

Influence of customer participation on creating and sharing of new product value

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Abstract This research applies an institutional arrangement perspective to develop an end-to-end model for the interaction between customers and upstream suppliers to develop a new product to understand how new product value is created and shared. The model is empirically tested by collecting primary data from 188 manufacturers across different industries. The research demonstrates that customer participation affects new product value creation by improving the effectiveness of the new product development process by enhancing information sharing and customer–supplier coordination and by increasing the level of customer and supplier specific investments in the product development effort. In addition, increasing the formalization of the customer participation process enhances both customer and supplier relationship-specific investments in the new product development process. The impact of customer participation on the customer's share of the new product value pie is more complex than is first apparent. Based on the dependence and equity perspectives the results suggest that exchange partners' power (relative dependence) positively influences a partner's ability to

capture new product value, but this power is offset by a desire of exchange partners to ensure the distribution of value is “fair” and reflects each party's contribution to the value creation.

Keywords New product development · Dependence · Equity · Customer participation · Relationship marketing · Institutional arrangement · Innovation

Utilizing new product development and innovation strategies to generate competitive advantage and superior financial performance have become widespread in the past decade, but many of these new products fail to meet expectations (Henard and Szymanski 2001). One commonly identified cause is that the information regarding the “need” resides within the customer, while the information regarding “the solution” is in the seller's domain (Henard and Szymanski 2001; Zipkin 2001). For example, the failure of Corning's optical fiber new product development in early 2000 was attributed largely to its failure to match their product to the customer needs (BusinessWeek 2006). Thus, closely linking the customer to the seller during the development process is argued to be a key success factor in new product development (Terwiesch and Loch 1999). Traditionally, in business markets, the impetus is for upstream suppliers to ask their customers to participate in the new product development (NPD) process, but more recently, customers are recognizing that they need to proactively become involved in their supplier's product development efforts to reduce costs and improve their product performance. For example, instead of being merely a passive buyer of components, Dell is a close participant in its vendors' development of new materials and parts. Prahalad and Ramaswamy (2000: 80) have called attention to this emerging trend, “customers are fundamentally

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changing the dynamics of the marketplace. The market has become a forum in which consumers play an active role in creating and competing for value.” Thus, both suppliers and customers are recognizing the advantage of and are pushing for close customer participation in suppliers' NPD process to create valuable new products, but along with this new awareness, customers are now demanding their share of the created value. Understanding the role of customer participation in the creation and sharing of new product value and the ultimate new product value obtained by the customer is the key focus of this paper; more specifically, we address three research questions:

- How does customer participation in the NPD process affect the size of the new product value pie?
- How does implementation of customer participation affect new product value creation?
- How is the customer's share of the new product value pie determined?

With regard to the first research questions, managerial practice supports the notion that customer participation improves suppliers' NPD performance but leaves the mechanisms of value creation unclear. This research demonstrates that customer participation affects new product value creation by improving the effectiveness of the NPD process by enhancing information sharing and customer–supplier coordination and by increasing the level of customer and supplier specific investments in the product development effort. Thus, the research contributes by explicating the mediating mechanisms by which customer participation drives new product value creation providing a foundation for further research aimed at improving the success of NPD.

We investigate how formalization of the customer process leverages the effects of customer participation on the drivers of new product value creation to inform the second question. Results suggest that increasing the formalization of the customer participation process enhances both customer and supplier relationship-specific investments in the NPD process. Moreover, it provides managerial direction on how the process of customer participation can be implemented to increase its impact.

The impact of customer participation on the customer's share of the new product value pie is more complex than is first apparent. Based on the dependence and equity perspectives the results suggest that exchange partners' power (relative dependence) positively influences a partner's ability to capture new product value, but this power is offset by a desire of exchange partners to ensure the distribution of value is “fair” and reflects each party's contribution to the value creation. In addition, we find customers face a tradeoff, where making specific investments in the NPD increases the overall size of the new

product pie, but also increases the customer's dependence lowering their share of the pie *ceteris paribus*.

This research applies an institutional arrangement perspective (Carson et al. 1999) to develop an end-to-end model for the interaction between a customer participating with an upstream supplier to develop a new product to understand how new product value is created and shared. This model is empirically tested by collecting primary data from 188 OEMs across different industries. In the following sections, we first develop our conceptual model and present individual hypotheses. Second, the empirical context of the research, data collection procedures, measurements, and the analysis of the model are discussed. Finally, we present the results and discuss the theoretical and managerial implications, research limitations, and future research directions.

Customer participation: an institutional arrangement perspective

The perspective of institutional arrangement is a theoretical framework that focuses on understanding why and how firms engage with other firms. Institutional arrangements include any type of contracting, ownership, or engagement in which firms seek to build or maintain an exchange and/or relationship (Davis and North 1971). Specifically, this perspective suggests that businesses will engage in value creating institutional relationships *only when* the exchange supports the allocation of benefits such that the joint benefit maximization is aligned with the maximization of firm-owned benefits (Carson et al. 1999). As Ghosh and John (1999: 133) argue, firms “will implement the activities associated with larger joint value if, and only if, their own share of the joint value also exceeds their previous profits.”

Two key elements in institutional arrangements contribute to the firm-owned benefit maximization (Carson et al. 1999). First, the new set of joint activities implemented by the partners' creates value, which affects the *size of the value pie*. Second, the joint benefits are shared between relevant partners to compensate for engagement in these activities such that each partner receives a *share of the value pie*. The institutional arrangement offers a valuable perspective to understand the value obtained by a customer from participating in a supplier's NPD process, since it integrates both value creation and sharing.

More specifically, applying the institutional arrangement perspective to an interaction between a customer participating with an upstream supplier to develop a new product suggests that both the size of the new product value pie and the customer's share of the pie will be critical to understanding how much value will be obtained by the customer and their willingness to participate. Thus, while

the research on new product development (NPD) is consistent in promoting the benefit to suppliers in having customers participate in the product development process little research has focused on understanding this phenomena from the customers perspective (Srivastava et al. 1999). This is critical since only by understanding the ultimate value obtained by the customer will suppliers understand how to gain their support in the NPD process and maximize the impact of their participation.

