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**Supplier Development:
Communication Approaches, Activities and Goals**

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Abstract

Operations managers rely on the purchasing function to obtain production inputs from suppliers, and to ensure supplier performance. The link between supplier development activities performed by buying firms with their suppliers, in terms of operational outcomes and impact on competitive advantage for the buying firm has been well documented. However, a buying firm should, prior to setting up a supplier development program and investing in supplier development activities, establish goals it wants to achieve and determine how to achieve these goals. Until now, supplier development goals in general and their relationship with supplier development activities have received little research attention. The results from this empirical study suggest that the relationship between the goal to improve a supplier's capabilities and knowledge transfer from the buyer to the supplier firm is moderated by the degree of human interaction. Buying firms pursuing the strategy to improve supplier capabilities rely more intensively on training and co-location of buyer and supplier employees to leverage the knowledge transfer to the supplier firm.

Keywords

Buyer-supplier relationships; Human resource issues; Supplier development; Communication; Moderated multiple regression; Survey

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1. Introduction

The formation of supply chains, networks, and buyer-supplier relationships necessitate a reconsideration and development of the communication, behavior and skill-sets of the humans involved in managing supplier relationships (e.g., Buhman, Kekre and Singhal, 2005; Parker and Anderson, 2002). As Hunter, Beaumont and Sinclair (1996, p. 235) point out, “partnership development places strong reliance on the human resource dimension of the two organizations.” The firm’s human resources, on the one hand, and suppliers, on the other hand, play a vital role for high operational performance and for implementing the firm’s business strategy (e.g., Adam, Flores and Macias, 2001; Wagner, 2006a). An overarching goal of the present research is to make an attempt to simultaneously shed more light into buyer-supplier relationships and human resource issues, in particular communication and co-location, within a production and operations management system.

Regarding *human resources*, in 1983 Adam incorporated behavioral aspects on the individual, small work group and large work group levels as a management component in his conceptual production and operations management system typology. Twenty years later in a review article, Boudreau et al. (2003) call attention to the criticality of human considerations in production and operations management and encourage academics and managers to pay closer attention to issues on the operations management–human resource interface. Given the current state of research on cross-disciplinary research in this area they point out that,

“historically [these two disciplines] have been very separate fields. In practice, operations managers and human resource managers interact primarily on administrative issues regarding payroll and other matters. In academia, the two subjects are studied by separate communities of scholars

publishing in disjoint sets of journals, drawing on mostly separate disciplinary foundations. Yet, operations and human resources are intimately related at a fundamental level. ... Operations are the context that often explains or moderates the effects of human resource activities ...” (Boudreau et al., 2003, p. 179).

Despite the importance of human issues in production and operations management, cross-disciplinary research in this area had just begun to emerge (Hunter, Beaumont and Sinclair, 1996). For that reason, Buhman, Kekre and Singhal (2005) recommended major research questions for production and operations management researchers to address, including issues on the interface of production and operations management to organizational behavior, and social/behavioral psychology, with “people,” besides technology and processes, being one of three elements in enterprise network research.

Regarding *suppliers*, the ability of a supplier to meet the buying firm’s needs in order to create and manufacture a product for its customers is a vital component of a firm’s production and operations management system. A firm’s buying needs include a supplier’s ability to perform in the short term, as to quality, cost, delivery and service, and, in the long term with respect to the supplier’s capabilities. In recent years, production and operations management researchers have focused on an industrial firm practice called “supplier development.” Supplier development activities are undertaken by a buying firm to improve the performance or capabilities of its suppliers (Krause, Handfield and Scannell, 1998).

Much of the extant research on supplier development has focused on the process of supplier development (e.g., Hartley and Choi, 1996; Krause, Handfield and Scannell, 1998), antecedents to supplier development (e.g., Krause, 1999; Sako, 2004), and performance outcomes of supplier development (e.g., De Toni and Nassimbeni, 2000; Dyer and Hatch, 2006; Krause, Scannell and

Calantone, 2000). However, the extant literature does not differentiate between supplier development goals and supplier development performance achievements. We believe that this distinction is important, because, for example, a firm may achieve joint cost savings with a supplier, while directing its efforts to achieving on-time delivery performance. While cost savings are important and welcome, the goal of the effort was improved delivery performance, and resources were allocated toward that goal. In the context of supply chain partnerships the distinction between goals and performance and the necessity to achieve the specific objective set for the partnership, and not any outcome, has been emphasized by defining the outcome of a supply chain partnering initiative as “how results compare with objectives” (Boddy, Wagner and Macbeth, 2000, p. 1007). Thus, the primary intent of this research is to investigate the importance of various supplier development activities and methods of communication and human interaction used by buying firms and whether they vary based on their supplier development goals. Furthermore, the article aims at identifying parsimonious structures of supplier development activities and goals.

