as one of the cornerstones of inter-firm relationship formation and development, captures interactivity, deep engagement, and ability and willingness to act on both sides. It is difficult to envisage a dialogue between two unequal partners. Under a high level of interdependence asymmetry, the dominant party imposes its views on the other partner, thus inhibiting dialogue between them. Ford and Thomas (1995) pointed out that, in asymmetric relationships, communication predominantly goes from the dominant party to the dependent party. A power imbalance further hampers the dependent party's responses to the dominant party's initiatives. Interdependence asymmetry leads to decreased trust and more conflicts and opportunism behavior, including deliberately hiding or distorting information (Kumar et al., 1995). All these factors discourage the cultivation of the customer’s affective relationship commitment. On the contrary, interdependence symmetry and power balance between partners can improve the affective commitment of customers. Based on these observations, we propose the following hypothesis:

\[ H_{2b}: \text{Interdependence symmetry positively impacts the customer’s affective commitment.} \]

We now examine the moderating effect of total interdependence in the link between interdependence symmetry and the customer’s relationship commitments. When both the manufacturer's and the customer's inputs are important for completing each task, it is difficult or even impossible to partition the development into consequent but interrelated steps (Von Hippel, 1990). Thus, interdependence creates a platform on which the manufacturer and customer can interact and learn from each other during each stage as the project progresses (Sobrero & Roberts, 2001).

However, when the customer's effort constitutes a significant portion of the development task, the coordination burdens significantly increase because the customer's and the manufacturer’s divergent perspectives must be resolved.
before the development can move forward (Olson et al., 1995). Low interdependence enables the manufacturer and the customer to use task partitioning and to take advantage of each other’s knowledge and expertise in specific areas, which reduces the overall coordination load of the business project (Carlile & Rebentisch 2003). Therefore, when the level of total interdependence is low, both the buyer and the seller do not expect to acquire satisfactory benefits from the relationship.

In this case, even though the partners can achieve a fairly symmetric interdependence structure, they still have a lower level of willingness to maintain a long-term relationship because both sides do not need to rely on the other for survival. In that case, they might search for more meaningful and promising partners rather than invest resources in the present partner who makes inadequate future promises. Therefore, both sides have no strong desires to maintain a long-term relationship. Based on these observations, we propose the following two hypotheses:

\[ \text{H}_3a: \text{ Total interdependence positively moderates the relationship between interdependence symmetry and the customer’s calculative commitment.} \]

\[ \text{H}_3b: \text{ Total interdependence positively moderates the relationship between interdependence symmetry and the customer’s affective commitment.} \]

3.2. Impacts of Relationship Commitments on Customer Participation

Mutual dependence and relationship commitments, both calculative and affective, between the seller and the buyer are necessary to promote value creation through customer participation (Holm et al., 1999). Relationship commitment is viewed as “an enduring desire to maintain a valued relationship” (Moorman et al., 1992, p. 316). In order to improve customer participation in a firm’s value-creation activities, commitment is needed to encourage customers to resist attractive short-term alternatives and pursue expected long-term benefits of
staying in the relationship (Ganesan, 1994). Customers who are committed to a long-term relationship will cooperate because of a desire to make the relationship work (Morgan & Hunt, 1994). Scholars have recognized commitment as an essential ingredient for successful long-term relationships (Gundlach et al., 1995; Ritter & Walter, 2003).

To put it succinctly, we argue that calculative and affective commitments can both contribute to customer participation.

Calculative commitment is developed on the basis of a rational analysis of the potential interests and costs of the exchange relationship (Bagozzi & Phillips, 1982). Customers with a high degree of calculative commitment will be actively engaged in the seller’s activities in the hope of acquiring benefits by leveraging the relationship instrumentally. The potential benefits include the customers’ attainment of superior value as the co-created offering better fits their value-creation processes (cf. Lengnick-Hall, 1996).

Participation is associated with improved perceived quality and greater perceived value by customers (e.g., Kelley et al., 1990; Anderson & Sullivan, 1993). It enables customers to have an active voice and to achieve control over the co-creation process (Lengnick-Hall, 1996; Prahalad & Ramaswamy, 2004).

Customers committed in a calculative way also expect to accrue economic value through participation, as they benefit from cost reductions and discounts when participating in the creation of offerings (Bettencourt, 1997; Prahalad & Ramaswamy, 2004). Besides, participation enhances customers’ skills to create value from the offering (cf. Lengnick-Hall, 1996). For example, in a B2B setting, a client organization may participate in creating business software, which in turn helps the client to acquire the skills required for integrating the software into its business process and operating it appropriately, thus allowing the client to realize better value (cf., Betancourt et al., 2002).