Understanding how customer participation influences the size of the new product value pie and the customer's share is more complex in the NPD context than is first apparent since some of the drivers of pie size may also affect the share received. Thus, participants must evaluate the tradeoff in expanding the size of the new product pie against potentially reducing their share of the value captured. In essence, customers are both collaborators and competitors when participating in a supplier's NPD project (Pralhad and Ramaswamy 2000). As a collaborator, the customer shares pertinent information with the supplier, coordinates activities, and integrates and adapts engineering and manufacturing processes to those of the supplier, thereby significantly improving the value of the product (Lengnick-Hall 1996; Dyer and Singh 1998). As a competitor, due to the self-interest nature of the parties seeking to maximize their individual benefits, the customer negotiates with the supplier over the pricing, delivery, and other terms of the new products, thus affecting how the created value is shared (Lengnick-Hall 1996; Jap 2001; Wernerfelt 2005). For example, a customer's investment in a supplier's product development effort may result in a more valuable new product, but these same investments may increase the customer's dependence on the supplier, reducing their

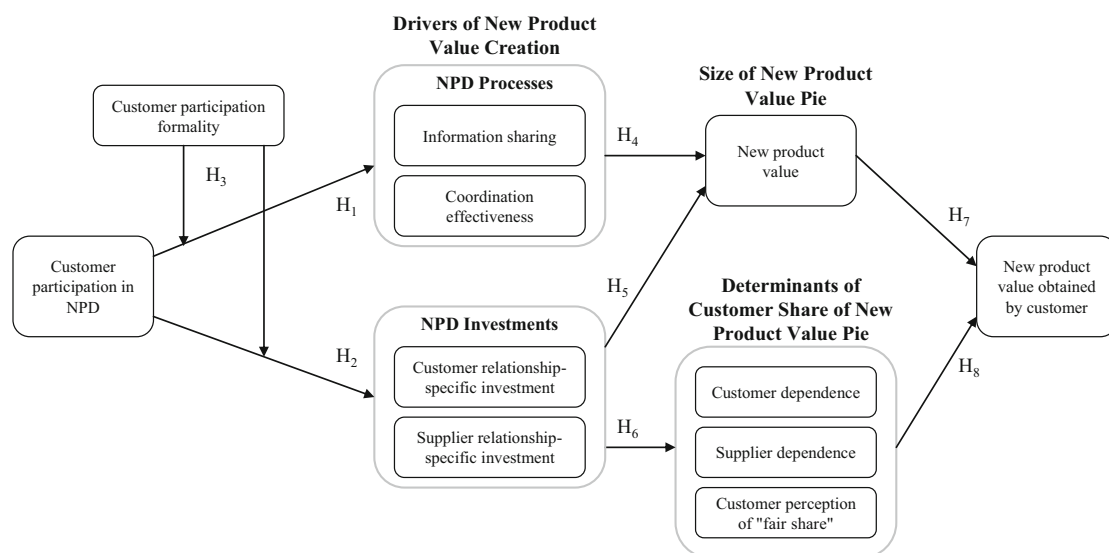
ultimate share of the new product value (due to less negotiation power).

Next, we develop a conceptual model for the impact of customer participation in the NPD process on the ultimate value obtained by the customer (Fig. 1). First, we investigate how customer participation influences the drivers of new product value creation (NPD processes and NPD investments) and explore how these effects may be leveraged. Second, consistent with the institutional arrangement perspective we investigate how the drivers of new product value creation impact the size of the new product value pie and the customer's share of this pie, and ultimately, the new product value obtained by the customer.

Effect of customer participation on drivers of new product value creation

Customer participation refers to both the breadth and depth of the customer's involvement in the NPD process. Breadth captures the scope of participation across the product development process, where a customer could be involved in just one activity (e.g., product testing) or in a wide range of activities from new concept generation, prototyping, up to and including product testing. Depth represents the customer level of involvement in a phase of the product development process, where some customers may only be superficially involved and other may be deeply involved. The level of customer participation can play a role in the key drivers to new product value creation, the NPD process, and the level of resources invested in the NPD (Dyer and Singh 1998; Sobrero and Roberts 2001).

Researchers have proposed that customer participation affects a supplier's NPD process by increasing the level of



Notes: NPD = new product development.

Figure 1 Influence of customer participation on creating and sharing new product value.

information shared during the NPD process, and by improving how well two firms coordinate their actions during the NPD process or coordination effectiveness (Dyer and Singh 1998; Larson 1992). *Information-sharing* refers to the extent to which two partners effectively exchange critical information about the product idea, market, and competition, among other issues, during the NPD process, and *coordination effectiveness* is the extent to which the two partners effectively work together in order to accomplish a collective set of tasks during the NPD process (Jap 1999; Van de Ven et al. 1976).

Customer participation enhances both parties' ability to identify what information needs to be shared and how to work more cooperatively. When a customer participates in a supplier's NPD process, each party knows the pertinent knowledge possessed by the other, which helps them evaluate and recognize what information to share and increases the efficiency of their coordination effort (Dyer and Singh 1998; Larson 1992). Researchers have found that customers' early involvement in the NPD process and higher levels of social interaction between the parties improve the information intensity, frequency, and breadth (Celly and Frazier 1996). Most research argues for the positive effects of customer participation on NPD, but it is possible that if the interaction is dysfunctional or leads to conflict then higher levels of involvement could be detrimental and offset some of the expected benefits. In aggregate, we expect that higher levels of customer participation improves communication, and helps both the customer and supplier specify the behaviors desirable in the relationship, which enhances the effectiveness of coordination efforts (Kogut and Zander 1996; Vli-Renko et al. 2001). Thus, we hypothesize that:

H₁: In aggregate, customer participation in NPD positively affects (a) information sharing and (b) coordination effectiveness.

Customer participation in the NPD process will positively affect customer and supplier's relationship specific investments since the higher levels of interaction associated with customer participation provide more opportunity for uncovering high return opportunities motivating investments. In addition, closer interaction between suppliers and customers enhance relational bonds and provides more opportunity to monitor behaviors, both of which decrease the risk associated with making specific investments. *Relationship-specific investments* are non-fungible investments that uniquely support the customer–supplier relationship (Williamson 1985); these investments can be physical assets, such as specialized design tools and engineering processes for a customized new product, or human assets, such as task-specific training relevant to customer preferences or manufacturing competencies. Lai (1990) suggests

that close interactions enhance both parties ability to uncover investment opportunities and increases confidence to make investments by suppressing opportunistic behaviors associated with specific investments. It must also be recognized that closer interactions may uncover information that could undermine a partner's desire to make investments. Overall, this negative effect may offset some of the benefits of increased customer participation. Customer participation provides both parties with opportunities to closely monitor each other's behavior and performance during various stages of the NPD process, which serves as a mechanism to safeguard past investments and promotes additional investments (Heide and John 1990). Therefore, we expect that:

H₂: In aggregate, customer participation in NPD positively affects relationship specific investments by the (a) customer and (b) supplier.