Subsequent sections of this article briefly review the relevant literature on supplier development, buyer performance goals, and three different communication approaches: supplier evaluation and feedback, knowledge transfer, and human interaction, the latter of which includes the transfer of employees from buying firm to supplier and vice versa. We develop a set of hypotheses that identify relationships between these different approaches to communication and the goals stated by the buying firms for their supplier development effort. In the following sections, we describe the data, measures, analysis, present results and discuss implications for future research.

2. Supplier development, goals, and activities

Within the buyer-supplier relationship domain, supplier development efforts by a buying firm to improve the performance or capabilities of its suppliers (Krause, Handfield and Scannell, 1998) are important to examine because of their impact on the buying firm's performance and competitive strategy (Krause, Scannell and Calantone, 2000; Wagner, 2006a). In order to realize performance improvements in cost, quality and delivery performance and benefit from enhanced supplier capabilities, in terms of increased managerial, product development, and operations expertise, the buying firms and supplier firms need to jointly engage in relationship-specific investments. Thus, the buyer-supplier relationship moves towards cooperation, and the buying firm and its suppliers share knowledge and asset investments (Dyer and Hatch, 2006; Langfield-Smith and Greenwood, 1998). Investments by the buying firm may take the form of information sharing, assistance through training programs, and technical and managerial assistance. The supplier firm may also contribute resources to the development effort, such as sharing information and dedicating physical and human assets (Hunter, Beaumont and Sinclair, 1996; Dyer and Nobeoka, 2000).

When making investments in the buyer-supplier relationship, the buying firm should determine what *goals* it has for the relationship (Dyer and Singh, 1998). However, the research on supplier development has been lacking so far, especially due to the missing distinction between supplier development goals and performance achievements. We still know relatively little about how various goals for supplier development efforts might affect the relationship between the buying firm and the supplier firm. In the present study, we differentiate between supplier development goals which are more immediate and short term in nature, including delivery, order

cycle times, and quality, and less immediate and more long-term goals such as strengthening a supplier's managerial, product development, and operations capabilities. Short term performance indicators may be measured by the buying firm regardless of whether its relationship with a given supplier is close and cooperative, or more arm's length in nature. For the buying firm's management the "emphasis is primarily on the *outputs*" generated by the supplier (Hunter, Beaumont and Sinclair (1996, p. 241). The goal of the buying firm's supplier development effort would focus on the supplier's outputs which are measurable at the buying firm. In contrast, and in line with the relational view the joint creation of value requires efforts from both parties, the combination of complementary capabilities, and a long-term focus on the supplier's capabilities (Dyer and Singh, 1998; Zajac and Olsen, 1993). Emphasis clearly shifts from observable supplier outputs to "the nature and quality of the *inputs*" (Hunter, Beaumont and Sinclair (1996, p. 243) which the supplier can bring to the relationship, that is, the resources and capabilities accumulated in the supplier organization. Thus, the goal of the buying firm's supplier development effort is to improve supplier capabilities.

Supplier development *activities* may include supplier evaluation and feedback, supplier training, the sharing and transfer of employees from one firm to another, and other related activities (Monczka, Trent and Callahan, 1993; Wagner, 2006b). The essence of these activities is that they incorporate various forms of communication, some of which is explicit, easily codified and exchanged, and parts of which are tacit, complex and thus more difficult to convey (Daft and Lengel, 1984; Fulk and Boyd, 1991; Prahinski and Benton, 2004; Sako, 2004).

3. Development of hypotheses

Drawing on the notion of Daft and Lengel's (1984, 1986) media/information richness model and Stryker and Statham's (1985) theory of structural symbolic interactionism, we differentiate between three forms of communication to ascertain the intensity of inter-personal interaction between the buying firm and the supplier in supplier development activities. Furthermore, we relate these three categories of supplier development activities to supplier development goals and derive testable hypotheses which are summarized in the conceptual framework depicted in Figure 1. The hypotheses are focused on differentiating between supplier performance improvements and supplier capability improvement goals, and the three supplier development activities that buying firms undertake to achieve these goals.

Insert Figure 1 about here

The first set of hypotheses is focused on testing the relationships between the buying firm's investments in supplier evaluation, and supplier performance and supplier capabilities. *Supplier evaluation and feedback* efforts represent evaluations of a supplier's quality, delivery, cost and service performance, and other facets of performance the buying firm may deem important. Supplier evaluation may be a unilateral communication mechanism from buying firm to supplier firm and may be in written form (Giunipero, 1990; Prahinski and Benton, 2004). Thus, the use of communication media such as numeric documents or impersonal written documents may constitute the supplier evaluation, and these are at the lower end of Lengel and Daft's (1984, 1986) media/information richness spectrum. An important part of the assessment process may include providing evaluative feedback to the supplier firm. The feedback may include setting

improvement targets which can be compared to current performance. Also, and potentially to a lesser degree, the evaluation and audit information generated by the buying firm could be used by the supplier to upgrade its capabilities in certain areas that have been identified by the buying firm as deficient. In sum, the buying firm may use supplier evaluation and feedback when it strives to improve short-term performance as well as long-term supplier capabilities. Thus, it is hypothesized that:

- H_{1a}: There is a positive relationship between a buying firm’s goal to improve a supplier’s *product and delivery performance*, and its effort to evaluate the supplier.
- H_{1b}: There is a positive relationship between a buying firm’s goal to improve a supplier’s *capabilities*, and its effort to evaluate the supplier.