Another instance comes from Aarikka-Stenroos and Jaakkola (2012). The authors examined the collaborative process of value co-creation in the context of
knowledge-intensive business services and found that customers’ involvement in co-production by inputting information, knowledge, efforts, time, and even financial resources can bring three kinds of significant value-in-use benefits to customers (i.e., direct monetary benefits, indirect monetary benefits, and non-monetary benefits). Furthermore, as the creation of offerings often necessitates the involvement of other actors beyond customers and sellers, participation supports customers in enhancing their networking capabilities (Etgar, 2008). Based on these observations, we propose the following hypothesis:

\[ H_{4a}: \text{Calculative commitment positively impacts customer participation.} \]

Affective commitment represents one party's affect for, and obligation to, the other party and a disposition to continue the pleasant and lasting relationship because of a demonstrated consistency in the business philosophies, goals, and values of the two firms. According to Gilliland and Bello (2002), it is a kind of dedication-based relationship maintenance. The two firms with a high level of mutual affective commitments reflect consistency in their management ideas, goals, and values. They are less likely, therefore, to exhibit opportunistic behavior and are more eager to maintain long-term stability of the relationship (Gilliland & Bell, 2002). In this context, positive emotions and strong ties generated by affective commitment could prompt a customer to actively develop cooperative behavior and to engage in value co-creation activities with the seller (Bergami & Bagozzi, 2000). Dhanaraj and Parkhe (2006) argued that, in an atmosphere of trust, loyalty, and affective commitment, appropriability concerns are low and learning flourishes because customers are more willing to share their proprietary knowledge. Based on these observations, we propose the following hypothesis:

\[ H_{4b}: \text{Affective commitment positively impacts customer participation.} \]
3.3. Moderators in Relationship Commitments and Customer Participation Link

The link between relationship commitments and customer participation is moderated by environmental factors and task-specific characteristics. Although two forms of commitments impact customer participation positively, such effects are contingent on moderators in opposite ways.

Scholars suggest that managerial choice and behavior may be severely influenced by the moderating effect of the external business environment (Kaur & Gupta, 2010). Environmental dynamism in terms of market turbulence, technological turbulence, and competitive intensity is likely to enhance market uncertainties, for they reflect rapidly changing buyer preferences, wide-ranging needs and wants, on-going buyer entry and exit from the marketplace, price pressure from ambitious competitors’ actions, quick technology shifts, and constant emphasis on offering new products/services.

Under those circumstances, spending resources in inter-firm collaboration would be highly risky for customers. Uncertain future expectation and related perceived risks will increase the customer’s intention to behave in an opportunistic way (e.g. Moschandreas, 1997; Lee, 1999; Achrol & Gundlach, 1999). Larson (1992) reported that firms, when facing environmental uncertainty, are more likely to selfishly pursue immediate gains from partners. Those customers who maintain a relationship with the seller based on calculative commitment are especially vulnerable to changes in environment and endeavor to minimize their risk expectations by reducing or even canceling their investments in inter-firm cooperation.

The party with a high calculative commitment will perceive low levels of control in the relationship and will hold pessimistic views toward the relationship (Jones et al., 2007). A turbulent environment will increase such pessimistic mood and finally restrain the firm from further involvement in cooperation with an
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uncertain outcome. In other words, in a dynamic environment, customers with calculative commitment have a lower level of intention to participate.

In contrast, affective commitment is established on mutual trust, communication, and loyalty. Customers with a high level of affective commitment are willing and able to understand the firm’s position and develop a strong belief that the firm will not sacrifice the customer’s interests in turbulent and uncertain market conditions. They even support the supplier to deal with the changing environment by building a long-term strategic alliance because of their assumption that loyalty could be attained from each other by working together in harsh market contexts.

Based on the preceding observations, we propose the following hypotheses:

\[ H_{5a}: \text{Environmental dynamism negatively moderates the relationship between the customer’s calculative commitment and customer participation.} \]

\[ H_{5b}: \text{Environmental dynamism positively moderates the relationship between the customer’s affective commitment and customer participation.} \]

The second potential moderator between relationship commitment and customer participation is process interdependence, which refers to the extent to which the completion of cooperative tasks depends on interactions between the seller and the customer (Sobrero & Roberts 2001). According to Von Hippel (1990), in the case of a high degree of process interdependence, both the seller’s and the customer’s inputs are important for finishing the task, and it is difficult or even impossible to partition the cooperation process into consequent but interrelated steps, such that each party completes certain tasks. In this situation, opportunism will stem from task ambiguity (John, 1984) because opportunistic behaviors are less likely to be identified and punished by the partner firm.
Besides, the expected return on investment in a joint task could hardly be accurately assessed. Therefore, firms with a high level of calculative commitment are induced to search for more interests and less costs by behaving in an opportunistic way and not spending enough company resources in inter-firm collaboration when conditions permit.

In contrast, when customers with a high degree of affective commitment engage in joint work with high process interdependence, they can better understand the need to communicate with the seller, exhibit responsible behavior, and strengthen cross-border personal interactions to benefit both parties. Actually, extensive interaction is prevalent, particularly in B2B contexts where the buyers’ and sellers’ value processes are closely interrelated and where the parties may directly influence each other (Grönroos, 2000). Value is then generated through the process of exchange, as affected by the relationship and interactions between the supplier and the customer (Grönroos, 2008).

As the state of attachment experienced as a feeling of allegiance or faithfulness (Collins et al., 1996; Gilliland & Bello, 2002), affective commitment represents the customer's affection for and obligation to the partner. It results from a strong sense of emotional loyalty and belongingness to the relationship (Lee et al., 2004). Such commitment, based not on economic motivations but on social and emotional sentiment (Gilliland & Bello, 2002; Kalleberg & Reve, 1992) desires to increase their investment in joint value-creation activities because they like the suppliers and enjoy the partnership through which they can better interact with the suppliers.

Based on the preceding observations, we propose the following hypotheses:

**H6a**: Process interdependence negatively moderates the relationship between the customer’s calculative commitment and customer participation.
H₆₆: Process interdependence positively moderates the relationship between the customer's affective commitment and customer participation.