Leveraging the effect of customer participation

We expect customer participation to have an overall positive impact on NPD process and the level of new product focused specific investments, but how a management team implements the customer participation process may enhance these effects. *Customer participation formality* represents the extent to which the customer participation in the NPD process follows specific rules and procedures (Zaltman et al. 1973). Formalization of decision-making processes enhances the likelihood that the partners will act cooperatively and not opportunistically since roles and responsibilities are more clearly defined (Das and Teng 1998), and thus, promotes risk-taking behaviors. Griffin (1997) suggests that a formalized development process involving the customer is more likely to improve the effectiveness of the NPD process. Therefore, more formalized customer participation should facilitate information sharing and resource investment and higher levels of cooperation among customers and suppliers. In sum, we hypothesize that:

H₃: In aggregate, the affect of customer participation on (a) information sharing, (b) coordination effectiveness, (c) customer relationship specific investment, and (d) supplier relationship specific investment are greater under high customer participation formality than under low customer participation formality.

Effects of NPD processes and investments on the size of new product value pie

Cooper and Kleinschmidt (1995) have identified communication between the supplier and customer regarding

customer preferences as a key prerequisite for new product value creation. Research on the formation of customers' new product preferences suggest that these preferences and needs evolve through the customer's engagement with specific new product ideas, concepts, and prototypes across the NPD stages (Hamel and Prahalad 1994; Huber 1991; Prahalad and Hamel 1990). Constant information sharing helps suppliers to probe and learn how customer needs evolve and emerge during the NPD process. Moreover, information shared by the supplier with the customer about the cost structure and production and engineering options help customers realize constraints and, thereby, make appropriate adjustments in their preferences for new products (Joshi and Sharma 2004). Due to information sharing, customers and supplier are better able to discover unique competencies and value creating opportunities. Thus, information sharing between supplier and customer should increase the size of the new product value pie.

In order to take advantage of each parties individual competencies, suppliers and customers must coordinate their efforts (through a regular pattern of similar or complementary actions) to increase the effectiveness of their interactions across the different stages in the NPD process (Anderson and Narus 1990). For example, in the product specification stage, suppliers and customers must develop product specifications of the new product to both fit customers' needs and control development costs (Iyer et al. 2005).

Customer-focused new product develop typically requires unique adaptation by both the supplier and customer, these adaptations are often reflected as relationship-specific investments where specific changes are only usable with a specific partner. Empirically, a manufacturer's physical asset specificity has been found to enhance new product improvements in engineering efficiency, fit with customer needs, and product quality (Nishiguchi 1994). A customer's physical investments, such as specific product line engineering modifications, are expected to improve the new product integration with the production line and potentially enhance the quality and reduce the engineering and manufacturing costs of the product (Walter 2003). Moreover, human asset specificity allows suppliers and customers to speak the same "language" and reduce communication errors, thereby enhancing the product's speed to market (Dyer 1996). Consistent with the literature, relationship specific investment by both customers and suppliers are expected to increase the ultimate value of a new product. Thus, we hypothesize that:

H₄: New product value is positively affected by (a) information sharing and (b) coordination effectiveness.

H₅: New product value is positively affected by (a) customer relationship specific investment and (b) supplier relationship specific investment.

Determinants of customer share of new product value pie

It is in the best interest of both the supplier and the customer to maximize the overall value of the new product, but only to the degree that they are able to capture a share of this value (Carson et al. 1999). For example, if the supplier increases the price of the new product to match the "value created" then the customer may actual receive no return on their participation in the NPD process. Thus, a key question is what determines the customer's share of the new product value pie?

Researchers have utilized dependence and equity perspectives to understand how jointly created value will be shared (Ghosh and John 1999). The *dependence* of a firm in a business relationship is the firm's need to maintain a relationship with a partner (Emerson 1962; Frazier 1983) and is determined, to a large extent, by how difficult it would be to replace that partner (Heide and John 1988). Thus, the difference in dependence between the two firms determines the power each partner has in the negotiation process and will impact their share of the new product value (Ganesan 1994; Heide and John 1988). In interorganizational relationships, based on the equity principle, the use of power is often mitigate by a desire to ensure the distribution of value is "fair" and reflects each party's contribution to the value creation (Bolton 1991; Corsten and Kumar 2003). For example, a supplier wants to ensure the customer perceives their share as fair to maintain good relationship quality and continuity in the relationship. *Customer perception of their "fair share"* is the customer's evaluation of the share they would judge as fair when comparing their ratio of inputs and outputs to the ratio of the supplier's inputs and outputs (Adams 1965). Research supports that both of these mechanisms operate to determine the ultimate share received by each partner, where power drives the pursuit of more absolute value, and fairness drives the value allocation toward equity (but not necessarily equality) between the two bargainers (Iyer and Villas-Boas 2003; Kagel et al. 1996).

While dependence is often modeled as an endogenous factor, researchers have shown that a party's specific investments in a relationship can increase their dependence on that relationship (Heide and John 1988; Palmatier et al. 2007). Because all or a large portion of the specific investments will be lost if the relationship is terminated, both parties' investments increase their dependence on each other (Ganesan 1994). This dependence occurs because a firm can no longer rely on the threat of switching to another relationship partner to reduce opportunistic behaviors. This switching cost, or the lack of replaceability, is a direct consequence of the immobility of a firm's assets (Heide and John 1988). In particular, Thompson (1967) suggests that if a firm's outcome is contingent on the input and resources of

its relationship partner, then the firm is more likely to depend on that partner. Thus, we expect a partner's relationship specific investments to not only increase the size of the new product value pie, but to also increase their dependence (reducing their power), which lowers their share of the pie *ceteris paribus*.

Moreover, since customers determine their “fair share” by comparing the ratio of their inputs and outputs to the supplier's ratio of inputs and outputs, as customer's increase their relationship specific investments (or suppliers decrease their investments) they will require a higher portion of the new product value to be considered fair. Conversely, according to the equity perspective (Emerson 1962), if the supplier contributes more tangible or intangible resources to customer specific new product development then the customer would expect the supplier to capture more share of the new product value.

