Supplier Traits for Better Customer Firm Innovation Performance

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Abstract
Previous research on embedded ties with suppliers in an innovation context left largely undetermined which supplier traits – apart from the technical and commercial capabilities of the supplier – have a positive impact on the customer firm’s innovation and new product performance and has ignored the need for the customer firm to assess and select suppliers to work with on the basis of a broader and solid assessment of relationship marketing constructs, namely homophily (i.e., similarity) of the supplier and the customer, as well as the supplier’s orientation towards the customer’s customers (i.e., the supplier’s downstream customer orientation). Using dyadic supplier-customer survey data, the proposed model was generally supported. The results suggest that the supplier’s downstream customer orientation and supplier-customer homophily have a significant impact on the customer firm’s new product effectiveness (i.e., innovativeness) and new product efficiency (i.e., project cost and project speed). More innovative products developed in projects with supplier contribution in turn positively influence the market performance and profitability of these products.

Keywords
Supplier-customer relationship; Supplier innovation; Customer orientation; Homophily; Survey; Structural equation modeling
1. Introduction

Firms in many industries are increasingly shifting to an ‘open innovation’ model and integrating company resources with the resources of external actors, with the aim of achieving and sustaining innovation. Recent research has highlighted the interactive character of generating high innovation performance, suggesting that successful innovators rely heavily on the interaction with external actors (Chesbrough, 2003; Fritsch and Lukas, 2001; Laursen and Salter 2006), such as the focal firm’s customers (e.g., Gruner and Homburg, 2000; Thomke and von Hippel, 2002) as well as suppliers (e.g., Brown and Eisenhardt, 1995; Petersen, Handfield, and Ragatz, 2005; Wagner, 2003). The interaction with suppliers may range from screening the supply base for new technologies and innovations or simple consultation with suppliers on design ideas to making suppliers fully responsible for the design of products that they will manufacture and deliver to the customer firm.

These examples illustrate and prior empirical research shows that suppliers can provide substantial benefits and enhance their innovation performance along several dimensions. Customer firms can benefit from involving suppliers in new product development (NPD) activities rather than working independently when it comes to NPD targets, such as product innovativeness, time-to-market of new products, product quality, product cost, or development time and development cost. Furthermore, such a strategy can help firms conserve resources, share risks, gain new competencies, and move faster into new markets (e.g., Clark, 1989; Dröge, Jayaram, and Vickery, 2000; Koufteros, Cheng, and Lai, 2007; Petersen, Handfield, and Ragatz, 2005; Takeishi, 2001).

Despite the largely positive discussion of supplier involvement in customer NPD activities there is also empirical evidence that provides only mixed support for the proposed positive effects. Several studies hint at the “rigidities, inflexibilities, and coordination issues that can affect performance negatively” (Das, Narasimhan, and Talluri, 2006, p. 569) when suppliers are involved in customer NPD. Researchers repeatedly found no positive linear relationships between supplier-customer interaction in NPD and innovation performance, or even showed negative linear effects (e.g., Eisenhardt and Tabrizi, 1995; Hartley, Zirger, and Kamath, 1997; Littler, Leverick, and Wilson, 1998; Von Corswant and Tunälv, 2002).

Given the ‘openness’ of the innovation process towards the firms’ suppliers, the potential positive impact of suppliers’ contributions to a customer’s NPD efforts, and the potential negative effects, there is an indication that supplier involvement in customer NPD requires the customer firm to cope with the inherent project, technical, and inter-organizational challenges of such a strategy (Wagner and Hoegl, 2007). A few of these areas have already drawn some research attention.

On the project level, where human beings from two organizations interact, management scholars have highlighted that it is vital to reinforce the ‘soft facts’ and ‘human issues’ since individuals from the supplier and customer firm interact on highly complex and sensitive subjects when suppliers contribute to the customers’ NPD. Gerwin and Ferris’s (2004) conceptual investigation of various project organizational options suggest that the preferred option of firms working either independently or with partners in NPD projects depends on the newness of the NPD alliance, the cooperativeness of the alliance in the past, and the distribution of skills among the partners. Gerwin’s (2004) theoretical model emphasizes the importance of reducing the coordination gap
in joint NPD projects. Mismatches between the required and actual coordination of tasks negatively influence the performance of a NPD project. In their empirical study of NPD projects, Hoegl and Wagner (2005) point out that the quality of the collaborative working between the customer’s and the supplier’s project members, characterized by an open sharing of information, mutual support and accommodation, and high project commitment, is key to project success. The interactions of the project members shape the inter-organizational exchange and thus are critical in determining its outcomes.

On the technical side it is vital that the product architecture, the type of design and development interaction with suppliers match. With a modular product architecture, which implies a one-to-one mapping from functional elements to physical components and standardized interfaces among the components of a product (Ulrich, 1995), the upgrade and substitution of components can be done without difficulty. The design can easily be divided among different suppliers and between suppliers and the focal firm (Schrader and Göpfert, 1997; Von Hippel, 1990). Conversely, integral product architectures are much more complex and physical components are coupled, i.e., many functional elements are implemented by more than one physical component and several physical components implement more than one functional element (Ulrich, 1995). The change of one component requires the change of other physical components. When the development of components is divided between the focal firm and various suppliers, the innovation processes and projects must be highly intertwined (Schrader and Göpfert, 1997; Von Hippel, 1990). Therefore, several researchers have recommended that supplier-customer interaction strategies in NPD are contingent on the architecture of the product and the design and development interfaces with suppliers, ranging from “none” and “white box” to “gray box” and “black box” supplier integration (Koufteros, Cheng, and Lai, 2007) or from “traditional” and “advanced” to “black box” and “integrated” subcontracting (Sobrero and Roberts, 2001). The technical difficulty of the NPD project brings us to the challenges in the supplier-customer relationship.

On the inter-organizational level, scholars in the field of strategy, marketing and operations management have recently paid more attention to the importance of aspects of the relationship between the customer and the supplier who contributed to the customer’s NPD project (Jap, 1999; Primo and Amundson, 2002; Sobrero and Roberts, 2001; Stump, Athaide, and Joshi, 2002). However, the question of when and how intensively to involve the supplier in the customer’s NPD process, how to interact with the supplier, and with which supplier to interact in NPD have been addressed to varying degrees.

Much of the previous research has focused on questions of when (i.e., how early in the overall innovation process from idea generation to product launch) and how much suppliers should be involved in the customer’s NPD. Handfield, Ragatz, Petersen, and Monczka (1999) identify five phases in which supplier interaction in customer NPD could start. Consistent with the need to align multiple processes at the supplier-customer interface, much of the empirical research on the timing of supplier involvement advocates that early and intensive interaction with the supplier results in a faster NPD process (Bozdogan, Deyst, Hoult, and Lucas 1998; Griffin and Hauser, 1992). Petersen, Handfield, and Ragatz (2005) add the stage of integration as a moderator into their model and also find that the relationship between project team effectiveness and design performance is influenced positively if decisions are made early in the NPD process.
Consistent with phase models of supplier-customer relationship development (e.g., Dwyer, Schurr, and Oh, 1987; Ellram 1991) that concentrate on the early identification and evaluation of suitable partners, is an effective process of supplier assessment and selection. For Petersen, Handfield, and Ragatz (2005) the first critical element is determining the effectiveness of the NPD project team. This encompasses the “detailed assessment of the suppliers being considered for involvement, leading to selection of a supplier with capabilities well-matched to the buying company’s needs” (Petersen, Handfield, and Ragatz, 2005, p. 374). Suppliers may possess component knowledge and architectural knowledge (Henderson and Clark, 1990). These two types explain why some suppliers are able to take on certain R&D responsibilities while others are not. Component knowledge involves the design and manufacture of one component (e.g., the fuel tank) for the buying firm’s product (e.g., an automobile), but not the product itself. All the supplier requires is R&D and design capabilities to develop the component. However, if a supplier possesses architectural knowledge, it has the ability to integrate and coordinate knowledge, capabilities, activities, or products from the customer firm and also from other suppliers.