The impact magnitude of relationship commitments on customer participation also depends on technological complexity, which refers to the extent to which the value co-creation task is technically complicated and requires the involvement of a wide range of organizational functions (Griffin, 1997). Prior research on organizational buying behavior shows that buying task complexity influences the decision making and behavior of customers (Johnston & Lewin, 1996; McQuiston, 1989). A B2B transaction often entails high complexity because of the number of persons involved, the monetary sacrifice associated with the purchase, and the significant amount of technical and economic information that must be considered. Complexity in B2B transactions may reflect a high level of technological requirements or sophisticated customized solutions (Backhaus et al., 2011).

According to Carbonell and Rodriguez (2006), technological complexity captures two aspects: newness of the technology embodied and technical difficulty involved in the task. These aspects potentially increase the perceived risk and uncertainty of the outcomes of and customer’s benefits from the joint project. Besides, as the degree of task complexity increases, it is generally necessary to improve coordination between partners by using a wide range of both formal (e.g., documentation) and informal (e.g., interaction, trust) mechanisms. For example, Toyota tends to rely more extensively on formal mechanisms for coordination (Morgan & Liker, 2006). However, the development of the hybrid car Toyota Prius involved major product and process development that forced the firm to use a wide range of coordination mechanisms (Magnusson & Berggren, 2001).

Customers with calculative commitment will be inclined to reduce their involvement in cooperation in order to minimize potential losses arising from the
outcome uncertainty. Also, customers could not behave properly under informal mechanisms because they lack trust and high-quality interactions with the seller. In contrast, affectively committed customers are more likely to increase their resource investment in the collaborative task because they consider the uncertain and difficult task brought about by technological complexity as a good platform they can contribute to the alliance’s long-term development, and they also perform better under the informal inter-organizational governance mechanism.

Based on these observations, we propose the following hypotheses:

**H7a:** Technological complexity negatively moderates the relationship between the customer’s calculative commitment and customer participation.

**H7b:** Technological complexity positively moderates the relationship between the customer’s affective commitment and customer participation.

4. **RESEARCH METHODOLOGY**

This section discusses the sampling and data collection activities of the current study and explains the measurement scales used.

4.1. **Sampling and Data Collection**

An e-mail survey of business managers was conducted to test the proposed model and hypotheses. A list of 2,000 business managers was purchased from a local market research company. It was decided that respondents should meet two qualifications:

1. Each respondent should work for a company that is a customer of industrial products or services.

2. Each respondent should be a mid-level or senior executive manager in his or her company so as to be familiar with the corporate strategy and policies of both the company and the supplier firm.
The 2,000 individuals on the list were contacted by e-mail to solicit their cooperation in the survey. They were informed of the academic purpose of the project and the confidentiality of their responses and were assured that they would receive a summary report of the results. In response, a total of 498 (24.9%) of those on the list agreed to participate. An e-mail survey was administered successfully to 418 of those agreeing to participate. After eliminating surveys with excessive missing data or contradictory answers, we obtained 376 complete responses, for a response rate of 18.8%.

Responses from early and late respondents were compared across select study constructs to assess the potential of non-response bias. The responses of early and late responders did not differ across any of the constructs tested. Consequently, it appears that non-response bias is not a serious concern in our study (Armstrong & Overton, 1977).

Respondents in the manufacturing industries included product managers, manufacturing managers, project managers, vice presidents of research and development, vice presidents of manufacturing, and so on. Respondents from the service industries were employed across a broad range of categories, including financial, general industrial software and electronic platforms, and management consulting.

A profile of the sampled companies is presented in Table 1.

4.2. Measurement Scales

Existing measures were used or adapted to suit the purposes of this study. All purified measures are seven-point Likert scales anchored by “strongly disagree” and “strongly agree.” The sources and description of the measures are presented in Table 2.

Among them, we evaluated interdependence structure by following the methods of Lusch and Brown (1996) and Ryu et al. (2011). Unilateral dependence – including seller’s dependence on the customer and the customer’s
dependence on the seller – were measured separately. After scale purification, we further calculated two dimensions of dependence structure in the following way. Total interdependence is the sum of two kinds of unilateral dependence, and interdependence asymmetry is the absolute value of the difference between the two. Then, we obtained the value of interdependence symmetry by subtracting the interdependence asymmetry from eight.

**Table 1**

Profile of Sampled Firms

<table>
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<tr>
<th>Characteristic</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Number of Employees</td>
<td></td>
</tr>
<tr>
<td>&lt;100</td>
<td>27.10%</td>
</tr>
<tr>
<td>100-500</td>
<td>31.90%</td>
</tr>
<tr>
<td>&gt;500</td>
<td>41.00%</td>
</tr>
<tr>
<td>Main Business Scope</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>60.10%</td>
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<tr>
<td>Services</td>
<td>39.90%</td>
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<tr>
<td>Age of Firm</td>
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<tr>
<td>&lt;10 years</td>
<td>45.20%</td>
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<tr>
<td>10-20 years</td>
<td>29.00%</td>
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<tr>
<td>&gt;20 years</td>
<td>25.80%</td>
</tr>
<tr>
<td>Ownership of Firm</td>
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<td>SOEs</td>
<td>17.80%</td>
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<tr>
<td>Private company</td>
<td>48.10%</td>
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<tr>
<td>Foreign investment company</td>
<td>29.30%</td>
</tr>
<tr>
<td>Others</td>
<td>4.80%</td>
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</tbody>
</table>
Table 2
Sources and Description of Measurement Scales

