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Co-creating value from knowledge-intensive business services in manufacturing firms: The moderating role of relationship learning in supplier–customer interactions

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ABSTRACT

This study seeks evidence for a positive moderating role of relationship learning in the relation between manufacturing firms' knowledge-intensive business services (KIBS), i.e., product-related services for developing customized solutions, and firms' customer-specific sales performance. Our findings from a survey of 91 supplier–customer relationships indicate that KIBS offerings do not generate performance per se; instead, supplier–customer relationships must be characterized by relationship learning to co-create value from the supplier's KIBS offerings. Our findings extend the literature on industrial service businesses by shedding a more nuanced light on the core activities that enable value co-creation and value appropriation in the KIBS context.

1. Introduction

Product-oriented manufacturing firms are shifting from product-centeredness toward a product-and-service orientation (Jacob & Ulaga, 2008; Kowalkowski, 2010), or "servitization" (Kastalli & Van Looy, 2013), by offering customized solutions, i.e., customer-focused combinations of products and services (Baines, Lightfoot, Benedettini, & Kay, 2009; Davies, Brady, & Hobday, 2007). The rationale behind this strategic shift encompasses the need to achieve competitive advantage by locking in customers and locking out competitors (Heskett, Sasser, & Schlesinger, 1997; Neely, 2008). As companies offer more novel customized solutions (e.g., propulsion systems or paper machines), the role of knowledge-intensive business services, i.e., manufacturers' product-related services that create knowledge for the development of customized solutions (e.g., problem analyses, feasibility studies, and product-tailoring services), increases in significance (Leiponen, 2006; Muller & Zenker, 2001). As a result, companies must incorporate such services into their offerings.

But what do we know about the performance benefits of services in manufacturing firms? The conventional view suggests a positive service-performance relationship, such that a service business generates new, counter-cyclical and more stable sources of revenue (Wise & Baumgartner, 1999) as well as higher profit margins (Gebauer & Fleisch, 2007; Mathe & Shapiro, 1993). In the context of knowledge-intensive business services (KIBS), this view would imply that KIBS allow manufacturing firms to develop customized industrial solutions that, in turn, yield increased customer satisfaction and higher profit margins (Davies et al., 2007; Kowalkowski, 2010; Matthyssens & Vandenbempt, 2008). However, other studies propose the opposite and label the inability to reap the benefits from a service business as a "service paradox" (Gebauer, Fleisch, & Friedli, 2005; Gebauer, Ren, Valtakoski, & Reynoso, 2012). In the KIBS context, a service paradox might occur due to the fact that knowledge-intensive business services include information asymmetries between the buyer and seller (Aarikka-Stenroos & Jaakkola, 2012) and are both labor-intensive and difficult to standardize (Hertog, 2000), all of which increase the costs (e.g., transaction costs, service delivery) and decrease the profitability of such services. In addition, some recent studies have found a U-shaped relationship between services and firm performance (Fang, Palmatier, & Steenkamp, 2008; Neely, 2008; Suarez, Cusumano, & Kahl, 2013). As such, it is easy to concur with Kastalli and Van Looy (2013: 170), who state, "the evidence regarding a manufacturer's ability to appropriate value from servitization is inconclusive."

Prior studies also note that offering services per se is insufficient to generate performance benefits (Kastalli & Van Looy, 2013; Kindström, Kowalkowski, & Sandberg, 2013). Instead, companies must engage their customers in the process of value co-creation to create and appropriate value (in the form of revenue, profits, referrals, etc.) from their

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service offerings (Etgar, 2008; Ramírez, 1999). This requirement is particularly evident in exchanges of knowledge-intensive business services (Aarikka-Stenroos & Jaakkola, 2012; Hu, Lin, & Chang, 2013; Kindström & Kowalkowski, 2009; Lapierre, 1997; Möller, Rajala, & Westerlund, 2008). However, value co-creation is argued to be a general and metaphorical term that is "difficult to apply when the discussion moves to an analytical level" (Grönroos & Voima, 2012: 136). Or, as Vargo et al. (2008: 151) inquire, "What exactly are the processes involved in value co-creation?" Motivated by the conflicting results on the service–performance relationship and unexplored processes of value co-creation, we tap into this research opportunity by focusing on the learning that occurs within a supplier–customer relationship, and we investigate the moderating role of relationship learning between the supplier's KIBS offerings and customer-specific sales performance.