A large body of literature in the relationship marketing domain in general and on inter-organizational innovation in particular underscores the way in which the customer and supplier firms should interact in order to achieve high innovation performance (e.g., Jap, 1999; Stump, Athaide, and Joshi, 2002). For example, the role of relationship connectors (i.e., information exchange, operational linkages, legal bonds, cooperation, and relationship-specific adaptations by suppliers and customers) in achieving high customer satisfaction and supplier performance has been investigated (Cannon and Perreault, 1999). Communication frequency and intensity builds stronger supplier-customer relationships and has a positive impact on channel performance in terms of effectiveness and efficiency (Mohr and Nevin, 1990; Mohr and Sohi, 1995). Furthermore, commitment and trust (Doney and Cannon, 1997; Morgan and Hunt, 1994), and connectedness (Gemünden, Ritter, and Heydebreck 1996; Johnson and Sohi, 2001) are also frequently cited antecedents of supplier-customer relationship outcomes. For a further discussion of determinants we refer to the analysis of Palmatier, Dant, Grewal, and Evans (2006).

Surprisingly, despite the criticality of selecting the “right” supplier to work with in NPD in the first place, it is – apart from the capabilities of the supplier – largely undetermined which supplier traits have a positive impact on the customer firm’s innovation and new product performance. The question of which supplier to select and involve in an innovation context has only recently received some research attention. Wynstra, Weggemann, and Van Weele (2003) point out plainly that the pre-selection and the selection of suppliers for involvement in NPD activities is a critical process in managing the supplier-customer relationship. However, the authors do not elaborate on any supplier selection criteria in this context. Birou and Fawcett (1994) quite specifically reveal that technology and expertise were important rationales for supplier involvement. Wagner and Hoegl (2006) interviewed R&D directors and project managers who state that the supplier’s competence in mastering a new or complex technology and the supplier’s innovation potential (i.e., the ability to steer the customer firm to highly innovative solutions in their NPD effort) are considered important ‘hard’ criteria. In addition, criteria of ‘soft’ nature include trust and reliability, openness and mutual support between the customer and the supplier firm, and goal congruence (Wagner and Hoegl, 2006).

Likewise, Petersen, Handfield, and Ragatz (2005) show that selecting appropriate suppliers for integration in NPD based on technical and commercial performance measures and targets, as well
as complementary capabilities has a significant impact on the effectiveness of a new product development team. Clearly, the focus of the items that tap supplier assessment and selection are the supplier’s technological and commercial capabilities, and the supplier selection process. While we fully agree with the observation of Petersen, Handfield, and Ragatz (2005, p. 375) that there will “be additional criteria that are specific to considering a supplier for integration into an NPD effort which reflect the broader objectives of the overall integration effort,” these authors limit their study to the technical, commercial, and process determinants. Merely one item in the supplier assessment scales touches upon ‘similarity’ between the supplier and customer organizations, which is an important antecedent of supplier-customer relationship performance (Palmatier, Dant, Grewal, and Evans, 2006), namely the degree to which a supplier’s business culture complements the customer’s business culture (Petersen, Handfield, and Ragatz, 2005).

In sum, selecting suppliers based on their technological expertise and product development capabilities appears to be essential for firms that hope to utilize their supplier’s innovation potential in order to leverage their NPD efforts. However, strong arguments can be derived from the marketing literature that a supplier and customer firm interacting in the customer’s NPD efforts should be concerned with creating relationship benefits (e.g., in the form of new or enhanced products) and reducing relationship costs (e.g., in the form of short NPD time and cost) (Jap, 1999; Ulaga and Eggert, 2006). Firms can create relationship benefits when they pay attention to the antecedents of supplier-customer relationship performance outcomes (Palmatier, Dant, Grewal, and Evans, 2006). Our study adds two relationship marketing concepts to firms’ NPD activities with supplier contribution. First, drawing on the exhaustive body of knowledge on customer and market orientation, we develop and test a new construct we call ‘downstream customer orientation.’ Second, drawing on the marketing, management, and sociology literature on homophily, we first apply a construct we call ‘supplier-customer homophily’ to NPD with supplier interaction. The result is a parsimonious framework for innovation performance in NPD that concentrates on the inter-organizational level of analysis and connects the research on marketing channels and relationship marketing with supplier innovation.

2. Conceptual background and hypotheses

2.1. Innovation performance: Effectiveness, efficiency, and overall new product performance

The interaction with suppliers in the innovation process can enhance the customer firms’ innovation project performance along an effectiveness and efficiency dimension (Alegre, Lapiedra, and Chiva, 2006). For the purpose of this research, the effectiveness dimension of innovation performance refers to the discontinuity which the newly developed product developed in the project generated in the technological and marketing process (Garcia and Calantone, 2002; Zhou, Yim, and Tse, 2005), whereas efficiency relates to the resources (i.e., time and cost) required to complete the innovation project (Griffin, 1997; Hoegl and Wagner, 2005). The third, overall dimension of innovation performance, the new product’s profitability, market share, and growth performance benefits from highly effective and efficient innovation project outcomes (Joshi and Sharma, 2004; Matsuno, Mentzer, and Özsomer, 2002).

Taking this broad, multi-dimensional perspective of innovation performance instead of using single constructs to evaluate outcomes produces much richer insights. Second, empirical studies
that have investigated market orientation-performance relationships have been criticized for the reason that “multiple performance measures are rare.” (Baker and Sinkula, 2005, p. 484). Third, our broad perspective is more consistent with the view of practitioners, who also have to meet and balance multiple objectives in innovation projects.

2.2. Hypotheses

We now extend the foregoing discussion to conceptualize the concepts of interest in the present study and derive testable hypotheses regarding the relationship between downstream customer orientation and supplier-customer homophily on the customer firm’s NPD project effectiveness and efficiency and the new product’s overall performance. Figure 1 depicts the main concepts and the ensuing relationships.

**Downstream customer orientation.** The ability of firms to create and deliver superior value to their customers – and hence create competitive advantage for the firm – is of utmost importance in today’s marketplace. It is widely accepted that firms can create value by addressing needs expressed by the customers and even needs of which customers are not aware by becoming more market oriented (Narver, Slater, and MacLachlan, 2004; Slater and Narver, 2000). Market orientation consists of a set of activities designed to satisfy customer needs better than the firm’s competitors and is regularly defined as the extent to which a firm uses knowledge about markets and customers for decisions regarding which products to develop, produce, and sell (Kohli and Jaworski, 1990). Narver and Salter (1990) describe the market orientation concept as encompassing three behavioral components: customer orientation, competitor orientation, and interdepartmental coordination. Since we will be extending our view of market orientation below, we are now focusing on the customer orientation component. This is consistent with the marketing concept, which places the customers’ interests at the top of the marketing agenda and prioritizes those interests in corporate culture (Deshpandé, Farley, and Webster, 1993).