<table>
<thead>
<tr>
<th>Construct</th>
<th>Scale Source and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer’s dependence on seller</td>
<td>Adapted from scale developed by Fang et al. (2008) and Ryu et al. (2011) consisting of 3 items. All items retained after purification.</td>
</tr>
<tr>
<td>Seller’s dependence on customer</td>
<td>Adapted from scale developed by Fang et al. (2008) and Ryu et al. (2011) consisting of 3 items. All items retained after purification.</td>
</tr>
<tr>
<td>Calculative commitment</td>
<td>Adapted from scale used by Liu et al. (2010) consisting of 4 items. All items retained after purification.</td>
</tr>
<tr>
<td>Affective commitment</td>
<td>Adapted from scale used by Liu et al. (2010) consisting of 4 items. All items retained after purification.</td>
</tr>
<tr>
<td>Customer participation</td>
<td>Adapted from scale developed by Yi and Gong (2013) consisting of 3 dimensions: information sharing (4 items), responsible behavior (4 items), and personal interaction (4 items). All items retained after purification.</td>
</tr>
<tr>
<td>Environmental dynamism</td>
<td>Adapted from scale used by Jaworski and Kohli (1993) consisting of 3 items. All items retained after purification.</td>
</tr>
<tr>
<td>Process interdependence</td>
<td>Adapted from scale used by Fang et al. (2008) consisting of 5 items. Three items retained after purification.</td>
</tr>
<tr>
<td>Technological complexity</td>
<td>Adapted from scale used by Cannon and Perreault (1999) and Carbonell and Rodriguez (2006) consisting of 4 items. Three items retained after purification.</td>
</tr>
</tbody>
</table>
5. RESULTS

This section discusses the reliability and validity of the customer participation scale and the reliabilities and validities of other scales in this study. It also presents the results of the research hypotheses tests.

5.1. Reliability and Validity of Customer Participation Scale

First, we assessed the construct reliability and validity of all items pertaining to customer participation through second-order confirmatory factor analysis (as shown in Table 3 and Table 4). The constructs’ Cronbach’s α coefficients (0.93, 0.92, and 0.90) and the composite reliabilities (CRs) (0.93, 0.92, and 0.89) of information sharing, responsible behavior, and personal interaction indicate that each exceeds the accepted reliability threshold of 0.70. In addition, the average variances extracted (AVE) of these three sub-dimensions are 0.78, 0.74, and 0.67, respectively, which is higher than the 0.50 cutoff. Thus, the measures demonstrate adequate reliability.

In addition, the customer participation measure underwent a careful discussion and pilot study among researchers and EMBA students, so that its content validity can be guaranteed.

The results of second-order confirmatory factor analysis – including loadings and fit indices for the customer participation scale – indicate that the model fits the data well ($\chi^2=151.53$; $df=51$; $\chi^2/df=2.86$; GFI=0.94; NNFI=0.98; CFI=0.99; RMSEA=0.07; RMR=0.04). All first-order standardized loading coefficients, ranging from 0.76 to 0.93, and all second-order standardized loading coefficients, ranging from 0.75 to 0.85, are significant at the one-percent significance level (as shown in Table 4). Therefore, convergent validity of the customer participation scale is acceptable.

Finally, discriminant validity of the customer participation scale was assessed by comparing the square root of AVE associated with each sub-dimension to the correlations among constructs. Diagonal elements represent the square roots of the AVE, whereas the off-diagonal elements represent the
correlations among constructs. According to the results shown in Table 3, all the diagonal elements are larger than any other corresponding row or column entry. Therefore, the discriminant validity of sub-dimension is established.

5.2. Reliabilities and Validities of Other Scales

Next, we assessed the construct reliabilities and validities of all items pertaining to other constructs through first-order confirmatory factor analysis.

All the constructs’ Cronbach’s α coefficients (ranging from 0.81 to 0.91) and the composite reliabilities (CRs) (ranging from 0.83 to 0.91) indicate that each exceeds the accepted reliability threshold of 0.70. In addition, the average variances extracted (AVE) are greater than the 0.50 cutoff (ranging from 0.56 to 0.77). Thus, all the measures demonstrate adequate reliabilities.

In addition, all measures were subjected to a careful discussion and pilot study among researchers and EMBA students; hence, their content validity can be guaranteed.

The first-order CFA yields a model that fits the data well with NNFI, CFI, and IFI all exceeding 0.90 and the RMSEA below 0.08 ($\chi^2=167.11; \text{df}=81; \chi^2/\text{df}=2.06; \text{GFI}=0.95; \text{NNFI}=0.95; \text{CFI}=0.95; \text{RMSEA}=0.07; \text{RMR}=0.04$). All item loadings, ranging from 0.66 to 0.94, are significant at the one-percent significance level. Therefore, convergent validities of all measurement scales are acceptable.