It is worth noting that, given the nature of NPD, its outcomes are often wrought with uncertainty (e.g., new product value is difficult to predict *ex ante*) and agreements over value sharing often evolve *ex post* (after the NPD process is completed) (Myerson and Satterthwaite 1983; Jap 2001). Hence, the negotiation process regarding value creation and sharing are endogenous in our model, and are hypothesized to be affected by customer NPD participation activities. Thus:

H₆: Customer relationship specific investment positively affects (a) customer dependence and (b) customer perception of fair share, while supplier relationship specific investment (c) positively affects supplier dependence and (d) negatively affects customer perception of fair share.

Effects of size and share of new product value pie on value obtained by customer

As discussed previously, based on an institutional arrangement perspective (Carson et al. 1999), the size and the share of the new product value pie are two key elements contributing to the benefits obtained by a firm. The *new product value obtained by the customer* captures the overall value or benefits that the customer receives from participating in the new product development process. All else being equal, we expect that the larger the new product value pie then the more value the customer will receive. In addition, the determinants of the customer share will affect the overall value obtained by the customer.

The determinants of the customer share derived from the equity and power perspectives can be viewed through a motivation–ability paradigm (Merton 1957). Fairness affects how much value the customer believes they *deserve* based on their and the supplier's contributions to the NPD

process and thus affects the customers *motivation* to negotiate, while the power/dependence of both parties affect their *ability* to negotiate for greater benefits. As customer perception of their fair share increases, we expect them to be more motivated to negotiate with the supplier for a higher share; thus, the customer is more likely to obtain more value of the new product. Further, when the supplier's dependence on the customer increases or customer's dependence decreases, customers have a greater *ability* to negotiate, so they are more likely to obtain more value of the new product. Therefore:

H₇: New product value, the size of the new product value pie, positively affects the new product value obtained by the customer.

H₈: Determinants of customer share of the new product value pie affect the new product value obtained by the customer, or more specifically (a) customer dependence negatively affects, and (b) supplier dependence and (c) customer perception of fair share positively affect new product value obtained by the customer.

Methodology

The structural model in Fig. 1 was tested by surveying purchasing and procurement executives from OEMs. Consistent with previous studies on business-to-business relationships (e.g. Heide 2003), this research focused on OEMs in three two-digit SIC major groups: 35 (general machinery), 36 (electrical and electronic machinery), and 37 (transportation equipment). This context is appropriate for testing our model since customers (OEMS) in these industries often participate in their suppliers' new product development process.

Data collection

For the survey portion of this study, we procured a mailing list from a commercial list broker, removed all incomplete addresses, and came up with an initial sample of 976 firms. For the first stage of data collection, we mailed a prescreening survey to the potential respondents assessing their appropriateness and willingness to participate in the study. We determined whether respondents had been involved in their supplier's NPD process in the last 2 years. Information was collected as to the respondents' title, number of years with the firm, and percentage of time spent on supplier-related activities. Of the 976 firms, we received prescreening responses from 387. We eliminated 20 respondents due to non-involvement in their suppliers'

NPD process in the previous 2 years, having less than 2 years in the position, spending less than 50% of their time with suppliers, or bearing titles that reflected a low-level position. The remaining 367 respondents held positions such as Vice President of Purchasing, Purchasing Manager, Procurement Manager, and Production Manager.

Questionnaire packets were then mailed to these 367 managers. Survey instructions requested respondents to reflect on the most recent NPD project they had been involved in and to complete the questionnaire with that project in mind. We sent a follow-up mailing 2 weeks later. In addition to the survey, each mailing included a prepaid return envelope and a cover letter. We used multiple mail contacts, first-class postage, prepaid return envelopes, and informative cover letters to increase survey response. This two-wave sampling effort generated 195 responses. Three responses were removed due to too many missing values (>5%). Early and later responses were compared and no indication of response bias was found.

The survey instrument included post hoc checks on the informants' knowledge and involvement in the suppliers' NPD processes. On a seven-point scale, the mean of their knowledge in their firm's purchasing decisions was 6.35, and the mean of their involvement was 6.13. Four responses that showed inadequate levels of informant knowledge or involvement were eliminated (less than 4 on a seven-point scale). Thus, 188 responses were included overall for further data analysis (51% effective response rate).

To further validate the measures and reduce concern of alternative explanations (e.g., common method variance), all the respondents were asked to indicate the contact information of the manager at the supplier who coordinated their participation in the NPD process. Questionnaires were sent to the 135 managers of supplier firms based on contact information provided by their customer. After a two-wave mailing, 64 responses were received. The supplier reported their *dependence on the customer* and their level of *relationship-specific investments*. As a supplementary test a reduced model was tested including all hypothesized paths involving these two supplier reported constructs using dyadic data ($N=64$). Reported results are consistent with the findings from the reduced model¹.

Measurement

Our measurement of customer participation was based on academic and practitioner literature as well as our field

interviews. We conducted nine extensive interviews with executives from different firms across the three industries listed above. The objective was to understand the phenomenon of customer participation in a supplier's NPD process and to develop a measure of customer participation. After introducing the objectives of our research, we conducted the interview, which lasted about 90 min. To minimize interviewer bias and broaden our understanding beyond our preconceived framework, we asked open-ended questions about the key underlying factors determining the levels of participation in the supplier's NPD process and the causal linkages between participation and the value obtained by customers (McCracken 1988; Zaltman 1997). Based on these interviews two aspects of customer participation emerged. Breadth and depth captured the level or extent of customer participation. More specifically, *breadth* refers to how broadly customers are involved in a supplier's NPD process. The scope of participation can range from one or a few NPD activities, such as new concept generation and prototyping, up to and including all NPD activities. The *depth* of customer participation represents how far customers are involved in the NPD process, which in some cases is very superficial with limited influence, and in other cases customer can be deeply involved or may even control the outcome of certain NPD activities. Overall, the extent or level of customer participation is reflected by the breadth and depth of the involvement in the supplier's NPD. It should be noted we are only capturing the breadth and depth of customer participation, but these measures do not indicate if this participation adds to or distracts from the overall NPD process.

Based on the NPD literature and our interviews with customers, we identified ten activities central to the NPD process (see Table 4 of the Appendix for all measures). For each one, we asked if the customer was involved (0="not involved" and 1="involved") in this activity, the sum of the number of activities the customer checked was used to represent the breadth of customer participation. If customers were involved in the activity, then we asked about the depth of their involvement using a seven-point Likert scale. We determined the overall depth of participation across the activities they were involved in by calculating the mean of the completed items. Thus, the level of customer participation is treated as a latent variable with two items: customer participation depth and customer participation breadth. Since breadth is determined as an additive measure (0 to 10), it was converted into a seven-point scale to correspond to the depth measure (Homburg et al. 2002).