In the past, research on market and customer orientation has investigated how a focal firm relates to its current and potential customers (i.e. with the next stage in the marketing channel or supply chain). Only recently have some researchers extended this view, understanding that firms “will often be able to make profitable use of market intelligence not only on its immediate customers, but also on customers further down the chain and especially on the end-users served by the chain” (Grunert, Jeppesen, Jespersen, Sonne, Hansen, Trondsen, and Young, 2005, p. 429).

Siguaw, Simpson, and Baker (1998) collected data from matched supplier-distributor dyads and studied the effects of the supplier’s market orientation on the distributor’s market orientation and on various channel relationship factors. The suppliers were asked to report on how they relate to their immediate customers (i.e., the distributors), and the distributors how they relate to their immediate customers. Based on the supplier’s responses, the authors show that the supplier’s perception of the distributor’s market orientation is correlated with the supplier’s perception of key relationship constructs, such as trust, cooperation, satisfaction, and commitment (Baker, Simpson, and Siguaw, 1999). This study is confining insofar as the suppliers were not asked how they relate to the distributors’ customers.
In their exploratory study, Steinman, Deshpandé, and Farley (2000) collected data on matched supplier-customer dyads and asked the intriguing question “what happens when customers and suppliers disagree about the appropriate level of a supplier’s market orientation?” They find that a “market orientation gap” does exist, with suppliers thinking more highly of themselves than of their customers.

Zhao and Tamer Cavusgil (2006) were also interested in the suppliers’ orientation towards the customer (i.e., the manufacturer) and show that if a supplier is market oriented, he can expect higher trust and a long-term commitment from the manufacturer.

To our knowledge, Langerak’s (2001) is the only large-scale empirical study that simultaneously considers what he labels “downstream market orientation” (i.e., customer orientation from the focal firm’s perspective) and “upstream market orientation” (i.e., supplier orientation from the focal firm’s perspective). The concept of upstream market orientation is unique in a way that it relates to “the intelligence generation and dissemination activities that are necessary to understand how the know-how and skills of suppliers can be used to create superior customer value (i.e., supplier orientation).” That is, upstream market orientation refers to the next stage upstream in the marketing channel or supply chain. However, the concept of downstream market orientation taps into the ‘traditional’ notion of market orientation since it simply refers to the next stage downstream in the marketing channel or supply chain.

Investigations that apply the market orientation concept not only to immediate customers (or suppliers), but to customers further down in the marketing channel or supply chain have only just started to appear. Grunert and his colleagues extend market orientation to the value chain level and present four preliminary exploratory case studies from the agricultural and fishery industries. They find that the degree of market orientation is distributed unequally across the stages of the value chain, and that heterogeneity and dynamism of end-users served determines the extent of market orientation of a value chain (Grunert, Jeppesen, Risom Jespersen, Sonne, Hansen, and Trondsen, 2002; Grunert, Jeppesen, Jespersen, Sonne, Hansen, Hansen, and Young, 2005). Likewise, Ottesen and Grønhaug present exploratory case studies conducted in the seafood industry. First, they investigate how upstream actors handle customers’ needs and wants when confronted with uncertain input supply, and find that upstream actors continuously watch the supply situation and consider the dimension ‘supply’ in their market orientation (Ottesen and Grønhaug, 2002; Ottesen and Grønhaug, 2004). Second, the majority of upstream actors possess limited knowledge about the end-users or consumers’ quality perceptions (Ottesen, 2006).

In our present study, we build on the view of suppliers’ customer orientation which they direct not to their immediate customers, but to their customers’ customers. We argue that the customer can benefit from the downstream customer orientation of his supplier since the supplier possesses a much better understanding of what the customer requires (e.g., in terms of new products) and can therefore satisfy his customer’s needs.

The benefits of being market- and customer-oriented in innovation contexts are largely accepted. In line with the conceptual writing of Kohli and Jaworski (1990) who argue that market-oriented firms are well prepared for the successful development of new products, a number of studies conducted over the past decade have emphasized the importance of market and customer orientation on various dimensions of an organization’s innovation performance. Atuahene-Gima (1995) reports a significant relationship between market orientation, development activities, new product performance, and the market performance of new products. Gatignon and Xuereb (1997)
found evidence that in markets with uncertain demand, customer orientation has a positive effect on innovation performance. Lukas and Ferrell (2000) found that firms with stronger customer orientation are more innovative in the sense that they are more likely to launch new-to-the-world instead of me-too products. According to Kahn (2001), there is a correlation between market orientation, interdepartmental integration with product development and product management performance. Langerak, Hultink, and Robben (2004) establish the link between market orientation, proficiency in predevelopment activities (strategic planning, idea generation, idea screening), new product performance, and organizational performance. Atuahene-Gima, Slater, and Olson (2005) found that responsive and proactive market orientations have a positive effect on product development performance when one is at higher level and the other is at lower level, and that they are moderated by organizational implementation conditions and marketing function power. Baker and Sinkula’s (2005) summary of empirical studies reinforces the strong link between market orientation and new product performance, since they show that 16 out of 17 studies which they analyzed report such positive links.

Bringing our novel concept of downstream customer orientation and insights from previous studies of the positive impact of market and customer orientation on effectiveness and efficiency dimensions of innovation performance as well as the new product’s overall performance together, we hypothesize:

Hypothesis 1a-c: Downstream customer orientation of the supplier will be positively associated with the customer firm’s (a) NPD effectiveness, (b) NPD efficiency, and (c) new product performance.

Supplier-customer homophily. It is a fundamental and well established principle of human communication that the exchange of ideas most frequently occurs between transceivers who are homophilous (Rogers and Bhowmik, 1971; Rogers and Kincaid 1981). Homophily – originally a sociological concept – is the tendency for the contact between similar individuals to occur at higher rates than among dissimilar individuals and that similar individuals are likely to associate with each other than by chance (Lazarsfeld and Merton, 1954). Individuals in homophilic relationships share attributes (e.g., beliefs, values, education) that make communication and relationship formation easier. According to Rogers and Bhowmik (1971), the parties in homophilic relationships interact more and the communication is more effective. In their original formulation of homophily, Lazarsfeld and Merton (1954) distinguished status homophily from value homophily. Status homophily is a tendency to associate with individuals with similar social status characteristics, and value homophily is a tendency to associate with people who think in similar ways, regardless of differences in status. A vast array of network studies has discovered that the similarity with respect to common cultures, beliefs, values, education, social status etc. translates into network distance. The closer the network ties the more frequent and intensive the interaction among the individuals in it (McPherson, Smith-Lovin, and Cook, 2001).

The idea of homophily depends on its context, that is, “who the source and receiver are, the message content, and other considerations” (Rogers and Bhowmik, 1971, p. 531). Since the concept of homophily as applied in our study pertains to supplier-customer innovation projects, we need to adapt the conception and operationalization accordingly. First, we need to specify the level of analysis. While homophily was originally related to the individual level, it was extended to the team-level (Joshi, 2006), and the inter-organizational level of analysis (Palmatier, Dant,
Grewal, and Evans, 2006). The latter is relevant for our research. Second, we operationalize supplier-customer homophily as an aggregate index along several dimensions which can facilitate the effective and efficient execution of NPD projects with supplier contribution. For example, since innovation projects are inherently risky, we included the strategic orientation of the two firms and their propensity for risk taking. Similar characteristics secure stability and foster communication in the supplier-customer relationship.