Finally, discriminant validities of all scales were assessed by comparing the square root of AVE associated with each construct with the correlations among constructs. Diagonal elements represent the square roots of the AVE, whereas the off-diagonal elements represent the correlations among constructs. According to the results shown in Table 3, all the diagonal elements are larger than any other corresponding row or column entry. Therefore, the discriminant validities of all measures are established.
<table>
<thead>
<tr>
<th>(1) Information sharing</th>
<th>(2) Responsible behavior</th>
<th>(3) Personal interaction</th>
<th>(4) Customer’s dependence on seller</th>
<th>(5) Seller’s dependence on customer</th>
<th>(6) Credibility commitment</th>
<th>(7) Affective commitment</th>
<th>(8) Customer participation</th>
<th>(9) Environmental dynamism</th>
<th>(10) Process interdependence</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s α</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.48</td>
<td>0.68</td>
<td>0.59</td>
<td>0.85</td>
<td>-0.04</td>
<td>0.87</td>
<td>0.59</td>
<td>0.85</td>
<td>0.81</td>
<td>0.82</td>
<td>0.88</td>
<td>0.80</td>
<td>0.78</td>
<td>0.74</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*Diagonal elements in bold represent the square root of the AVE.*

*Off-diagonal elements (below the square root) represent the standardized correlations among constructs.*
Table 4
Second-Order CFA Results of Customer Participation Measurement Scale

<table>
<thead>
<tr>
<th>Second-Order Latent Variables</th>
<th>First-Order Latent Variables</th>
<th>Observed Variables</th>
<th>Second-Order SLC (t-Value)</th>
<th>First-Order SLC (t-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Participation</td>
<td>Information Sharing</td>
<td>1. Our company keeps the supplier informed about what is happening in the market.</td>
<td>0.85(16.80)</td>
<td>0.91(-)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Our company clearly explains the detailed requirements for the products and services to the supplier.</td>
<td></td>
<td>0.79(22.18)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Our company provides necessary information so that the supplier could perform its duties.</td>
<td></td>
<td>0.89(29.36)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Our company actively answers the questions about our business presented by the supplier.</td>
<td></td>
<td>0.88(28.48)</td>
</tr>
<tr>
<td></td>
<td>Responsible Behavior</td>
<td>1. Our company seriously performs the tasks requested by the supplier.</td>
<td>0.84(16.99)</td>
<td>0.93(-)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Our company fully fulfills all our responsibilities.</td>
<td></td>
<td>0.89(30.16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Our company adequately completes all the expected behaviors.</td>
<td></td>
<td>0.87(29.19)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Our company follows directives or orders from employees of the supplier.</td>
<td></td>
<td>0.76(21.04)</td>
</tr>
<tr>
<td></td>
<td>Personal Interaction</td>
<td>1. Our employees are friendly to supplier's employees.</td>
<td>0.75(13.53)</td>
<td>0.86(-)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Our employees interact with supplier's employees actively.</td>
<td></td>
<td>0.86(21.24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Our employees have good personal relationships with supplier's employees.</td>
<td></td>
<td>0.77(17.68)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Our employees give praise to supplier's employees when they provide excellent products or services.</td>
<td></td>
<td>0.85(20.85)</td>
</tr>
</tbody>
</table>

χ²=151.53; df=51; χ²/df=2.86; GFI=0.94; NNFI=0.98; CFI=0.99; RMSEA=0.07; RMR=0.04  SLC: standardized loading coefficient
<table>
<thead>
<tr>
<th>Latent Variables</th>
<th>Observed Variables</th>
<th>SLC (t-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer's dependence on seller</td>
<td>1. Our company is quite dependent on this supplier.</td>
<td>0.83(19.26)</td>
</tr>
<tr>
<td></td>
<td>2. If this relationship ended, our company would face a significant loss.</td>
<td>0.91(21.94)</td>
</tr>
<tr>
<td></td>
<td>3. The supplier provides vital resources our company would find difficult to obtain elsewhere.</td>
<td>0.81(18.31)</td>
</tr>
<tr>
<td>Seller's dependence on customer</td>
<td>1. This provider is quite dependent on our company.</td>
<td>0.86(20.24)</td>
</tr>
<tr>
<td></td>
<td>2. If this relationship ended, the supplier would face a significant loss.</td>
<td>0.94(23.46)</td>
</tr>
<tr>
<td></td>
<td>3. Our company provides vital resources this supplier would find difficult to obtain elsewhere.</td>
<td>0.84(19.68)</td>
</tr>
<tr>
<td>Calculative commitment</td>
<td>1. We wish to keep the relationship with this supplier because we can purchase satisfactory offering from them.</td>
<td>0.77(16.63)</td>
</tr>
<tr>
<td></td>
<td>2. We want to keep the relationship with this supplier because it is difficult to find similar suppliers.</td>
<td>0.75(15.97)</td>
</tr>
<tr>
<td></td>
<td>3. We hope to maintain the relationship with this supplier because establishing new relationship requires much more resources.</td>
<td>0.79(17.19)</td>
</tr>
<tr>
<td></td>
<td>4. We need to keep the relationship with this supplier because ending the relationship will bring us heavy losses.</td>
<td>0.66(13.49)</td>
</tr>
<tr>
<td>Affective commitment</td>
<td>1. We intend to continue working with this supplier because we feel like they are “part of the family”.</td>
<td>0.87(20.48)</td>
</tr>
<tr>
<td></td>
<td>2. We do not want to terminate relationship with this supplier even if other suppliers provide much better conditions.</td>
<td>0.78(17.54)</td>
</tr>
<tr>
<td></td>
<td>3. We have similar business values with this supplier so we want keep relationship with them.</td>
<td>0.75(16.43)</td>
</tr>
<tr>
<td></td>
<td>4. Our loyalty to this supplier is a major reason our company continue to work with them.</td>
<td>0.83(19.92)</td>
</tr>
<tr>
<td>Environmental dynamism</td>
<td>1. In our kind of business, customers' product preferences change quite a bit over time.</td>
<td>0.82(18.16)</td>
</tr>
<tr>
<td></td>
<td>2. Competition in our industry is cutthroat.</td>
<td>0.89(20.42)</td>
</tr>
<tr>
<td></td>
<td>3. The technology in our industry is changing rapidly.</td>
<td>0.78(17.15)</td>
</tr>
<tr>
<td>Process interdependence</td>
<td>1. The joint task depends on our cooperation with this supplier to a large extent.</td>
<td>0.83(17.38)</td>
</tr>
<tr>
<td></td>
<td>2. The joint task requires both the supplier and us to coordinate each other's effort through all the stages.</td>
<td>0.79(16.57)</td>
</tr>
<tr>
<td></td>
<td>3. The completion of the joint task requires both the supplier and us to consult with each other frequently.</td>
<td>0.69(13.99)</td>
</tr>
<tr>
<td>Technological complexity</td>
<td>1. There is high degree of newness of the technology embodied in the joint project.</td>
<td>0.86(20.42)</td>
</tr>
<tr>
<td></td>
<td>2. Technical difficulty involved in the cooperative task is significant.</td>
<td>0.93(23.14)</td>
</tr>
<tr>
<td></td>
<td>3. The joint project between the supplier and our company is difficult to understand.</td>
<td>0.84(19.60)</td>
</tr>
</tbody>
</table>