The second set of hypotheses examines the relationships between the buying firm’s efforts to transfer tacit knowledge to the supplier, and supplier performance and supplier capabilities. *Knowledge transfer focused on capabilities* includes the transfer of specialized knowledge in order to actively influence the development of the supplier’s capabilities (Lorenzoni and Lipparini, 1999). When buying firms share knowledge with the goal to strengthen a supplier’s capabilities, in terms of managerial, product development, and operations expertise, they are faced with conveying a large amount of highly technical and tacit information which is relatively ambiguous and difficult to encode, communicate and interpret (Langfield-Smith and Greenwood, 1998). This suggests the necessity to use media on the “richer end” of Daft and Lengel’s (1984, 1986) media/information richness spectrum, such as face-to-face communications. Since the buying firm may engage in knowledge transfer activities with suppliers in order to improve long-term supplier capabilities that will lead to improvement in the supplier’s product and delivery performance it is hypothesized that:

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- H_{2a}: There is a positive relationship between the buying firm's goal to improve a supplier's *product and delivery performance*, and the buying firm's effort to transfer tacit knowledge.
- H_{2b}: There is a positive relationship between the buying firm's goal to improve a supplier's *capabilities*, and the buying firm's effort to transfer tacit knowledge.

The following hypothesis attempts to differentiate between the relationship of supplier evaluation, on the one hand, and knowledge transfer, on the other hand, with both supplier development goals. Because supplier evaluation is an activity with limited investment and commitment on the buying firm's side, it will demonstrate a weaker relationship with the supplier development goals than knowledge transfer (Krause, Scannell and Calantone, 2000). Because the transfer of knowledge as a "direct assistance activity" (Langfield-Smith and Greenwood, 1998) requires higher commitment and resources it will be more strongly related to the goals. In short, the buying firm will expect a stronger impact on goal achievement from the more laborious knowledge transfer activities than from performing a mere evaluation of suppliers. It is hypothesized that:

- H₃: There is a stronger relationship between the buying firm's goals and the effort to transfer tacit knowledge than between the goals and the effort to evaluate the suppliers.

The final hypothesis examines the moderating effect of employee exchange between the two firms. *Exchange of employees (or human assets)*, according to the relational view, represents an additional step in sharing relationship-specific assets (Dyer and Singh, 1998). Heide and John (1990) noted that as the degree of interpenetration of firm boundaries (i.e. joint activities), increases in scope, the relationship moves toward an alliance or partnership. Boddy, Wagner and Macbeth (2000) emphasized in their study of Sun Microsystems's supply chain partnering

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3 initiative that the achievement of the partnering goals heavily depended on the interaction of the
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5 people of Sun Microsystems and its supplier through joint institutions such as weekly review
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7 meetings, quality meetings and commercial reviews. Communication theorists proposed the
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9 structural symbolic interactionism theory (Stryker and Statham, 1985) which “asserts that
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11 interpersonal interactions are symbolic because individuals use interactions as the basis for
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13 constructing meaning.” (Fulk and Boyd, 1991, p. 410). That entails that the co-location of buyer
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15 or supplier employees not only enables a richer form of communication, but can carry the
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17 symbolic meaning that the joint supplier development effort is of high importance for the firm.
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19 For the present study, we propose that “exchange of employees” represents an additional
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21 investment in the buyer-supplier relationship and a highly interpersonal interaction, significantly
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23 beyond the face-to-face communication that takes place in “knowledge transfer” (Dyer and
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25 Nobeoka, 2000; Langfield-Smith and Greenwood, 1998).
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33 Empirical evidence shows that co-location is associated with more frequent and more
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35 intensive communication, and the exchange of up-to-date knowledge between the parties
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37 (Moenaert and Caeldries, 1996). In new product development, co-location can foster improved
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39 collaboration and interaction between firms and departments working together in R&D projects
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41 (Keller, 1986). Transferred to the context of buyer-supplier relationships we posit that the
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43 exchange of employees will enhance knowledge transfer in supplier development activities as
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45 specified in the following hypothesis:
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50 H₄: The degree of employee exchange between the buying firm and supplier firm will
51 moderate the relationship between the buying firm’s goal to improve the supplier’s
52 capabilities and the buying firm’s effort to transfer knowledge.
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4. Methods

To test these hypotheses, data were collected through a written questionnaire which was dispensed to purchasing and supply chain management executives from the mailing list of a leading European supply chain management research institution, containing the names and contact information of these executives employed by industrial and service firms. These key informants were selected because they likely possess an overarching, boundary-spanning view of their companies' supplier development activities. The survey was administered to 251 firms in total. We received responses from 65 firms, accounting for an effective response rate of 25.9%.