Joshi (2006, p. 584) notes that “[H]omophilous exchanges are considered more stable than interactions with dissimilar individuals.” Stability comes from higher levels of mutual trust and interpersonal attraction among supplier and customer employees (Joshi, 2006). Similarity increases trust (Morgan and Hunt, 1994), and is thus a critical dyadic antecedent for this customer-focused relational mediator (Palmatier, Dant, Grewal, and Evans, 2006).

Similar attributes of the supplier and customer firm facilitate communication. Marketing channel research suggests that communication frequency and intensity have positive influences on channel results (e.g., coordination, satisfaction, commitment) and enhance channel performance in terms of effectiveness and efficiency (Mohr and Nevin, 1990). The more intensive and frequent the communication between channel members, such as suppliers and customers, the more likely for ambiguity in the message to be reduced. Likewise, communication among the entities involved in innovation projects is a key success factor for project outcomes and an efficient execution of the project. Hoegl and Wagner (2005) have shown that a certain level of communication frequency and intensity is imperative for NPD project performance. When information about the content and the status of the joint work product is frequently shared, all supplier and customer project team members are likely to be better informed and can incorporate this up-to-date information in their own work (Ragatz, Handfield, and Scannell, 1997). This intensive communication will therefore lead to effective and efficient NPD outcomes.

In sum, a higher homophily between the supplier and the customer along several dimensions relevant for interfirm innovation projects will support stable interactions between the two parties and result in more intensive communication between the supplier and the buyer. Thus we hypothesize:

Hypothesis 2a-c: Supplier-customer homophily will be positively associated with the customer firm’s (a) NPD effectiveness, (b) NPD efficiency, and (c) new product performance.

NPD effectiveness (innovativeness). Various terminologies and measures have been used interchangeably to describe innovativeness. While there is still an ongoing debate about the composition and evaluation of product innovativeness with the goal of separating and describing parsimonious dimensions, it is generally accepted that innovativeness refers to the potential discontinuity which a product generates in the technological and marketing process (Calantone, Chan, and Cui, 2006; Danneels and Kleinschmidt, 2001; Garcia and Calantone, 2002). Since the goal of our present research is not to contribute to the decomposition of the product innovativeness construct, for simplicity we follow the notion of innovativeness used by Sivadas and Dwyer (2000). They describe the degree of newness of an innovation as ‘low’ or ‘incremental’ on the one end of the innovativeness spectrum, and as ‘high’ or ‘radical’ on the other end. Sivadas and Dwyer (2000) refer to new products with incremental innovation as improvements, revisions or supplements to existing products, and with radical innovation as new-
to-the-world and pioneering products representing technological breakthroughs. In general, this
degree of newness can be judged from the customer’s, the firm’s, the market’s, the industry’s, or
from other perspectives (Garcia and Calantone, 2002; Lee and O’Connor, 2003). Our
classification of incremental and radical innovations is also multi-faceted and combines aspects
of newness to the firm and newness to the market/customer.

Some prior empirical research supports our proposition that innovativeness and new product
performance are positively related. Robinson (1988) surveys a cross-section of mature industrial
goods firms and shows that pioneering firms, those that are the first to develop new products,
achieve higher relative market shares. Kleinschmidt and Cooper’s (1991) study of 195 new
product cases found that highly innovative products have the highest success rate (80%) while
medium- and low-innovative products have lower success rates. They conclude that the high
success rate of highly innovative products results from the superior product advantages that
characterize this type of innovation. Furthermore, highly innovative products are less risky than
they are assumed to be (Kleinschmidt and Cooper, 1991). The results of a survey of 275
manufacturing and service companies provide strong support for the proposition that market
orientation has a greater positive influence on the performance of new products when the degree
of newness to customers and the firm is high (radical new products) rather than low (incremental
new products) (Atuahene-Gima, 1995). In his study of 147 product innovations in the US
electronics industry Zirger (1997) finds a significant and positive linear relationship between the
degree of product innovativeness and product success. Goldenberg, Lehmann, and Mazursky’s
(2001) classified 70 successful and 57 unsuccessful products and identified that the successful
products were associated with a higher newness to the market as well as a higher newness to the
firm. As a generalization of their decade-long research program focused on companies from a
dozen of industrial and transition economies operating in business-to-business markets,
Deshpandé and Farley (2004, p. 18) conclude that innovativeness has a consistently positive
impact on firm performance, particularly in the industrial world. Likewise, Szymanski, Kroff,
and Troy (2007) deduce from their recent meta-analysis that the relationship between
innovativeness and new product success is small but positive on average.

In contrast, some research reveals that the innovativeness–new product performance relationship
only holds under selected conditions (e.g., Szymanski, Kroff, and Troy, 2007) or that highly
innovative products may have a negative impact on new product performance. This is, for
example, due to the fact that customers may have negative associations with high-tech products
and therefore hesitant to purchase them. As a consequence, the market shares, growth rates and
profitability of the new product might be negatively affected (Cooper, 1985; Mick and Fournier,
1998). While we acknowledge these findings, we did not expect to discover negative
relationships between innovativeness and new product performance in our present study. The
setting of our study was the manufacturing sector and encompassed, for example, automotive,
machinery, chemicals, and some technology firms. On average, the products developed by these
manufacturing firms are not necessarily ‘high-tech.’ Therefore, the technological fear which is an
issue in the commercialization of high-tech products is less prevalent.

Overall and in line with Szymanski, Kroff, and Troy (2007) we expect the innovativeness of the
product developed by the project with the supplier’s contribution (i.e., NPD effectiveness) to be
related to the product’s performance. We hypothesize:
Hypothesis 3: NPD effectiveness of the project with supplier contribution will be positively associated with new product performance.

**NPD efficiency.** It is widely accepted that efficiency is determined by the resources in cost and time required to complete an innovation project (Clark and Fujimoto, 1991; Wheelwright and Clark, 1992). The speed of innovation affects and is affected by NPD project costs (Meyer, 1993). Therefore, we treat NPD efficiency as a multidimensional theoretical construct that refers to two distinct but interrelated dimensions: project cost and project speed. Summarizing the first-order constructs cost and speed on NPD efficiency, a second-order formative model is proposed. This model posits a ‘Type II’ second-order factor specification (Jarvis, MacKenzie, and Podsakoff, 2003) with formative indicators for the second-order latent NPD efficiency construct, and reflective indicators for the first-order measurable constructs.

Efficiently executed projects can foster new product success along the time and cost dimension. First, for profitable growth through new products, firms need to move these products to market faster because of shrinking product life cycles and rapid obsolescence of established products on the market. The shorter the NPD cycle time, the greater the likelihood that the firm can adopt first-mover strategies, be first to the market and reap pioneering benefits (Lieberman and Montgomery, 1988). Many studies of innovation success and failure have claimed that development speed and new product profitability are causally related and hinted at the importance of development speed in the success of an NPD project (e.g., Cordero, 1991; Griffin, 1993; Griffin, 1997; Kessler and Chakrabarti, 1996; Kessler and Chakrabarti, 1999).