χ²=167.11; df=81; χ²/df=2.06; GFI=0.95; NNFI=0.95; CFI=0.95; RMSEA=0.07; RMR=0.04

SLC: standardized loading coefficient
5.3. Results of Research Hypotheses Tests

We used the hierarchical regression technique to examine the main effects, interaction effects, and moderating effects in our research model.

Table 6 indicates the results of the research hypotheses tests regarding the link between the interdependence structure and customer’s relationship commitments (H₁, H₂, H₃).

Table 7 shows the results of the hypotheses tests regarding the link between the customer’s relationship commitments and customer participation (H₄, H₅, H₆, H₇). The variance inflation factors in all regression models are below two, indicating that multicollinearity is not a serious problem in this study.

There are three models for each dependent variable in Table 6. At the first stage, only two control variables (company scale and company age) are included in the regression analysis (Model 1a and Model 1b). The results indicate that company scale explains no variations in two forms of customer’s relationship commitments with these survey data. Besides, company age positively impacts calculative commitment (β=0.12, t=2.21) and affective commitment (β=0.18, t=3.30), for the regression coefficients are significantly positive at 0.05 level.

The second regressions (Model 2a and Model 2b) add two independent variables. The results, shown in Table 6, indicate that total interdependence positively impacts customer’s calculative commitment (β=0.34, t=7.04) and affective commitment (β=0.35, t=7.40). Therefore, H₁a and H₁b are supported. In addition, the two models also indicate that the negative impact of interdependence symmetry on calculative commitment (β=-0.08, t=-1.71) is marginally significant (at 0.10 level), and that its positive effect on affective commitment (β=0.14, t=3.01) is significant at 0.05 level, thus supporting both H₂a and H₂b.
<table>
<thead>
<tr>
<th></th>
<th>②Dependent Variable: Calculative Commitment</th>
<th>②Dependent Variable: Affective Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1a</td>
<td>Model 2a</td>
</tr>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company scale</td>
<td>0.05(0.97)</td>
<td>0.02(0.39)</td>
</tr>
<tr>
<td>Company age</td>
<td>0.12*(2.21)</td>
<td>0.11*(2.09)</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total interdependence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.34*** (7.04)</td>
<td>0.31*** (6.04)</td>
</tr>
<tr>
<td>Interdependence symmetry</td>
<td>-0.08* (-1.71)</td>
<td>-0.06* (-1.25)</td>
</tr>
<tr>
<td><strong>Interaction Term</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total interdependence ×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interdependence symmetry</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.12* (2.38)</td>
<td></td>
</tr>
<tr>
<td><strong>VIF (≤)</strong></td>
<td>1.16</td>
<td>0.99</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.02</td>
<td>0.14</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.02</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>F-value</strong></td>
<td>4.29*</td>
<td>15.22***</td>
</tr>
</tbody>
</table>

*: p<0.1; *: p<0.05; **: p<0.01; ***: p<0.001
The third regressions (Model 3a and Model 3b) shown in Table 6 add the interaction term. The two independent variables were mean-centered before we calculated the interaction terms to avoid multicollinearity interference. The results show that the interaction between total interdependence and interdependence symmetry has a significantly positive impact ($\beta=0.12$, $t=2.38$) on customer’s calculative commitment and marginally positive impact ($\beta=0.09$, $t=1.91$) on customer’s affective commitment. Hence, $H_{3a}$ and $H_{3b}$ are supported by the survey data.