Customer participation formality was measured using the average of three items developed for this study, which assessed the extent to which the customer participation process was formalized into structured rules and activities. For the other constructs in the proposed framework,

¹ A summary of the results from these supplementary tests are available upon request.

existing measures were used wherever possible. All the items used to measure the constructs were closed-ended, with seven-point Likert-type scales anchored at *strongly disagree* and *strongly agree*, except where otherwise noted.

New product value is reflected in (1) the direct benefits of the new product (or component) and (2) how the new product (or component) improves the engineering, production, and delivery of the final end-product. Three items were developed to measure direct new product benefits, and three items were used to measure the indirect aspects. *Information sharing* is the extent to which the supplier and customer effectively exchange critical information about the market, product, and competition. Four items, based on the work of Heide and John (1990), were used to evaluate the extent to which critical information and knowledge were shared between the two partners. *Coordination effectiveness* describes the extent to which suppliers and customers effectively work together to accomplish a collective set of tasks in the NPD process. Four items were adapted from Jap (1999).

Customer (supplier) dependence is defined as the need to maintain a relationship with the other party. Three items were adopted from Kumar et al. (1995) to evaluate each type of dependence. Specifically, respondents were asked to evaluate their dependence on their supplier as well as the perceived dependence of the supplier on them. *Customer perception of “fair share”* involves the extent to which the customer feels they deserve a larger portion of value of the new product than does the supplier. Two items were developed specifically for this study.

The scales to measure *relationship-specific investments* from the customer (supplier) described the investments made by the customer (supplier) dedicated to the relationship with a particular supplier (customer) for the development of a new product. These investments are difficult to redeploy in another relationship, except at a loss in value. Four items were used based on the work of Heide and John (1990) to measure this construct.

With regard to *new product value obtained by the customer*, most scholars agree that value is a construct that involves a trade-off between benefits and costs (e.g., Hauser and Urban 1986; Zeithaml 1988). New product value obtained by the customer is the trade-off between benefits of the new product versus the costs (price) incurred by customers in order to obtain the product. Three items were developed to measure this construct. A number of control variables were included in the model. Customer share of new product development cost could be expected to affect the customer's perception of their fair share and thus, is included as a control variable. The age of the supplier–customer relationship is also included as a control variable for new product value obtained by the customer.

Analytical approach

A two-stage approach was employed to analyze the data and test the proposed model. In the first stage, a confirmatory factor analysis measurement model was assessed using AMOS. Once a suitable measurement model was obtained, a path model was identified using the maximum likelihood criterion in AMOS. According to Anderson and Gerbing (1988), the two-stage approach to model fitting has two main advantages. First, it is less demanding on the sample size owing to the reduced model at each stage. Second, the potential confounding effect between the structural model and the measurement model can be avoided.

Assessment of the measurement model

Confirmatory factor analysis was used to estimate a measurement model to evaluate construct reliability and convergent and discriminant validity. All latent constructs were estimated in one measurement model with each scale item loaded on its a priori specified factor, and correlation among factors was allowed (Gerbing and Anderson 1988). Maximum likelihood estimates of the measurement models were obtained using AMOS. The measurement model exhibited acceptable fit indices: $\chi^2_{(645)}=1,874.05$ ($p<.01$), goodness of fit index (GFI)=.88, comparative fit index (CFI)=.89, normed fit index (NFI)=.87, and root mean square of approximation (RSMEA)=.07 (90% confidence interval of .06 to .08). Each factor loading was positive and significant at the .01 level (see Table 4 of the Appendix). The coefficient alpha also provided satisfactory evidence of reliability.

Next, a series of nested confirmatory factor model comparisons between any two constructs in the model assessed whether significant chi-square differences existed between the models when correlation between the latent variables were set free versus when it was constrained to 1.0. The various chi-square difference tests were all significant and provided evidence of discriminant validity (Bagozzi et al. 1991). The more stringent test suggested by Fornell and Larcker (1981) was used. The average variances extracted of the constructs were greater than the square of the correlation between any pair of constructs, further supporting the discriminant validity of the constructs. The descriptive statistics, extracted variances, reliabilities, and correlation matrix of all the constructs in the model are shown in Table 1.

Tests of the hypotheses

Path analysis was used to assess the hypothesized model relationships. Data were analyzed using AMOS. Path

Table 1 Descriptive statistics and correlations

Constructs	Mean	SD	Ave.	Correlation coefficients														
				1	2	3	4	5	6	7	8	9	10	11	12	13		
1. Customer participation	4.32	1.32	.49	.62														
2. New product value	5.24	0.97	.48	.18	.93													
3. Information sharing	5.23	0.93	.54	.54	.33	.83												
4. Coordination effectiveness	4.84	1.32	.63	.34	.47	.53	.84											
5. Customer dependence	4.12	1.67	.62	.05	.10	.06	.11	.73										
6. Supplier dependence	4.00	1.49	.57	.29	.32	.33	.35	.34	.75									
7. Customer perception of “fair share”	3.46	1.13	.56	.01	.04	-.11	-.22	-.05	.02	.67								
8. Customer relationship-specific investment	3.41	1.40	.55	.13	.08	-.06	-.19	.32	.16	.24	.80							
9. Seller relationship-specific investment	4.09	1.58	.58	.30	.27	.25	.45	.29	.53	-.09	.35	.82						
10. New product value obtained by customer	5.65	1.36	.60	.13	.22	.01	.16	-.17	.13	.21	.02	.10	.75					
11. Customer share of new product development cost	3.25	1.23	n/a	.22	.07	.11	.32	.20	.20	.34	.13	.14	.08	n/a				
12. Customer participation formality	4.23	1.03	.59	.41	.07	.12	.10	-.08	.02	.11	.19	.06	.12	.01	.78			
13. Age of the relationship	5.35	4.98	n/a	.16	.07	.07	.17	.17	.14	.01	.15	.16	.13	-.10	-.11	n/a		

Coefficient alphas are reported along the diagonal; $p < .05$ if $r > .17$ or $r < -.17$.

Ave.: average variance extracted, n/a: single-item manifest variable

analysis, using structural equation modeling methodology, made it possible to test simultaneously all the hypothesized relationships among the focal constructs. Item factor scores were averaged to derive the factor scores for path analysis (Jap 1999).