Second, efficient NPD projects with faster development processes place a cap on R&D and engineering hours because there is less time to spend R&D funds. These projects consume fewer resources through lower development and product commercialization costs (Rosenthal, 1992). As a consequence, a smaller amount of development cost needs to be recovered by the newly developed product on the market. This gives the firm the opportunity either to achieve higher profit margin, or lower the price of the product and capture larger shares of the market.

Brown and Eisenhardt’s (1995) review of factors affecting the success of NPD projects also strongly supports our proposition that NPD efficiency is a driver for new product performance. The authors argue first, that fast and highly productive NPD processes lead to lower costs and consequently to lower prices, which, in turn, contribute to the success of the new product, and second, that the fast execution of development projects reduces the time-to-product launch and establishes strategic flexibility. Shorter time-to-market and flexibility consecutively result in financially successful NPD projects (Brown and Eisenhardt, 1995).

In line with Brown and Eisenhardt (1995) and other authors (e.g., Kessler and Chakrabarti, 1996; Lieberman and Montgomery, 1988) who emphasize the role of efficient NPD project execution and its link to financial performance of the product, we hypothesize:

Hypothesis 4: NPD efficiency of the project with supplier contribution will be positively associated with new product performance.
3. Methodology

3.1. Research setting and data

This research program employed a demanding matched supplier-customer sampling methodology. Data were collected on both sides of the supplier-customer dyad. It is not concerned with the supplier firms’ innovative activities and supplier-customer relationships in general. Instead, it focuses on the innovative contribution to a NPD project of a specific customer (“Customer X”). The customer firm target sample consisted of the members of a national purchasing and supply management association. The survey required respondents to report on a recently finished NPD project and to specify a supplier which contributed to this particular project (“Supplier X”). Managers involved in purchasing, materials and supply chain management are suitable to serve as key informants on NPD projects with supplier innovation (Roy, Sivakumar, and Wilkinson, 2004). First, they play an important role in NPD projects with supplier innovation and are frequently team members on such projects. Second, they possess a boundary-spanning view and are capable of providing information about the general (and long-term) business relationship of their firms with the supplier. Electronic questionnaires were sent to 729 customer firms, with follow-up emails sent within a week. To encourage participation, all participants were offered the opportunity to enter a raffle. Ninety-six responses were obtained, resulting in a response rate of 13.2%. While an increasing number of prominent firms, such as Boeing or Toyota, have extended their NPD activities across organizational boundaries (Chesbrough, 2003; Quinn, 2000), many firms still do not exploit their suppliers’ innovation potential. Therefore, the number of companies that are able and willing to report on NPD projects with supplier contribution is still limited, and consequently the response rate of this study was satisfactory.

The customer firm’s key informants were asked to provide the name of the supplier who contributed to the NPD project in addition to the name and contact details of an individual contact in the supplier firm with knowledge about the relationship with this customer. A total of 90 informants provided the required details. Thus, 90 electronic questionnaires were mailed to suppliers. Reminders sent after one week and additional follow up calls within another two weeks generated a total of 45 completed supplier responses, resulting in a 50.0% response rate. Thus, the data analysis in the subsequent sections is based on 45 matched sets of supplier-customer data (i.e., N = 45).

To test for non-response bias in customer firm responses, early respondents (first one-third of responses) were compared to late respondents (last one-third of responses) and customer firms for which matched supplier questionnaires were returned (one-half of responses) were compared to those of customer firms where matched supplier questionnaires were not returned (one-half of responses) on firm characteristics (i.e., annual sales and number of employees), as well as on the items used in the model. There were no significant differences in all tests, indicating that non-response bias was not present in the data.

The annual sales volumes of the customer firms ranged from US$ 0.8 million to US$ 3.1 billion with an average of US$ 510.6 million. The firms employed between 6 and 16,000 people with an average of 2,277. The customer sample represents a wide range of industries: automotive and automotive suppliers (13.3%), machinery (17.8%), metal (6.8%), high-tech, electronics (17.8%),
construction and construction suppliers (13.3%), chemicals (6.7%), textiles (4.4%), packaging and paper (4.4%), food (4.4%), and other industries (11.1%).

The suppliers’ annual sales volume ranged from US$ 0.9 million to US$ 1.3 billion with an average of US$ 138.7 million. Between 2 and 4,700 employees worked at the supplier firms; the average was 576 employees.

3.2. Measures

Multiple-item scales were developed based on previously published research as well as our own conceptualization. The individual questionnaire items are depicted in the Appendix.

**Downstream customer orientation.** Our primary concern in measuring this construct was to identify a scale that would allow the assessment of the suppliers’ orientation towards their customers’ customers. Since downstream customer orientation is a novel concept, the scale is also new. However, it has much of its grounding in the seminal work in the area of market orientation, that is, the generation of market intelligence, the dissemination of the intelligence, the organization-wide responsiveness to it (Kohli and Jaworski, 1990), as well the behavioral components of customer orientation and interdepartmental coordination (Narver and Slater, 1990). The supplier respondents were asked questions pertaining to their customer’s customers on a 5-point Likert type scale anchored “strongly disagree” and “strongly agree.”

**Supplier-customer homophily.** In order to create germane items for a homophily scale, Rogers and Bhowmik (1971, p. 531) advocate considering the “relevant variables” which in turn depend on the parties involved on both sides of the dyad (in our case business firms) and the situation (in our case an innovation context). Since innovative activities within a supplier-customer relationship involve significant risks and resources on both sides (e.g., Goffin, Lemke, and Szweczyewski, 2006; Koufteros, Cheng, and Lai, 2007) and require goal and task alignment, in addition to coordination on the organizational and project levels (e.g., Gerwin and Barrowman, 2002; Wagner and Hoegl, 2006), we created a five-item formative scale to measure supplier-customer homophily. The supplier respondents rated their similarity (Palmatier, Dant, Grewal, and Evans, 2006) with the customer firm along five dimensions: strategic orientation, innovativeness, risk taking, and interfirm partnering. The items were measured on five-point Likert type scales anchored “low” and “high.”

Following earlier recommendations to assess innovation output multi-dimensionally, several constructs pertaining to performance of the innovation project, as well as the market and financial performance of the product were included in the model (Brown and Eisenhardt, 1995; Cordero, 1990; Madhavan and Grover, 1998; Verona, 1999). The customer firm respondents were asked to answer the questions with respect to the specific NPD project to which Supplier X contributed. The advantage of using a project as unit analysis over other units of analysis (e.g., business units or a firm’s supplier relationships in general) is that specific products and projects can better be monitored for efficiency and effectiveness (Kessler and Chakrabarti, 1999). Consistent with prior research (e.g., Joshi and Sharma, 2004; Langerak and Hultink, 2006; Sivadas and Dwyer, 2000), these outcome measures were assessed using subjective rather than objective measures. Subjective measures are preferable to objective measures since they are easier to obtain and can facilitate comparisons between the projects and products (Matsuno, Mentzer, and Özsomer, 2002). Subjective performance measures have demonstrated statistically significant correlations.
with their corresponding objective measures of performance (e.g., Pearce, Robbins, and Robinson, 1987), indicating that the perceptual rating of new product performance can be considered a reliable indicator.

**NPD effectiveness (innovativeness).** The six-item innovativeness construct taps the discontinuity which the product developed by the specific project generated in the technological and marketing process (Garcia and Calantone, 2002). We employed the measures used by Sivadas and Dwyer (2000) and augmented them with items from Lee and O’Connor (2003). All items were measured on a five-point-Likert type scales anchored “strongly disagree” and “strongly agree.”