Further regression analysis was conducted to examine the effects of one party’s dependence on the other (i.e., customer’s dependence on seller and seller’s dependence on customer) on two forms of relationship commitments (the process is omitted for simplicity). The results show that the customer’s dependence on the seller has a significant and positive impact on calculative commitment ($\beta=0.48$, $t=10.47$), whereas the seller’s dependence on the customer has no significant effect on calculative commitment ($\beta=0.03$, $t=0.58$). Therefore, the more dependent the customer is on the seller, the higher the customer’s calculative commitment. In addition, affective commitment is positively impacted by both the customer’s dependence on the seller ($\beta=0.33$, $t=6.82$) and the seller’s dependence on the customer ($\beta=0.19$, $t=4.16$).

The hypotheses test results regarding the link between relationship commitments and customer participation are presented in Table 7. The first regression analysis (Model 4), which contains only two control variables (company scale and company age), shows that these two factors individually and collectively explain no variations in customer participation with the survey data.

The second regression (Model 5), which adds two independent variables, indicates that both calculative commitment ($\beta=0.39$, $t=8.34$) and affective commitment ($\beta=0.33$, $t=7.00$) positively impact customer participation, supporting $H_{4a}$ and $H_{4b}$.
<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company scale</td>
<td>0.07 (1.24)</td>
<td>0.06 (1.37)</td>
<td>0.06 (1.25)</td>
<td>0.06 (1.32)</td>
</tr>
<tr>
<td>Company age</td>
<td>0.05 (0.85)</td>
<td>-0.06 (-1.30)</td>
<td>-0.04 (-0.87)</td>
<td>-0.05 (-1.09)</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculative commitment</td>
<td>0.37*** (8.34)</td>
<td>0.35*** (7.44)</td>
<td>0.30*** (6.42)</td>
<td></td>
</tr>
<tr>
<td>Affective commitment</td>
<td>0.33*** (7.00)</td>
<td>0.33*** (5.01)</td>
<td>0.34*** (7.38)</td>
<td></td>
</tr>
<tr>
<td><strong>Moderating Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental dynamism</td>
<td></td>
<td>0.15* (3.44)</td>
<td>0.14* (3.36)</td>
<td></td>
</tr>
<tr>
<td>Process interdependence</td>
<td></td>
<td>0.26*** (5.80)</td>
<td>0.25*** (5.78)</td>
<td></td>
</tr>
<tr>
<td>Technological complexity</td>
<td></td>
<td>0.05 (1.22)</td>
<td>0.07* (1.66)</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction Terms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculative commitment × Environmental dynamism</td>
<td></td>
<td></td>
<td>-0.20*** (-4.61)</td>
<td></td>
</tr>
<tr>
<td>Affective commitment × Environmental dynamism</td>
<td></td>
<td></td>
<td>0.08* (1.81)</td>
<td></td>
</tr>
<tr>
<td>Calculative commitment × Process interdependence</td>
<td></td>
<td></td>
<td>-0.25*** (-5.75)</td>
<td></td>
</tr>
<tr>
<td>Affective commitment × Process interdependence</td>
<td></td>
<td></td>
<td>0.01* (2.34)</td>
<td></td>
</tr>
<tr>
<td>Calculative commitment × Technological complexity</td>
<td></td>
<td></td>
<td>-0.15* (-3.35)</td>
<td></td>
</tr>
<tr>
<td>Affective commitment × Technological complexity</td>
<td></td>
<td></td>
<td>0.04 (0.76)</td>
<td></td>
</tr>
</tbody>
</table>

VIF (≤) 1.02 1.00 0.98 0.99
R² 0.01 0.36 0.38 0.41
Adjusted R² 0.01 0.35 0.37 0.40
F-value 1.77 52.12*** 45.27*** 37.05***

*: p<0.1; *: p<0.05; **: p<0.01; ***: p<0.001
The third regression (Model 6) shown in Table 7 adds three moderating variables. The results indicate that environmental dynamism ($\beta=0.15$, $t=3.44$) and process interdependence ($\beta=0.26$, $t=5.80$) have significantly positive impacts on customer participation, but technological complexity has no significant effect ($\beta=0.05$, $t=1.22$).

The fourth regression (Model 7) adds two-way interaction terms of two kinds of relationship commitments and three moderators. To avoid multicollinearity interference, all the independent variables and moderator variables were mean-centered before we calculated the interaction terms. The results, shown in Table 7, indicate that the standardized coefficients of the interaction terms of calculative commitment and three moderators are all significantly negative at 0.001 level ($\beta$ values are between -0.25 and -0.15, and $t$-values are between -5.75 and -3.35), thus supporting $H_{5a}$, $H_{6a}$, and $H_{7a}$.

In addition, the positive moderating role of environmental dynamism in the affective commitment and customer participation link is marginally significant, a finding that supports $H_{5b}$.

The standardized coefficient of the interaction term of customer affective commitment and process interdependence is significantly positive at 0.05 level ($\beta=0.01$, $t=2.34$), providing empirical support for $H_{6b}$.

Finally, the coefficient of the interaction between affective commitment and technological complexity is not significant. Therefore, $H_{7b}$ is not supported by the study data.

6. CONCLUSIONS, MANAGERIAL IMPLICATIONS, AND LIMITATIONS OF THE STUDY

This section presents the conclusions of the current study, discusses the managerial implications and limitations of the study, and offers suggestions for future research directions.
6.1. Conclusions

Customer participation (i.e., the customer’s contribution of labor or resources to the creation of offerings) has been one of the central themes in marketing and management research for the last 40 years (Mustak et al., 2013). Most of the research, however, focuses primarily on the customer participation issue in B2C contexts, without paying enough attention to industrial settings. Furthermore, most papers take the seller’s view by discussing why firms are willing and how they are able to involve customers in value co-creation activities. Among the limited number of studies that do explore how customers are encouraged to participate, very few examine the drivers of customer participation from the perspective of inter-organizational relationships (except for Ritter & Walter, 2003). The literature offers little knowledge on the extent of connection between inter-firm dependence structure and customer participation and the potential mediators and moderators in this link.