Common method and acquiescence bias

Because we used a cross-sectional survey, it was necessary to control for two sources of potential bias: (1) common method bias due to a single instrument of data collection, and (2) acquiescence bias due to a person's tendency to agree with items (Agustin and Singh 2005). To control for common method bias, based on procedures recommended by Lindell and Whitney (2001) and Agustin and Singh (2005), we included a construct (supervisor's trust toward the respondents measured by three items adapted from Ramaswami and Singh (2003)) that is theoretically unrelated to the constructs in the model, and related it to all the endogenous constructs in the tested model to partial out the effects of common instrument bias. To control for acquiescence bias, we followed Baumgartner and Steenkamp's (2001) recommendation to identify three matched sets of positively and negatively worded items. We then computed a difference score between these items and included it as an exogenous factor in the model and linked it to all constructs in the structural models to partial out the effect of acquiescence bias².

² Items used in constructing common method and acquiescence factors are available from the authors upon request.

Results: hypothesized main effects

The structural model indicated good fit indices: $\chi^2_{(43)} = 135.11$ ($p < .01$), goodness of fit index (GFI) = .92, comparative fit index (CFI) = .91, normed fit index (NFI) = .90, and root mean square of approximation (RSMEA) = .06 (90% confidence interval of .05 to .07). The results pertaining to the individual hypotheses are detailed below and summarized in Tables 2 (main effects) and 3 (moderation effects).

Customer participation positively influenced both information sharing ($\beta = .41$, $p < .01$) and coordination effectiveness ($\beta = .29$, $p < .01$) supporting H_{1a} and H_{1b}. Both H_{2a} and H_{2b} were supported because the impact of customer participation on relationship specific investment from the customer ($\beta = .17$, $p < .05$) and from the supplier ($\beta = .31$, $p < .01$) were both significant and positive.

Information sharing ($\beta = .14$, $p < .05$) and coordination effectiveness ($\beta = .38$, $p < .01$) positively affected new product value supporting H_{4a} and H_{4b}. In addition, customer relationship specific investment positively affected new product value ($\beta = .22$, $p < .05$) supporting H_{5a}, but H_{5b} was not supported as supplier relationship specific investment was not significantly related to new product value ($\beta = .03$, ns.).

Customer relationship specific investment positively influenced customer dependence ($\beta = .16$, $p < .05$) and customer perception of fair share ($\beta = .22$, $p < .01$) supporting H_{6a} and H_{6b}. Supplier relationship specific investment did not significantly influence supplier dependence ($\beta = .12$, ns.), but as hypothesized, did negatively influence customer perception of fair share ($\beta = -.27$, $p < .01$). Thus, H_{6c} was rejected and H_{6d} was supported. The control

Table 2 Results: hypothesized main effects

Hypothesized path	Path coefficient unstandardized	<i>t</i> value	Hypothesis
Effects of customer participation→drivers of new product value creation			
Customer participation→information sharing	.41	4.02*	H _{1a}
Customer participation→coordination effectiveness	.29	3.12*	H _{1b}
Customer participation→customer relationship-specific investment	.17	1.73**	H _{2a}
Customer participation→supplier relationship-specific investment	.31	2.82*	H _{2b}
<i>R</i> ² (coordination effectiveness)=.11; <i>R</i> ² (information sharing)=.22; <i>R</i> ² (customer relationship-specific investment)=.03; <i>R</i> ² (supplier relationship-specific investment)=.06			
Effects of drivers of new product value creation→size and share of new product value pie			
Information sharing→new product value	.14	1.75**	H _{4a}
Coordination effectiveness→new product value	.38	3.87*	H _{4b}
Customer relationship-specific investment→new product value	.22	1.89**	H _{5a}
Supplier relationship-specific investment→new product value	-.03	1.01	H _{5b}
Customer relationship-specific investment→customer dependence	.16	1.95**	H _{6a}
Customer relationship-specific investment→customer perception of “fair share”	.22	2.74*	H _{6b}
Supplier relationship-specific investment→supplier dependence	.12	1.11	H _{6c}
Supplier relationship-specific investment→customer perception of “fair share”	-.27	2.36*	H _{6d}
Customer share of new product develop cost→customer perception of “fair share”	.23	2.44*	control
<i>R</i> ² (new product value)=.21; <i>R</i> ² (supplier dependence)=.02; <i>R</i> ² (customer perception of “fair share”)=.20			
Effects of size and share of new product value pie→new product value obtained by customer			
New product value→new product value obtained by customer	.30	2.74*	H ₇
Customer dependence→new product value obtained by customer	-.15	1.36***	H _{8a}
Supplier dependence→new product value obtained by customer	.21	2.34*	H _{8b}
Customer perception of “fair share”→new product value obtained by customer	.19	2.01**	H _{8c}
Age of relationship→new product value obtained by customer	.11	0.96	Control
<i>R</i> ² (new product value obtained by customer)=.14			

p*<.01; *p*<.05; ****p*<.10 (one-sided)

variable of customer share of new product development cost positively influenced customer perception of fair share ($\beta=.23, p<.01$).

New product value positively influenced new product obtained by customer ($\beta=.30, p<.01$), supporting H₇. Supplier dependence ($\beta=.21, p<.05$) and customer perception of fair share ($\beta=.19, p<.05$) both positively affected new product value obtained by customer supporting H_{8b} and H_{8c}. The proposed negative effect of customer dependence on new product value obtained by customer (H_{8a}) was only marginally significant ($\beta=-.15, p<.10$). The control variable of age of relationship was not significantly related to new product value obtained by customer.