**NPD efficiency (project cost and project speed).** The aggregate, second-order construct project efficiency consisted of two dimensions. A formative construct is appropriate because the dimensions of project cost and project speed induce the efficiency of the customer’s NPD project (Edwards, 2001). The first-order project cost construct taps the financial requirements and associated human resources needed to complete an NPD project (Rosenthal, 1992). It includes measures of development cost and commercialization cost because cost data are of interest by phases (Griffin, 1993). The development phase begins with the expenditure of money on research and product development, and the commercialization phase is the phase where manufacturing trials begin (Griffin, 1997). The cost components associated with these phases are the development and commercialization costs that together constitute project costs. This construct is operationalized as a four-item scale, anchored “strongly disagree” and “strongly agree.” The first-order construct project speed represents the time it takes to carry out the new product project, that is, the time elapsed between the initial development efforts and the introduction of the product into the market (Griffin, 1993; Kessler and Chakrabarti, 1999). The three-item, five-point Likert type scale (anchored “strongly disagree” and “strongly agree”) was adapted from prior research (Akgün and Lynn, 2002).

**New product performance.** To measure the new product’s overall innovation performance, customer respondents were asked three questions which were taken from the research of Joshi and Sharma (2004). On a three-point scale they had to assess their perceptions of the new product’s performance relative to their principal competitor (i.e., profitability, market share, and growth).

**Control variables.** We control for variables that, while not the focus of this research, are likely to influence the key variables in our model. First, size of the customer firm can be important in the context of supplier innovation. On the one hand, the human and financial resources available to larger firms may make them more successful in their innovation efforts. On the other hand, smaller firms might be more entrepreneurial and bring about more inventions than larger firms. Since the purpose of the research question was to ascertain and depict the effects of supplier innovation apart from firm size, we eliminated this undesirable source of variance that may confound the analysis by including firm size as a control variable. Firm size was operationalized as the log transformation of the customer firm’s number of employees. Second, we aimed to investigate the influence of our focal constructs independent from the history of the supplier-customer relationship. Therefore, relationship age – the number of years the supplier had been doing business with the customer firm – was included as a control variable.
4. Results

Because our causal model involves both reflective and formative measures we have chosen the variance-based partial least squares (PLS) approach to analyze both the measurement and also the structural model (Fornell and Bookstein, 1982). PLS approximates the latent variables as exact linear combinations of observed measures, therefore avoids the indeterminacy problem and provides an exact definition of component scores. It is assumed that all the measured variance is useful variance to be explained. The determinate nature precludes parameter identification problems that can occur under covariance-based approaches (Bollen, 1989). For a detailed discussion of the PLS algorithm see Wold (1980) and Lohmöller (1989).

4.1. Measurement validation

Reflective constructs, second-order constructs, and formative constructs need to be validated separately (Bollen and Lennox, 1991; Diamantopoulos and Winklhofer, 2001; Hulland, 1999). We estimated two separate confirmatory factor analyses (CFA) for measure validation: (1) for the three reflective scales (i.e., downstream customer orientation, innovativeness, new product performance), and (2) for the two proposed second-order factors (i.e., project efficiency comprising project cost and project speed). For these two CFAs we cannot report overall fit indices, since the objective of PLS is prediction versus fit.

The reliabilities of the individual item were evaluated by examining the loadings of the measures on their respective reflective constructs. Loadings of .70 or higher (which implies a shared variance of 50% or more between the individual item and the construct) are indicative of good item reliability. Cronbach’s α (Cronbach, 1951) was used to assess convergent validity. In addition, we followed the recommendation to calculate Fornell and Larcker’s (1981) reliability measure $\rho$. In the context of PLS analysis, this measure of composite reliability is often considered superior to Cronbach’s $\alpha$ since $\lambda$-equivalency among the measures is not assumed and the loadings estimated within the causal model are used in its computation (Chin, 1998, p. 320; Hulland, 1999, p. 199). Cronbach’s $\alpha$ values and composite reliabilities of more than .9 indicate high convergent reliability (Hair, Black, Babin, Anderson, and Tatham, 2005). The ranges of loadings for each measure as well as Cronbach’s alphas, and composite reliabilities are depicted in the Appendix.

We begin with the assessment of the first CFA for the reflective constructs. All indicators loaded significantly and substantially on their hypothesized factor ($p < .001$). For the three reflective constructs 14 items had loadings greater than .9, 2 items had loadings greater than .7, and no item had a loading less than .7. Overall, all items loaded higher than the recommended threshold level, an indication of a satisfactory level of item reliability. All constructs exhibit satisfactory $\alpha$ values and composite reliabilities of more than .9, thus indicating high convergent validity (Hair, Black, Babin, Anderson, and Tatham, 2005).

The inspection of the second CFA for the higher-order constructs shows that these indicators also loaded significantly and substantially on their hypothesized factor ($p < .001$). For the two constructs of project cost and project speed, five items had loadings greater than .9 and two items had loadings greater than .8, indicating a high level of item reliability. The two constructs exhibit satisfactory $\alpha$ values and composite reliabilities of more than .9, thus indicating high convergent validity (Hair, Black, Babin, Anderson, and Tatham, 2005). We validated the proposed second-
order formative model of project efficiency by modeling the weights \( (\gamma) \) of the first-order factors to the second-order factor by means of the CFA procedure in PLS (Diamantopoulos and Winklhofer, 2001; Edwards, 2001). The impact of both first-order constructs on the second-order construct is significant (i.e., project cost: \( \gamma_1 = .55, t = 43.32, p < .001 \); project speed: \( \gamma_2 = .48, t = 27.82, p < .001 \)). Project efficiency is proposed as a unitary second-order construct formed by project cost and project speed.

We proceed with the assessment of the formative construct. Formative items are not expected to be correlated with each other. Instead they “can have positive, negative, or no correlation.” (Bollen and Lennox, 1991, p. 307). Therefore, the traditional measures of item and construct reliability applied above are not appropriate. Instead, it is recommended that researchers closely examine the weights of the formative indicators in their respective constructs in the light of the theory employed to identify appropriate measures (Chin, 1998, p. 307; Jarvis, MacKenzie, and Podsakoff, 2003, p. 202). Based on the evaluation of the weights under theoretical considerations we have maintained the five formative indicators for the construct homophily. However, formative items should be deleted in case of multicollinearity (Diamantopoulos and Winklhofer, 2001). We conducted several tests to uncover multicollinearity between and among the items and found no evidence of multicollinearity (Hair, Black, Babin, Anderson, and Tatham, 2005, p. 227ff.; Mason and Perreault, 1991). First, all bivariate correlations among the items were below the commonly used cutoff level of .8 (Mason and Perreault, 1991). Second, we conducted six linear regression analyses by regressing each item against the other items, so that each item is the regressant at one time. We found the highest variance inflation factor (VIF) score to be 3.14, which is much below the upper limit of 10, indicating that no item is highly collinear (Marquardt, 1970). Furthermore, the highest condition index was 17.30, which is considerably below the recommended threshold level of 30 (Belsley, Kuh, and Welsh, 1980). In sum, multicollinearity was not a problem and no item had to be deleted.