4.1. Sample

Approximately 9.2% of the responding firms employed 100 people or less, 23.1% had between 100 and 500 employees, 26.2% between 500 and 1,000, 24.6% between 1,000 and 5,000 and 16.9% employed more than 5,000 people. The average number of employees was 6,218. A wide variety of manufacturing firms is represented in the sample: machinery and plant construction (16.9%), high-tech (13.8%), electro and electronics (10.7%), automotive (6.2%), construction (6.2%), chemicals and pharmaceuticals (6.2%), food (3.1%), textiles (3.1%), and other manufacturing (18.4%). Service firms were in banking and insurance (6.2%), telecommunications (4.6%), and other services (4.6%). Overall, the sample consisted of 15.4% service firms and 84.6% manufacturing firms.

The majority of informants included in this sample held titles such as head of purchasing (63.1%) and head of supply chain management, logistics or materials management (18.5%). The

remainder characterized their position as purchasing or commodity managers (12.3%), head of supplier development, procurement information manager, or quality manager (6.1%). The respondents had worked in their present position for an average of 5.0 years, and had been with their respective firms for 6.8 years on average.

4.2. Measures

The survey instrument and measures were developed in several stages. First, a preliminary questionnaire was drafted on the basis of prior research. Second, a number of academicians and practitioners commented on the items included in the questionnaire, their relevance, their comprehensibility, as well as the questionnaire format. Third, to further refine the survey instrument, it was pre-tested through in-depth interviews with purchasing executives from a small number of firms. Again, their comments were incorporated in the final version.

The questions used for this study asked respondents to report on their firms’ supplier development activities and goals in general, i.e. independent of a specific buyer-supplier relationship or product sourced. Thus, the unit of analysis is the supplier development program, or, more generically, the supply base management practices the respondent firms had in place in terms of the types of activities that were involved, and the goals of these activities. Multiple-item measures were used to assess the focal constructs on 5-point Likert scales, anchored “strongly disagree” and “strongly agree”. Descriptions of the specific items used in this study can be found in Tables 1 and 2.

Insert Tables 1 and 2 about here

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3 *Supplier development goals.* The respondents were asked to indicate whether their firms
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5 regularly pursued a number of supplier development goals. A list of supplier development goal
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7 items were generated based on the pertinent literature on supplier performance and competitive
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9 priorities in operations management (Monczka, Trent and Callahan, 1993; Ward, McCreery,
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11 Ritzman and Sharma, 1998; Watts and Hahn, 1993). The extant literature distinguishes between
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13 supplier performance-related and supplier capability-related goals of supplier development, and
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15 this research follows that precedent (Krause and Ellram, 1997).
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21 The supplier performance-related goals were captured with the product and delivery
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23 performance improvement goal construct. Product performance includes quality improvements,
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25 and order cycle time reductions, the latter being an indicator of increased flexibility. The
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27 supplier's delivery performance has two primary components: (1) delivery dependability, which
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29 is the ability to routinely deliver when promised, and (2) delivery service (Ward, McCreery,
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31 Ritzman and Sharma, 1998).
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36 The respondents were also asked to rate the importance of various supplier capability
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38 improvements as supplier development goals. Capabilities can be understood as "the socially
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40 complex routines that determine the efficiency with which firms physically transform inputs into
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42 outputs." (Collis, 1994, p. 145). Suppliers require a bundle of organizational capabilities in order
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44 to improve their ability to generate a sustainable high quality output for their customers. As such,
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46 the supplier capability improvement items included suppliers' product development, managerial,
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48 and manufacturing capabilities, as well as the suppliers' ability to manage their financial viability.
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50 A supplier's financial situation is expected to have an impact on its capacity to build up and
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52 exploit organizational capabilities.
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Supplier development activities. The respondents rated their firms' use of a number of supplier development activities. Supplier development activity items were derived from the extant literature (Krause, Scannell and Calantone, 2000; Wagner, 2006b). These items are associated with various types of communication approaches.

When a buying firm undertakes supplier evaluation and provides feedback on the evaluation to the supplier, it may also ask for improvements along the evaluation criteria and set improvement targets (Krause and Ellram, 1997). In a supplier audit, a team from the buying firm may conduct an on-site assessment at the supplier and write an assessment report for internal and supplier use. Since a supplier audit is basically a more in-depth predictive assessment of the supplier's performance, it was also included as an item the supplier evaluation and feedback construct (Krause, Handfield and Scannell, 1998).

Supplier development activities in the knowledge transfer construct consist of providing expert advice which helps the supplier to improve in the technological, product development, quality, and manufacturing domains (Krause, Handfield and Scannell, 1998; Wagner, 2006b). As such, the respondents indicated the degree to which they were active in transferring a selection of manufacturing, technological, product development and quality related information – which is difficult to codify and transfer – to their suppliers.