The results of the current study are an important contribution to the literature in three ways.

1. The results underscore practitioners' observations about the trade-off effect between customers’ relationship commitments and the further impact degree of customer participation and suggest a theoretical explanation of how interdependence structures contribute to this effect.

2. The study explores the relationship commitments theory for explaining the affection of customer participation by sellers and buyers. The current research highlights this point by introducing customer participation into business-to-business (B2B) firms.

3. The study enhances the understanding of relationship marketing in Chinese business. Additional research should follow this line of inquiry by examining the contingency effects of customer participation for other types of inter-organizational business relationships.
This study posited several hypotheses. Only one (H7b) was not supported by the survey data; that is, the positive moderating role of technological complexity in the customers’ affective commitment and customer participation link is not significant. The possible reason for this finding is that customer participation not only is determined by the willingness of customers to participate, but also is impacted by their ability to participate. When affectively committed customers feel obliged to engage more actively in the seller’s business activities, the actual degree to which the customer can participate depends ultimately on the customer’s technological expertise and competence, which is more demanding when the value-creation task is technologically complex.

6.2. Managerial Implications

The research findings of this paper can help managers of B2B firms better understand the conditions under which their customers would be more willing to participate in the firms’ value-creation activities. In this regard, there are two important points.

1. B2B firms should try to gain maximum benefits from cooperating with customers by properly matching two forms of customers’ relationship commitments with three kinds of moderators. The research findings of this paper indicate that customer’s calculative and affective commitments can both improve customer participation. However, the moderators play opposite roles in the commitments and participation link. Therefore, firms should leverage different kinds of customers’ relationship commitments under different environmental and task conditions. More specifically, in the context of a high level of environmental dynamism and process interdependence, firms need to pay special attention to developing customers’ affective commitment because the trust and loyalty of customers are particularly relevant in terms of inducing them to become involved in joint programs.
In contrast, in a comparatively stable market environment, or for tasks with a low degree of process interdependence and technological complexity, firms need to better leverage customers’ calculative commitment. Their commitment improves customer participation to a greater extent by emphasizing the potential net economic benefits that the project could bring to customers.

2. Inter-firm dependence structure could be considered by B2B firms as a useful way to cultivate different kinds of customers’ relationship commitments. More specifically, firms should try to increase their total interdependence level, which would help improve the degree of customers’ relationship commitments, both calculative and affective, and would positively moderate the link between interdependence symmetry and customers’ commitments in various ways such as increasing relationship-specific investments in terms of physical assets and human resources.

Furthermore, the history of cooperation and times of transactions also determine the degree of interdependence (Dyer & Singh, 1998). Therefore, firms should carefully assess customers and choose those who have a long history of cooperation and frequent transactions as major partners. In addition, firms could improve customers’ calculative commitment by enlarging interdependence asymmetry while developing customers’ affective commitment by keeping interdependence balance.

Various forms of powers, including coercive and non-coercive, could be used by the firm to change the state of interdependence symmetry. In particular, the results of additional regression analysis show that it is the customer’s dependence on the seller, not the seller’s dependence on the customer, that has a significant and positive impact on calculative commitment. Therefore, firms should improve customers’ calculative
commitment, if the moderating variables suggest so, by making every effort to increase its powers against the customers.

Overall, making customers more willing to participate in a firm’s value-creation activities is a complex task. Successfully managing the promotion of customer participation for a firm involves three interrelated processes:

1. Evaluating environmental dynamism and task-specific characteristics, including process interdependence and technological complexity

2. Properly matching two forms of customer relationship commitments with the above-mentioned moderators in order to encourage customer participation

3. Leveraging total interdependence and interdependence symmetry to cultivate appropriate kinds of customer’s relationship commitments.

6.3. Limitations of Study and Future Research Directions

This study has some theoretical and methodological limitations that provide meaningful directions for future research.

By taking the inter-organizational perspective, extant literature lacks sufficient discussion about customer participation. The present study narrows this research gap by examining how firms can stimulate customers to participate by leveraging two dimensions of interdependence structure. Still, there should be other potential inter-firm relationship variables that have the potential to impact customer participation intention.

In addition, as mentioned in the conclusions, the level of customer participation is determined by the customer’s ability to participate. Therefore, future research could examine the impacts of other inter-firm relationship variables, such as relational learning (Selnes & Sallis, 2003), or alliance-level relational capabilities (Capaldo & Petruzzelli, 2011) on customer’s willingness.
and capability to participate. Other moderating variables could also be included in the conceptual framework, so that the research findings would provide more insightful implications for B2B managers for taking a contingent view to manage customer participation activities.

The present study also has some limitations in terms of research methodology. The sampled firms were drawn from a variety of industries. However, a homogenous sample may provide deeper insights into the relations addressed in our conceptual model. In this vein, future studies could investigate specific industries, such as high-tech manufacturers or professional service companies. There are also other inevitable problems that are inherent in survey research, such as inability to determine causality. These deserve careful attention when interpreting the findings.

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