In order to assess discriminant validity in the context of PLS analysis, the square roots of the average variance extracted (AVE\(^2\)) (i.e., the average variance shared between a construct and its measures) and the correlations between the different constructs need to be computed and examined (Chin, 1998, p. 321; Hulland, 1999, p. 199f.). Discriminant validity, that is, the degree to which the measures of the various constructs used in the model differ from each other, is acceptable. First, the constructs account for at least 79% of the variance of the indicators (see Appendix). This is well above the recommended threshold of 50% (Chin, 1998, p. 321). Second, Table 1 shows that the diagonal elements of the correlation matrix containing the square roots of the AVE are significantly greater than the off-diagonal elements containing correlations (Chin, 1998, p. 321; Hulland, 1999, p. 200).

Overall, in the assessment of the constructs we have shown that all psychometric properties for the measurement model are strong enough for the estimation of the structural model for hypothesis testing to be appropriate.

### 4.2. Hypothesis testing

The estimation of the parameters in the PLS structural model allows us to test our hypotheses. A bootstrapping method on the basis of 200 bootstrapping runs was used to calculate the statistical significance level of the parameter estimates and the standard errors. Unlike in SEM techniques,
there is no summary statistic for overall model fit. Instead, variance explained ($R^2$) and the sign and significance of the parameter estimates are used to assess the structural model (Chin, 1998, Hulland, 1999). The $R^2$ values range from .34 for NPD efficiency to .87 for new product performance. That is, all endogenous constructs explain substantial variance.

Table 2 summarizes the results of the PLS estimation and hypothesis tests. In support of H1a and H1b, they show that the supplier’s downstream customer orientation is positively related to the customer firm’s NPD effectiveness ($\beta = .30, < .01$) as well as NPD efficiency ($\beta = .28, < .01$). However, there is no direct effect between the supplier’s downstream customer orientation and the customer firm’s new product performance, thus indicating lack of support for H1c. The results further show that supplier-customer homophily is positively related to the customer firm’s NPD effectiveness ($\beta = .57, < .01$) as well as NPD efficiency ($\beta = .54, < .01$), lending support for H2a and H2b. However, there is no direct effect between the supplier-customer homophily and the customer firm’s new product performance, thus indicating lack of support for H2c. As expected and in support of H3, NPD effectiveness and new product performance are significantly related ($\beta = .86, < .01$). The last hypothesis specifies that NPD efficiency will affect new product performance. Though, contrary to expectations this hypothesis is not supported ($\beta = .10, > .05$), thus indicating lack of support for H4. In sum, five out of eight hypotheses were substantiated by our data. The results indicate the importance of the supplier’s downstream customer orientation and supplier-customer homophily for the customer firm’s NPD efficiency (i.e., project cost and project speed) as well as the customer firm’s NPD effectiveness (i.e., innovativeness) and new product performance.

With regard to the control variables, firm size had no significant impact on any of the dependent variables. Relationship age had a significant influence in the explanation of NPD efficiency ($\beta = .13, < .05$), but neither influenced new product performance nor NPD effectiveness.

5. General discussion and implications

By drawing on two new relationship marketing constructs and applying them to the context of innovation in supplier-customer relationships we have generated some unique insights from this alternative research approach. Of particular interest is that the supplier’s downstream customer orientation and supplier-customer homophily have a positive impact on the customer firm’s NPD effectiveness and efficiency. That means that downstream customer orientation and supplier-customer homophily are key traits to be considered when suppliers are selected for inclusion in the customers’ new product projects. This insight calls for an extension of the traditionally limited focus on technological and commercial supplier selection criteria. Customer firms need to assess the additional criteria identified in this research prior to working with suppliers in innovation projects. We discuss our results, and their implications for marketing theory and practice in the following sections.

5.1. Implications for marketing researchers and limitations

After nearly two decades of research on market orientation efforts of the focal firm, a central element of the marketing concept, this is the first study that investigated how the orientation of the focal firm’s supplier towards the customer’s customer (i.e., the focal firm’s customer)
influences the focal firm’s NPD effectiveness and efficiency and performance of a new product developed in a NPD project. Researchers should take this construct and transfer it to other settings in interfirm innovation research, and to marketing channel research in general. It is worth studying how suppliers can actively build up and market downstream customer orientation capabilities. How can they acquire knowledge about the downstream customers, how can this knowledge be transferred to the immediate customer, and how can it be exploited in innovation and marketing initiatives? These and like questions are vital for the enhancement of relationship marketing and the marketing channel research.

The present study was a next step in the study of supplier-customer homophily in the context of supplier-customer innovation. We substantially augment the hitherto predominant focus on the supplier’s technical and commercial capabilities in supplier selection decisions. Our research underlines that such ‘softer’ criteria should play a more prominent role since they explain substantial variance of the customer firm’s innovation performance. Studying supplier-customer homophily in more depth is also a fruitful avenue to explore.

In contrast to most other studies, we used a multi-dimensional perspective of innovation performance, including NPD effectiveness, NPD efficiency, and overall new product performance. The advantage of such an approach is that it is closer to the problem that managers face and provides richer results.

The results from this study are based on data from both the supplier and the customer organization and pertain to 45 supplier-customer dyads. The empirical data base for this research comprises 90 individual responses. This dyadic research design reduced the likelihood of common method biases by (1) obtaining measures of the independent and dependent variables from different sources, (2) offering anonymity and confidentiality to supplier and customer respondents in order to reduce the chances of desirable responses, and (3) informing respondents that there are no right or wrong responses and that they should answer as honestly as possible to reduce evaluation apprehension (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). This procedure accompanied the challenge of collecting and matching data sets from both sides of the supplier-customer dyad. The drawback of such a procedure is that the resource demands involved in handling the complexity and quantity of data collection often permit the inclusion of only a limited sample (Steinman, Deshpandé, and Farley, 2000). Other researchers had to cope with even smaller numbers. For example, Steinman, Deshpandé, and Farley (2000) base their analysis of the appropriate level of a supplier’s market orientation on a very small, but undisclosed number of supplier-customer dyads and Primo and Amundson (2002) investigated 38 NPD projects to study the impact of supplier integration on product quality, project development time and project cost. Nevertheless, it should be noted that the small sample limited the statistical power. Hence, while our research provides support for five out of eight hypotheses with statistically significant results, this study does not possess the statistical power to reject the relationship that failed to show a statistically significant result. In general, future studies should strive to collect a larger number of matched responses. Another limitation is the cross-sectional nature of our study. Hence, it cannot establish causality between variables. Only a longitudinal research design could provide better answers to questions of causality as well as the development of key variables such as downstream customer orientation, supplier-customer homophily, or innovativeness over time (e.g., over the lifetime of a supplier-customer relationship).
5.2. Managerial implications

From the *customer firm’s perspective*, our research shows the importance of selecting suppliers to work with based on a broader and solid assessment of the supplier-customer homophily (i.e., similarity), as well as the supplier’s orientation towards the customer’s customers (i.e., the supplier’s downstream customer orientation). The members of the buying center should therefore augment and reinforce their supplier assessment and selection process with appropriate criteria. In the end, commercially and technically competent suppliers which also have a thorough understanding of the downstream customer’s needs and wants and share similar characteristics with the customer firm will have a stronger positive impact on the customer firm’s innovation performance.