The rationale for dedicating special attention to the moderating role of relationship learning on customer-specific performance is twofold. First, prior studies indicate that the successful co-creation of business services requires collaborative relationships (Bettencourt, Ostrom, Brown, & Roundtree, 2002; Chang & Gotcher, 2007; Chen, Tsou, & Ching, 2011; Hu et al., 2013; Roels, Karmarkar, & Carr, 2010) and that interacting, learning and sharing knowledge are vital to value co-creation (Grönroos & Voima, 2012; Lusch, Vargo, & Tanniru, 2010; Payne, Storbacka, & Frow, 2008). Thus, we build on these studies and propose that relationship learning increases suppliers' understanding of their customers' needs through knowledge-sharing interactions and enables suppliers and their customers to co-create value from the suppliers' KIBS (Cheung, Myers, & Mentzer, 2010). Increased customer value improves the customer's experience in the customer–supplier relationship (Tuli, Kohli, & Bharadwaj, 2007), builds customer satisfaction and loyalty (Kim & Kim, 2009) and increases the supplier's revenues (Heskett et al., 1997; Matthyssens & Vandenbempt, 2008). This approach is distinctive, as the rich stream of literature on collaborative supplier–customer relationships (Cannon & Perreault, 1999; Ganesan, 1994) has predominantly focused on how such relationships enhance firm-level learning (Håkansson, Havila, & Pedersen, 1999) or how relationship learning influences relationship value (Cheung et al., 2010; Selnes & Sallis, 2003), thus neglecting the facilitating role of relationship learning on supplier performance.

Second, we adopt the supplier–customer relationship and suppliers' customer-specific sales performance as the level of analysis because the industrial service literature suggests that the value of a service business is specifically co-created in supplier–customer relationships (Grönroos & Helle, 2010; Lusch et al., 2010; Payne et al., 2008). Put differently, firm-level performance attributes could yield significantly misleading results because service success in one customer relationship may not be directly linked with firm-level outcomes (Gebauer et al., 2012).

The present study contributes to the literature on the service business of manufacturing firms (Antioco, Moenaert, Lindgreen, & Wetzels, 2008; Fang et al., 2008; Kindström et al., 2013) by demonstrating that the co-creation of knowledge-intensive business services requires not only "a deep understanding of customer experiences and processes" from the supplier (Payne et al., 2008: 89) but also relationship learning within the supplier–customer relationship. By doing so, we answer the call of Gebauer et al. (2012: 130), who conclude that "future research should try to identify the detailed mechanisms through which service provisions have an impact on firm performance" and argue that in the context of KIBS, relationship learning is one such mechanism.

2. Co-creating value from knowledge-intensive business services

2.1. Value creation, appropriation and KIBS

Prior studies have conceptualized value in various ways. For example, Porter (1985) defines value as the amount that buyers are willing to pay for a supplier firm's offering, whereas Payne et al. (2008) and Vargo and Lusch (2011) argue that value only emerges as a product or a service is consumed. Gupta and Lehman (2005) suggest that value can be divided into two categories: value to the customer (value creation) and value to the supplier (value appropriation). This study investigates the financial value appropriated by the supplier by adopting suppliers' sales performance at the level of a single customer relationship as the dependent variable because this variable reflects the factual and calculative value created in that relationship. Value creation and value appropriation are interrelated because the value created for a customer affects the financial value generated by the supplier (Grönroos & Helle, 2010; Gupta & Lehman, 2005).

Services, in turn, are generally defined as something consumed but not possessed by customers (Barry & Terry, 2008). Thus, services do not involve ownership (Edvardsson, Gustafsson, & Roos, 2005) but are consumed when produced in an interaction between a supplier and its customer (Lusch et al., 2010). Muller and Zenker (2001) distinguish KIBS into two categories: 1) traditional professional services and 2) new technology-based KIBS. Building on the latter, we define KIBS as those types of an industrial manufacturer's product-related services that create knowledge for the purpose of developing a customized solution to satisfy a customer's needs (Homburg, Fassnacht, & Guenther, 2003; Muller & Zenker, 2001; Oliva & Kallenberg, 2003).