Results: hypothesized moderating effects

To test the moderating effects, the sample was median-split based on the moderator variable and two-group path analyses were conducted. The comparison was based on the chi-square difference between the two models, in which one model constrained all the hypothesized path coefficients to be equal across the two groups and the other permitted the hypothesized moderated path to be unconstrained. If the chi-square difference between the two models was found to be significant and the effects were in the proposed direction then the hypothesis is supported. The results are presented in Table 3. Customer participation

Table 3 Results: moderation effects of customer participation formality

Hypothesized path	β high	β low	$\Delta\chi^2$ (1 df)	Hypotheses
Customer participation→ information sharing	.26**	.37**	0.57	H _{3a}
Customer participation→ coordination effectiveness	.32**	.28**	1.11	H _{3b}
Customer participation→ customer relationship-specific investment	.26*	.05	5.11*	H _{3c}
Customer participation→ supplier relationship-specific investment	.37**	.16	4.55*	H _{3d}

β represents the unstandardized path coefficient for that group; $\Delta\chi^2$ represents the difference in χ^2 between the constrained and free models for the path being tested with 1 degree of freedom.
* $p < .05$; ** $p < .01$

had a significantly higher effect on both customer ($\Delta\chi^2_{(1)} = 5.11$, $p < .05$) and supplier's ($\Delta\chi^2_{(1)} = 4.55$, $p < .05$) relationship specific investments when the customer participation process was more formalized supporting H_{3c} and H_{3d}, but had no effect on either information sharing or coordination effectiveness. Thus, H_{3a} and H_{3b} were rejected.³

Discussion

Both customers and suppliers are recognizing the benefits from working together to develop new products as a path to sustainable competitive advantage and superior financial performance (Prahalad and Ramaswamy 2000). Extant research has proposed that suppliers should seek customer participation in their new product development (NPD) process to improve product performance and reduce costs (Dyer and Singh 1998; Terwiesch and Loch 1999), but offered little insight into how this value is created, shared between the customer and supplier, or how it should be implemented. Providing theoretical and managerial insight into these three questions is the primary focus of this research and thus, the discussion is structured around these questions.

More specifically, we apply an institutional arrangement perspective, a theoretical framework that argues that value creation and value sharing are the critical explanatory elements for why and how firms engage with other firms to maximize captured value (Carson et al. 1999; Davis and

North 1971), to interactions between customers participating with suppliers to develop new products. Consistent with this theoretical foundation our conceptual model investigates two key determinants, *size of the new product value pie* and *share of the new product value pie*, for the influence of customer participation in the NPD process (Fig. 1). This theoretical perspective is well suited to this context since the results suggest that the effects of customer participation involve tradeoffs between creating new product value and the sharing of this value. Only by understanding both mechanisms can the true impact of customer participation on the value obtained by the customer be understood. For example, customer participation increases the size of the new product pie by increasing customer specific investments while these same investments can reduce the customer's share by decreasing their power to negotiate for a larger share.

How does customer participation affect the size of the new product value pie?

Utilizing a new measure of customer participation, capturing both the breadth of participation across NPD activities (i.e., idea generation, concept testing, etc.) as well as the depth of involvement in these activities, our results support the premise that customer participation creates new product value by improving the supplier's NPD processes (information sharing and coordination) and by increasing relationship specific investments focused on NPD. Customer participation improves suppliers' NPD process by increasing information sharing and coordination effectiveness between suppliers and customers, which has the potential to prevent costly mistakes, redirect efforts to higher return features, and optimize the numerous product versus cost tradeoffs required during NPD.

In addition, to improving the NPD process customer participation also increases the level of specific investment in the NPD by both the customer and supplier. This suggests that closer interaction allows both parties to uncover high return value-creating opportunities and possibly reduce each parties perceived risk via increased monitoring and stronger relational bonds, thus leading to higher levels of new product specific investments. It is especially interesting to note that the magnitude of the effect of customer participation on investment was approximately twice as large for suppliers as for customers. This suggests that customers who want suppliers to increase their investments in new products that are specific to them should increase the depth and breadth of their participation in a supplier's NPD process. Similarly, suppliers may want to request customers to participate in the product development process as a precursor to direct requests to increase investment levels.

³ As a further test, we evaluated each hypothesized interaction using multiple regression analyses. The results were identical to the multigroup method. Details are available upon request.

How does implementation of customer participation affect new product value creation?

Assessment of the impact of formalization of the customer process on the effects of customer participation on the drivers of value creation (NPD processes and investments) suggests that the effects are mixed. The premise that customer participation has a larger impact on specific investments was fully supported for increased levels of participation formality. Thus, customers and suppliers alike should recognize that customer participations effect on the level of investment into the NPD process is contingent on the structure of the participation process itself. For example, the strong support for the leveraging effect of participation formality gives suppliers a strategy for increasing the effectiveness of customers existing level of participation. This may be especially importance in situations where customers are hesitant or not prone to participate in suppliers' NPD.

Contrary to our expectations, the level of formalized did not moderate the impact of customer participation on NPD processes (information sharing and coordination effectiveness). These findings suggest that the impact of customer participation on NPD processes is relative stable and not affected by the structure in the participation process. More research is required to determine if these effects are homogenous across contexts or if this in an anomaly of our sample or measures. Since the impact of participation on NPD processes is stable while its impact on NPD investments is moderated, our findings suggests that the impact of customer participation on new product value creation mediated by NPD investments will increase relative to the impact of NPD processes as product development decisions becomes more formalized.

How is the customer's share of the new product value pie determined?

Turning to the third research questions, our finding suggest that for business-to-business relational exchanges two key mechanisms determine a customer's share of the new product value. Both *dependence* and *equity* perspectives influenced the division of the new product value between suppliers and customers. Suppliers that were more dependent had less power to negotiate resulting in the customers receiving a larger share of the new product pie. Similarly, marginal support ($p < .10$) was received for the premise that customers that are more dependent would obtain less value from new products.

While dependence reduces a customers' *ability* to extract value from the exchange, this effect is somewhat offset by the equity perspective, which suggests that as customers' perceive they deserve a larger portion of the value pie they

will be more *motivated* to negotiate for their share. Consistent with this argument, we found that customers who felt they deserved a larger portion of the new product value actually obtained more new product value.

Understanding the overall effects of customer participation on value obtained by the customer is complex, since relationship specific investments (RSI) influence both the size and share of the new product value pie. For example, customer RSI positively affects the overall product value, while simultaneously affecting the customer's share obtained via its impact on perception of fair share and customer dependence. Similarly, as supplier's increases their RSI customer's expectation of the value they should received decreases, which subsequently reduces their new product value received.

Overall, our research supports the institutional arrangement where customer participation's influence on new product value obtained by an exchange partner is driven by both value creation and value sharing, and value sharing can be understood within a dependence-equity framework. All three pathways, to different degrees, contribute to how customer participation affects new product value obtained by the customer. From a value creation perspective the overall effect of customer participation on customer value obtained is positive via both improvements in the NPD process as well as increases in customer specific investments. Thus, customer participation increases the size of the pie, but the share obtained by the customer is reduced by the overall negative effect of customer dependence (via customer RSI), and by the overall negative effect of the customer's perception of fair share (via both customer and supplier RSIs). For this sample, the impact of value creation on value obtained was reduced by approximately 4% due to customer dependence and 20% due to perceived equity, but overall, the net effect of customer participation on the value obtained by the customer is positive.