Finally, the employee exchange items consisted of various ways to co-locate either buying firm or supplier firm employees so that they are able to learn from each other and communicate face-to-face and share even more tacit information during their residence with the other firm (Hunter, Beaumont and Sinclair, 1996; Langfield-Smith and Greenwood, 1998).

Controls. In order to eliminate undesirable sources of variance two control variables that may influence and confound the relationship between supplier development goals and activities were included in the analysis. First, firm size is an important structural variable with potential impact on many areas of an organization (Blau and Schoenherr, 1971). Firm size and the financial resources of larger firms are likely to influence the supplier development activities of the buying firm (Wagner, 2006b). Although we acknowledge that this effect can be important, the focus of this research was to learn more about the relationship between goal strength and activities apart from the size of the buying firm. Firm size was measured by a single item asking respondents for their firms' number of employees. Second, since manufacturing firms perform specific supplier development activities differently than service-based firms (Krause and Scannell, 2002), we controlled for whether the firm belonged to the manufacturing or service industries. Following the procedure suggested by Cohen, Cohen, West and Aiken (2003), service firms were coded as one, hence, manufacturing firms were used as base.

4.3. Factor analyses

To achieve one objective of this study, namely the identification of parsimonious structures of supplier development goals and activities, i.e. the determination of underlying superordinate dimensions, exploratory factor analyses with a confirmatory mindset were conducted. Furthermore, reliability tests were performed for each factor using Cronbach's alpha (Cronbach, 1951).

4.3.1 Supplier development goals

To determine whether it is adequate to perform a factor analysis the Anti-Image Correlation Matrix was examined. The diagonals on the matrix should exhibit an overall Measure of Sampling Adequacy (MSA) of 0.5 or above (Hair, Black, Babin, Anderson and Tatham, 2005). Individual variables can be considered for elimination from the analysis if they are low on this measure. An inspection showed that the goal variables had MSA values between 0.72 and 0.90, hence, all being accepted as sufficiently high. The data set of eight variables resulted in a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.78, which is considered as middling (Kaiser, 1974). Another test for the data, Bartlett’s Test of Sphericity was approximate Chi-Square 177.710 with 28 degrees of freedom at a significance level of $p < 0.000001$, indicating that the population correlation matrix is unlikely to be an identity matrix. Overall, the results indicate that the data set complies with the requirements for factor analysis.

Principal Component Analysis was used to extract the factors. To enhance interpretation, the factor matrix was rotated using the orthogonal, Varimax, rotation. The two goals extracted – (1) product and delivery performance improvement, and (2) supplier capability improvement – explain 67.9% of the variation. The results of the rotated factor matrix indicating the factor loadings are documented in Table 1. The Cronbach alpha reliability estimates for the supplier performance and supplier capability goals were 0.786 and 0.816 respectively, providing evidence that the internal consistency of these sets of scale items is satisfactory (DeVellis, 2003).

4.3.2 Supplier development activities

For the factor analysis on supplier development activity items, we followed the same procedure as for supplier development goals. The examination of the Anti-Image Correlation Matrix revealed that the diagonals on the matrix range from 0.62 to 0.89, hence, exceeded the threshold level of 0.5 (Hair, Black, Babin, Anderson and Tatham, 2005). Individual variables can be considered for elimination from the analysis if they are low on this measure. An inspection showed that the activity variables had MSA values between 0.73 and 0.91, hence, all being accepted as sufficiently high. The data set of twelve variables resulted in a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.83, which is considered as meritorious (Kaiser, 1974). Another test for the data, Bartlett's Test of Sphericity was approximate Chi-Square 332.299 with 55 degrees of freedom at a significance level of $p < 0.000001$, indicating that the population correlation matrix is unlikely to be an identity matrix. Overall, the results indicate that the data set complies with the requirements for factor analysis.

Principal Component Analysis was used to extract the factors. Three factors explaining 73.6% of the variation were subsequently extracted: (1) supplier evaluation and feedback, (2) knowledge transfer, and (3) employee exchange. To improve interpretation, the factor matrix was rotated using the orthogonal, Varimax, rotation. The results of the rotated factor matrix indicating the factor loadings are documented in Table 2. The Cronbach alpha reliability coefficients of the scales for supplier evaluation, knowledge transfer, and employee exchange, were 0.851, 0.857, and 0.820, respectively. These results demonstrate sufficiently high reliability of the supplier development activity scales (DeVellis, 2003).

5. Results

The descriptive statistics and correlations of the identified supplier development goal factors and supplier development activity factors are summarized in Table 3. The respondents indicated that supplier evaluation and feedback-related supplier development activities (mean 3.28) have been performed more extensively than knowledge transfer (3.04) and employee exchange (2.47). Furthermore, their primary goals was to improve their suppliers’ product and delivery performance (mean 3.95), and to a lesser degree their suppliers’ capabilities (2.60).