From a *supplier perspective*, our research provides additional avenues how suppliers can differentiate themselves from their competitors. The first way is through superior downstream customer orientation. By demonstrating and vigorously marketing to the (immediate) customer that the supplier firm possesses knowledge about the customer’ customers, it can generate benefits for the customer firm’s innovation performance. Supplier firms that solely focus on the customer are incapable of offering such benefits. Second, actively establishing embedded ties with potential customers who share akin attributes (e.g., attitudes towards innovation and risk, personal characteristics of customer employees) is a promising strategy in building up interfirm relationships in the marketing channel. Ceteris paribus, joint projects with homophilous customers will be more successful for the customer firm and result in higher customer satisfaction.

Notes

1 Internal consistency $\rho_y = ((\sum \lambda_{yi})^2 / ((\sum \lambda_{yi})^2 + \sum \text{var}(\epsilon_i)))$, where $\text{var}(\epsilon_i) = 1 - \lambda_{yi}^2$ (Fornell and Larcker, 1981).

2 Average variance extracted $\text{AVE} = (\sum \lambda_{yi})^2 / (\sum \lambda_{yi}^2 + \sum \text{var}(\epsilon_i))$, where $\text{var}(\epsilon_i) = 1 - \lambda_{yi}^2$ (Fornell and Larcker, 1981).
References


Fornell, Claes and Larcker, David F. (1981): Evaluating structural equation models with unobservable variables and measurement error, in: Journal of Marketing Research, Vol. 18, No. 1, February, pp. 39-50


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Appendix. Measures

Notes: $\alpha =$ Cronbach’s alpha. CR = composite reliability. AVE = average variance extracted. (R) indicates reverse coded items.

**Downstream customer orientation**

(Range of loadings .78-.99; $\alpha = .98$; CR = .98; AVE = .88; 5-point scale anchored: Strongly disagree - Strongly agree)

Please indicate your opinion on the following statements:

- In our firm we believe that it is critically important to serve the needs of downstream customers.
- We gather information about product related experiences of our customers’ customers.
- Our strategy to gain competitive advantage is based on our understanding of the final customers’ needs.
- In our business objectives we explicitly consider the satisfaction of downstream customers.
- We constantly think about serving the needs of those who use our customer firms’ products.
- We systematically and frequently measure the satisfaction of the final customers.
- Information on the satisfaction of downstream customers (i.e., the users of our customer firm’s products) is disseminated throughout all levels of our firm.

**Supplier-customer homophily (formative)**

(5-point scale anchored: Low - High)

Please rate the level of similarity between your firm and CUSTOMER X on the following areas:

- General approach of doing business.
- Strategic orientation.
- Innovativeness.
- Risk taking.
- Views regarding close partnering with other firms.

**NPD effectiveness (Innovativeness)**

(Range of loadings .93-.99; $\alpha = .99$; CR= .99; AVE = .96; 5-point scale anchored: Strongly disagree - Strongly agree)

Please rate the following with respect to the product developed with the contribution from SUPPLIER X:

- This was a unique new product project that did not directly build on technology of an exiting product line.
- This project capitalized on existing technology but represents a significant extension of technology existing within our firm.
- This product was an updated version of an existing product (R).
- The product was pioneering, first of its kind.
- Similar products were available in the market when we introduced our product into the market (R).
- Our customers required new knowledge or infrastructure to use this product.
NPD efficiency (Second-order construct that consists of project cost and project speed)

Project cost

(Range of loadings .86-.92; α = .91; CR= .94; AVE = .79; 5-point scale anchored: Strongly disagree - Strongly agree)

With regard to the product development project with contribution from SUPPLIER X, please rate the following statements:

- The development costs exceeded budget (R).
- Relative to similar scale products we have developed in the past, the development costs were less.
- The commercialization costs exceeded budget (R).
- Relative to similar scale products we have developed in the past, the commercialization were less.

Project speed

(Range of loadings .94-.98; α = .96; CR = .97; AVE = .93; 5-point scale anchored: Strongly disagree - Strongly agree)

With regard to the product development project with contribution from SUPPLIER X, please rate the following statements:

- This project took longer than the usual amount of time for a project like this in our firm (R)
- My firm holds this project up as an example of fast product development.
- This was one of the fastest projects ever undertaken by our firm.

New product performance

(Range of loadings 1.00-1.00; α = 1.00; CR = 1.00; AVE = 1.00; 3-point scales)

Relative to our main competitor’s new product, the performance of the new product developed by this project is:

- Profitability (Less profitable / About equally profitable/ More profitable).
- Market share (Lower market share / About the same market share / Greater market share).
- Growth rate (Slower growth rate / About the same growth rate / Faster growth rate).
### Table 1. Correlation matrix and square roots of average variance extracted

<table>
<thead>
<tr>
<th>Construct</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Downstream customer orientation</td>
<td>0.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Supplier-customer homophily</td>
<td>-0.06</td>
<td>a</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>3. NPD effectiveness</td>
<td>0.27</td>
<td>0.53</td>
<td>0.98</td>
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<td></td>
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<tr>
<td>4. NPD efficiency</td>
<td>0.25</td>
<td>0.50</td>
<td>0.93</td>
<td>a</td>
<td></td>
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<td></td>
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<tr>
<td>5. New product performance</td>
<td>0.29</td>
<td>0.44</td>
<td>0.93</td>
<td>0.88</td>
<td>1.00</td>
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<td></td>
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<td>6. Firm size</td>
<td>0.03</td>
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<td>0.07</td>
<td>0.09</td>
<td>0.06</td>
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<td>7. Relationship age</td>
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<td>-0.09</td>
<td>0.05</td>
<td>0.10</td>
<td>0.09</td>
<td>0.01</td>
<td>b</td>
</tr>
</tbody>
</table>

Notes: Diagonal contains the square root of the average variance extracted (AVE) for each construct.
- Formative construct, i.e. AVE is not reported.
- Single item construct, i.e. AVE is not reported.

### Table 2. Results of PLS estimation and hypothesis tests

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Standard coefficient</th>
<th>t-Statistic</th>
<th>Hypothesis</th>
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</thead>
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<tr>
<td>NPD effectiveness (R² = .38)</td>
<td>Downstream customer orientation</td>
<td>0.30 **</td>
<td>2.92</td>
<td>H₁a: supported</td>
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<td></td>
<td>Supplier-customer homophily</td>
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<td>5.95</td>
<td>H₂a: supported</td>
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<td>NPD efficiency (R² = .34)</td>
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<td>0.28 **</td>
<td>2.88</td>
<td>H₁b: supported</td>
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<td>Supplier-customer homophily</td>
<td>0.52 **</td>
<td>5.77</td>
<td>H₂b: supported</td>
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<tr>
<td>New product performance (R² = .87)</td>
<td>Downstream customer orientation</td>
<td>0.03</td>
<td>1.04</td>
<td>H₁c: not supported</td>
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<td>0.81</td>
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<td></td>
<td>NPD effectiveness</td>
<td>0.86 **</td>
<td>3.24</td>
<td>H₃: supported</td>
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<tr>
<td></td>
<td>NPD efficiency</td>
<td>0.10</td>
<td>0.33</td>
<td>H₄: not supported</td>
</tr>
</tbody>
</table>

* p < 0.05; ** p < 0.01
Figure 1. Conceptual framework and structural model

Supplier “traits”

- Downstream customer orientation
- Supplier-customer homophily

Customer innovation performance

- NPD effectiveness (Innovativeness)
- NPD efficiency (Project cost and speed)

New product performance

Controls:
- Firm size
- Relationship age

Supplier data

Customer data