Possibly, due to the relational nature of business-to-business exchanges, average relationship age in this sample was 5.4 years, exchange partners do not fully utilized their power to extract the maximum value from a jointly developed new product since coercing a partner would undermine the exchange. Rather our results suggest exchange partners' value sharing is driven more by a desire to share created value equitable. This finding suggests some managerial strategies for exchange partners to increase their share of the pie. For example, managers should ensure they are communicating their level of effort and investment in the value creation process so that when partners are evaluating the relative ratio of inputs and outputs they are given full "credit" for their efforts. In addition, it would seem that for relational based exchanges, partners do not need to be overly concerned with the loss of power caused by RSIs decreasing their ultimate share of the value

creation. In summary, these results suggest that customer participation in NPD affects the value obtained by a customer mainly by creating a bigger “pie” rather than by its affect on the share of the “pie.”

Limitations and future research directions

This research breaks new ground in addressing the complicated phenomenon of customer participation in NPD. As such, the study is subject to several limitations. Measurement of many constructs is limited by single-source data, which relies on customer reports. Even though we validated the measurements using additional data collected from suppliers, a dyadic study collected from both parties is warranted to examine this issue further. More specifically, research might measure both customer's and supplier's perceptions of fair share during the participation process, as well as their dependence on each other. This perspective would generate additional insights into how the process of customer NPD participation leads to value creation and sharing.

In addition, the dynamic nature of customer participation invites future research into how it evolves over time. It is possible that success in past NPD efforts or perceptions of potential success during the participation process will influence its effect. Moreover, as customers make investment focused towards a specific new product, they may increase their level of participation in order to safeguard these investments. We do not model this potential feedback process from investments to participation. Obtaining longitudinal data across multiple NPD projects would help shed light on the dynamic nature of customer participation, actual causal ordering among constructs, and may be a fruitful research direction.

The research finds that in aggregate customer participation improves the NPD process, but there could be situations where participation leads to conflict, uncovers damaging information, or is actually dysfunctional. Researchers should attempt to identify the contextual factors or participation quality indicators that would provide insight into when customer participation may negatively affect NPD. For example, while formality positively leveraged the impact of participation on specific investments in this sample, increased formality may also add to the cost of the interaction. Thus, in some situations this cost may overcome any benefits. Overall, this study investigates the overall positive impact of breadth and depth of customer participation, but future research should also investigate the conditions when customer participation negatively affects performance.

Overall, this research focused on understanding the phenomena of customer participation in NPD from the little researched *customers' perspective* (Srivastava et al.

1999), our findings should be integrated into future models for the impact of participation on supplier performance.

Appendix

Table 4 Measurement items and factor loadings

Constructs	Factor loadings
Customer participation in new product development	
For each of the following activities in the new product development process, we would like you to identify whether you participated in this activity (0=“no”, 1=“yes”). If you participated, how deeply were you involved? (7-point Likert scale with anchors 1=“very superficial” and 7=“very deeply”)	.66
(1) Idea generation; (2) concept screening; (3) product specification; (4) business evaluation; (5) product design; (6) product engineering; (7) prototyping; (8) product testing; (9) formation of cross-functional new product development team; and (10) controlling and monitoring of the development process	.63
New product value	
The component provided by this supplier is produced at low cost.	.59
The component provided by this supplier is highly innovative.	.67
The component provided by this supplier is of high quality.	.74
The component provided by this supplier complies very well with our assembly processes.	.74
The component provided by this supplier improves the engineering process of our end product.	.77
The component provided by this supplier improves the overall functioning of the end product.	.69
Information sharing	
During the NPD process	
Both partners expect that significant knowledge will be shared in the relationship.	.81
Both partners are expected to keep the other partner informed about changes that could affect that partner.	.73
Exchange of information and knowledge between partners takes place frequently.	.80
It is expected that both partners will share proprietary information and knowledge if it can enhance the quality of the NPD process and our relationship.	.55
Coordination effectiveness	
During the NPD process:	
This supplier and my firm work together very effectively to exploit unique opportunities.	.77
Both companies are always looking for synergistic ways to do business together.	.80
We work effectively on joint projects tailored to our joint needs.	.76
The supplier and my firm coordinate our business activities very effectively.	.84

Table 4 (continued)

Constructs	Factor loadings
Customer's dependence on seller	
It would be difficult to replace this supplier.	.66
If this relationship ended, we would face a significant loss.	.90
We are quite dependent on this supplier.	.84
Seller's dependence on customer	
It would be difficult for our supplier to replace us.	.66
This supplier is quite dependent on us.	.90
If this relationship ended, this supplier would face a significant loss.	.73
Customer's perception of fair share	
We feel that we deserve more of the value of the component purchased from this supplier than our supplier.	.70
It is reasonable that we take away more value created in the purchased component from this supplier than our supplier.	.67
Customer specific investments in new product development During the NPD process	
We have made significant investments in tooling and equipment dedicated to our relationship with this supplier.	.76
Our production system has been tailored to meet the requirements of dealing with this supplier.	.88
Our production system has been tailored to use the particular components bought from this supplier.	.64
Gearing up to deal with this supplier requires highly specialized tools and equipment.	.60
Seller specific investments in new product development During the NPD process	
This supplier has made significant investments in tools and equipment dedicated to the relationship with our company.	.68
This supplier's production system has been tailored to meet the requirements of dealing with our company.	.70
This supplier has made extensive adaptations in physical plant and equipment in order to deal effectively with our company.	.82
The procedures and routines developed by this supplier as part of their relationship with our company are tailored to our particular situation.	.63
New product value obtained by customer	
For the involvements and efforts you input in the component, I would say the component is of great value	.77
For the price and efforts, I am very satisfied with the functioning of the product.	.84
I would think of the component as providing great value.	.68
Customer participation formality	
We are ___ involved in the NPD process of this component. (1="informally" to 7="formally")	.80
There is ___ imposed regarding our involvement in this supplier's NPD process of the component. (1="no formal rule" to 7="a system of formal rules")	.77
We follow ___ in our participation activities of the NPD process. (1="no formal procedure" to 7="formal written procedures")	.84

All items were measured using seven-point scales anchored by 1="strongly disagree" and 7="strongly agree" unless otherwise indicated.

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