Insert Table 3 about here

Hierarchical multiple regression analysis and moderated multiple regression analysis were used to test the hypotheses pertaining to the relationship between supplier development activities and goals, as shown in Table 4. First, in order to test the linear relationships for the supplier development activities, we regressed the two supplier development goal constructs on the control variables (i.e., firm size and industry) in model 1 and estimated the parameters for the supplier development main effects (i.e., supplier evaluation and feedback and knowledge transfer) in model 2. The standardized regression coefficients for supplier evaluation and feedback are neither statistically significant for product and delivery performance improvement nor for capability improvement, suggesting that hypotheses H_{1a} and H_{1b} are not supported. The relationship between knowledge transfer and both supplier development goals, however, is statistically significant with standardized parameter estimates of 0.48 (p < 0.01) for product and delivery performance improvement and 0.44 (p < 0.01) for capability improvement. Hence, H_{2a} and H_{2b} are supported.

 Insert Table 4 about here

Second, in order to test H_3 , an inspection and comparison of the standard coefficients is warranted. For both regression models (model 2) the coefficients for knowledge transfer are larger than the coefficients for supplier evaluation and feedback: 0.48 vs. 0.15 with product and delivery performance as goal, and 0.44 vs. 0.15 with supplier capability improvement as goal. As such, there is a stronger relationship between knowledge transfer and the supplier development goals than between supplier evaluation and feedback and the supplier development goals. This result provides support for H_3 .

Third, the interaction effect was tested based on the procedure proposed by Zedeck (1971). Prior to analysis we transformed the variables so that the means of the transformed variables were zero (Cohen, Cohen, West and Aiken 2003; Jaccard and Turrissi, 2003). After mean centering of the variables and entering the potential moderator exchange of employees (model 3) the following model 4 was estimated in order to examine the moderator effect of exchange of employees on the relationship between knowledge transfer and the capability improvement goal construct:

$$\text{Supplier capability improvement} = a + b_1 \text{ X Supplier evaluation and feedback} + b_2 \text{ X Knowledge transfer} + b_3 \text{ X Employee exchange} + b_4 \text{ X (Knowledge transfer X Employee exchange)}$$

A significant increase of variance explained (R^2) upon entering the interaction term would indicate the presence of a moderated relationship (Jaccard and Turrissi, 2003; Zedeck, 1971). Model 4 with capability improvement as dependent variable supports our hypothesis that the exchange of employees moderates the relationship between knowledge transfer and the capability

improvement goal. Model 4 explains 8% additional variance upon introducing the interaction term. The standardized parameter estimate is 0.30 with $p < 0.01$. In sum, H_4 is supported.

In all models the inspection of the standard estimates for the control variables of firm size and industry (manufacturing or service) reveals that they are not statistically significant, indicating the results hold independent of the firms' size and industry.

6. Discussion

This article has focused on two issues with regards to supplier development activities and goals, and the relationships among them. First, we attempted to obtain a meaningful structure of supplier development goals and supplier development activities. Our results empirically show that firms distinguish between the two dimensions of goals underlying the definition of supplier development (Krause, Scannell and Calantone, 2000): (1) supplier product and delivery performance improvement, and (2) supplier capability improvement.

Our analysis shows that supplier development activities can range from the (1) compilation of information about the supplier, the evaluation of the supplier's performance, and the unidirectional provision of explicit information about the supplier's evaluation results to the (2) provision of specialized and in-depth technical, process, or managerial knowledge, and the (3) interactive sharing of tacit knowledge through exchange of human assets (e.g., employees from the buyer and supplier firm). The first set of activities, is often referred to as indirect or externalized supplier development (e.g., Krause, Scannell and Calantone, 2000; Wagner, 2006b). While the latter two sets of supplier development activities have been subsumed under the heading of direct or internalized supplier development (e.g., Krause, Scannell and Calantone,

2000; Wagner, 2006b), the results of our factor analyses show (supported by the moderated multiple regression analyses) that direct or internalized supplier development contains two conceptually and empirically distinct types of interaction that need to be distinguished. On the one hand buying firms transfer manufacturing, technological and other types of knowledge to the supplier. On the other hand, supplier employees are transferred to the buying firm (or vice versa) and supplier employees are trained by the buying firm.

Second, besides the separation of supplier development goals and activities, we investigated the relationship between the goals and activities by deriving and testing a number of hypotheses. Contrary to expectations, the buying firms' supplier development goals are independent of how extensively the buying firms evaluate suppliers and provide feedback to them. Supplier audits, formal supplier evaluations, informing suppliers about their performance and setting improvement targets are perhaps practices commonly used in supplier management (Wagner and Johnson, 2004) and not particularly in the context of supplier development. Such practices are said to precede or enable direct supplier development activities (Krause, Scannell and Calantone, 2000; Wagner, 2006b). This interpretation is also supported by our present study.

As hypothesized, knowledge transfer is positively related to both supplier development goals, and the exchange of employees is positively related to the buying firm's goal to improve supplier capabilities by means of knowledge transfer. Furthermore, the more buying firms try to improve the capabilities of their supplier by means of knowledge transfer, the more they rely on their human resources and use employee exchange in order to transfer complex knowledge. The more intensive the interaction among employees from the buyer and supplier firms, the stronger the relationship between knowledge transfer activities and the goal to improve supplier capabilities. In other words, while the transfer of manufacturing, technological and other types of

knowledge is a means of direct supplier development, its deployment is moderated by the degree of employee exchange (i.e., the degree of training and co-location of buyer and supplier employees). This important finding generalizes the approach followed by Toyota in Japan (Dyer and Nobeoka, 2000) and Australia (Langfield-Smith and Greenwood, 1998). In order to achieve the goal to improve their suppliers' production capabilities through the adoption of the Toyota Production System (TPS) and a change in the workplace culture, Toyota not only gave advice on the TPS to their suppliers but conducted training seminars and transferred engineers to these suppliers for several weeks to provide direct assistance (Dyer and Nobeoka, 2000; Langfield-Smith and Greenwood, 1998).

7. Implications, limitations and conclusion

Advances in theory and practice have contributed to a better understanding of supplier development activities and processes, antecedents to supplier development, and performance outcomes, however, researchers have known little about a buying firm's supplier development goals and their relationship with the buying firm's supplier development activities. Therefore, we explored this nascent field in the present empirical study.

From the results of this study, several implications can be drawn. First, this study distinguishes between three dimensions of supplier development activities. The results of the exploratory factor analysis indicate the usefulness of media/information richness as a means to differentiate the qualitative aspects for communication between buying and supplier firms. The results also suggest that buying firms invest in communication to varying degrees, and that these variations may be dependent on the goals they pursue. Second, if firms strive to improve their

suppliers' capabilities, with a potential long-term impact on the suppliers' performance, they not only transfer knowledge that helps the suppliers to increase the effectiveness and efficiency of their product creation and operations functions. Instead, they also employ a very rich mode of communication, namely the exchange of buyer and supplier employees, in order to be able to share and convey tacit and rich know-how to the supplier. Third, this study indicates that although supplier evaluation and feedback is performed by respondent firms, the evaluations alone are considered insufficient investments when the goal is to build suppliers' capabilities. Fourth, the level of knowledge transfer and in particular the level employee exchange activities conducted by the buying firms in the sample were rather low. However, we believe that because these activities are important to upgrading supplier capabilities, firms should not neglect the potential of these highly interactive supplier development activities and should consider investing more effort into these human resource-related activities.

The results of our study must be viewed in conjunction with its limitations. First, as this research is cross-sectional in nature, it cannot establish causality between variables. Only a longitudinal research design could provide answers to questions of causality as well as the evolution of key variables over time, such as a firm's supplier development activities or supplier development goals. Second, the small sample size limits statistical power. Hence, while this study provides support for four out of six hypotheses with statistically significant results, it does not provide the statistical power to firmly dismiss the relationships that failed to show statistically significant results. A larger sample should be utilized to permit more powerful statistical tests. Third, one executive per firm was used as key informant in the present study. Although the reliability of the measures generated satisfactory results, the use of multiple informants or data

collection on both sides of the dyadic buyer-supplier relationship could provide additional insights into the research topic and improve the quality of the data analysis.

In retrospect, and as we look forward to future research endeavors, we are interested in expanding our examination of communication and knowledge sharing. The measures in the present study tap into the notions of evaluation and feedback, and of sharing technological, product development, quality, and manufacturing expertise. However, the further investigation of qualitative and quantitative aspects of communication in supplier development, also referred to as communication content and frequency, the methods used to share information, and inter-organizational learning (Daft and Lengel, 1986; Hult, Ketchen and Slater, 2004; Mohr and Nevin, 1990) are of interest as researchers attempt to develop better insights into this topic. Furthermore, while we contributed to the hitherto neglected interdisciplinary research at the operations management–human resource interface, more work is required to better understand the role of the human resources in buyer-supplier relationships in general and supplier development in particular.

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Figure 1. Conceptual framework

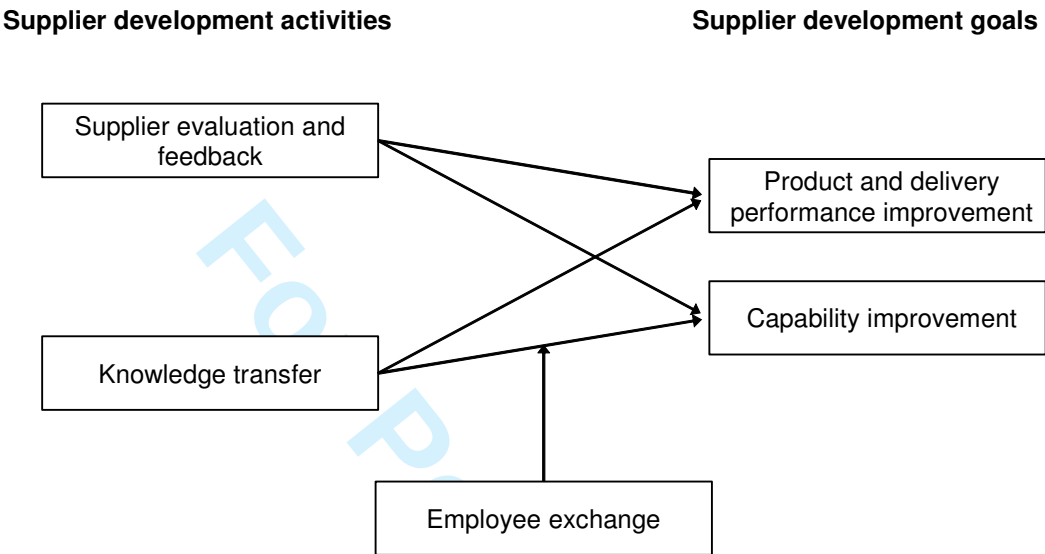


Table 1. Exploratory factor analysis on supplier development goals

Items	Extracted factors	
	Product and delivery performance improvement	Capability improvement
	(alpha = 0.786)	(alpha = 0.816)
Frequently, supplier development has the following goal: improving delivery service.	0.844	0.169
improving delivery dependability.	0.818	0.197
reducing reorder-time.	0.721	0.204
improving quality of purchased items.	0.688	0.049
Frequently, supplier development has the following goal: strengthening supplier's product development capabilities.	0.195	0.837
strengthening supplier's managerial capabilities.	0.161	0.809
strengthening supplier's manufacturing capabilities.	0.330	0.763
strengthening supplier's financial situation.	0.015	0.720

Table 2. Exploratory factor analysis on supplier development activities

Items	Extracted factors		
	Supplier evaluation and feedback	Knowledge transfer	Employee exchange
	(alpha = 0.851)	(alpha = 0.857)	(alpha = 0.820)
Our firm has extensively undertaken supplier development by: providing feedback about their performance.	0.839	0.138	-0.080
strong formal supplier evaluation.	0.770	0.334	-0.042
setting improvement targets.	0.765	0.209	0.228
auditing suppliers.	0.741	0.231	0.305
Our firm has extensively undertaken supplier development by: giving manufacturing related advice to suppliers (e.g. processes, machining process, machine set up).	0.171	0.870	0.090
giving technological advice to suppliers (e.g. software, materials).	0.205	0.820	0.207
giving product development related advice to suppliers (e.g. processes, project management).	0.351	0.734	0.135
giving quality related advice to suppliers (e.g. use of inspection equipment, quality assurance procedures).	0.464	0.646	0.275
Our firm has extensively undertaken supplier development by: transferring supplier employees to our firm.	-0.001	-0.034	0.903
transferring our employees to suppliers.	0.019	0.453	0.757
training employees from suppliers.	0.309	0.289	0.752

Table 3. Descriptive statistics and correlations

Variables	Mean	Standard deviation	(1)	(2)	(3)	(4)	(5)	(6)
(1) Product and delivery performance improvement	3.95	0.71	1					
(2) Supplier capability improvement	2.60	0.83	0.44***	1				
(3) Supplier evaluation and feedback	3.28	1.00	0.44***	0.44***	1			
(4) Knowledge transfer	3.04	1.00	0.55***	0.55***	0.61***	1		
(5) Employee exchange	2.47	1.07	0.09	0.44***	0.24*	0.43***	1	
(6) Firm size	6,218	16,129	-0.04	0.06	-0.03	0.04	0.14	1
(7) Service firm	NA	NA	-0.09	-0.17	-0.08	-0.29*	-0.13	0.23*

Table 4. Parameter estimates and significance levels of regression models

Independent variables	Dependent variables					
	Product and delivery performance improvement		Supplier capability improvement			
	Model 1	Model 2	Model 1	Model 2	Model 3	Model 4
Firm size	-0.02	-0.08	0.10	0.06	0.03	-0.07
Industry	-0.09	0.08	-0.21	-0.06	-0.05	-0.04
Supplier evaluation and feedback		0.15		0.15	0.16	0.21
Knowledge transfer		0.48**		0.44**	0.34*	0.34*
Employee exchange					0.24*	0.17
Knowledge transfer X Employee exchange						0.30**
F	0.27	7.06***	1.46	6.93***	6.65***	7.52***
R ²	0.01	0.32	0.05	0.32	0.36	0.44
Adjusted R ²	-0.02	0.28	0.01	0.27	0.31	0.38
R ² change	0.01	0.31	0.05	0.27	0.04	0.08
F value of R ² change	0.27	13.74***	1.46	11.87***	4.11*	7.89**