2.2. Value co-creation and relationship learning

The value of services is typically created together with suppliers and customers (Vargo & Lusch, 2004). This is particularly evident in the KIBS context (Bettencourt et al., 2002; Hu et al., 2013; Oliva & Kallenberg, 2003), as such service exchanges typically require an integration of knowledge-based (Leiponen, 2006) or "operant" resources (Vargo et al., 2008: 148) and include extensive information asymmetries (Kohtamäki, Partanen, and Möller, 2013; Stump, Athaide, & Joshi, 2002). Due to the rapidly expanding body of literature that draws from different fields (e.g., service management, industrial marketing, operations management, and innovation), the terminology has become scattered (Ballantyne, Williams, & Aitken, 2011; Grönroos & Voima, 2012; Payne et al., 2008). Therefore, depending on the theoretical discipline, mutual value creation has been labeled as joint production (Roels et al., 2010), co-production of value (Bettencourt et al., 2002) or, more generally, value co-creation (Aarikka-Stenroos & Jaakkola, 2012; Grönroos & Helle, 2010; Payne et al., 2008). We adopt the view of Grönroos and Voima (2012: 138), who define value co-creation as "a joint process whereby firms and customers together, in interactions, create value" and argue that value co-creation occurs specifically in "joint value spheres" between suppliers and customers. In this respect, KIBS provide a suitable context for investigating value co-creation between supplier and customer, as such services "are both supporters of clients' innovation and delivery agents for their own internal innovation activities" (Hu et al., 2013: 1437) and therefore contribute to the joint "customization sphere" of an industrial solution (Jaakkola & Hakanen, 2013).

A notable characteristic of mutual value creation is that it occurs in the context of ongoing interactions between suppliers and customers (Van der Valk & Wynstra, 2012; Vargo & Lusch, 2008) where "the core of interaction is a physical, virtual, or mental contact" (Grönroos & Voima, 2012: 140). We investigate the enabling activities of value co-creation by adopting the concept of relationship learning, as the importance of learning (Payne et al., 2008) has been widely acknowledged by scholars in the field (Grönroos & Voima, 2012; Lusch et al., 2010). Based on organizational learning theory, Selnes and Sallis (2003) have developed a conceptualization of relationship learning and a means of measuring the learning that occurs between a supplier and its customer. They define relationship learning as "a joint activity between a supplier and a customer in which the two parties share information, which is

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then jointly interpreted and integrated into a shared relationship-domain-specific memory" (Selnes & Sallis, 2003: 80).

2.3. Research model and hypothesis development

The service management literature suggests that a service orientation requires manufacturing firms to shift from a transactional to a relational approach (Oliva & Kallenberg, 2003; Windahl, Andersson, Berggren, & Nehler, 2004) and that services are co-created in supplier–customer interactions (Grönroos & Helle, 2010; Kowalkowski, 2010; Vargo & Lusch, 2008). Studies also note that learning is particularly important in surface-level encountering processes in which the supplier and the customer meet, interact and jointly create value based on the supplier's KIBS (Aarikka-Stenroos & Jaakkola, 2012; Bettencourt et al., 2002).

More importantly, relationship-level learning is measured as the shared variance among knowledge sharing, joint sense-making and knowledge integration within relationship-specific memory. *Knowledge sharing* increases the supplier's understanding of the customer's needs during the exchange process, which is particularly relevant in the context of KIBS, in which service exchanges consist of tacit knowledge that is known to be difficult to transfer (Nonaka & Takeuchi, 1995). In addition, knowledge-intensive business services are typically characterized by significant ex ante information asymmetries (Aarikka-Stenroos & Jaakkola, 2012; Bäck & Kohtamäki, 2015). Frequently, a supplier has insufficient knowledge regarding its customer's needs—particularly those of its end customer (i.e., a customer's customer)—prior to the occurrence of a complex service exchange, whereas the customer has insufficient knowledge regarding the supplier's resources and capabilities (Kohtamäki, Partanen & Möller, 2013; Stump et al., 2002).

Whereas knowledge sharing is central to the explication and dissemination of knowledge in the manufacturer–customer relationship, *joint sense-making* is required to increase the common understanding of the customized solutions that are being developed (Kindström et al., 2013; Medlin & Törnroos, 2014). This sub-dimension of relationship learning builds on the dialogical relationship between a supplier and its customer and is enabled by relational structures that create a platform for open discussions. Open interactions enable both knowledge absorption and the cognitive reconstruction of knowledge that is central for the exchange of knowledge-intensive services. In these processes of joint sense-making, cognitive distance is reduced (Fang, Fang, Chou, Yang, & Tsai, 2011) because the supplier and customer both absorb and jointly construct and reconstruct existing knowledge structures (Johnson, Sohi, & Grewal, 2004; Huikkola, Ylimäki, & Kohtamäki, 2013). Sense-making can be particularly relevant in inter-organizational relationships, in which cognitive distance is frequently greater than it is in intra-organizational relationships (Ring & Van De Ven, 1994). Finally, it is the role of *knowledge integration* to embed new knowledge within existing knowledge structures and to modify current knowledge structures accordingly. This dimension is essential for putting new knowledge into use to obtain its expected performance benefits (Ballantyne, 2004; Crossan, Lane, & White, 1999; Moorman & Miner, 1998).

In summary, relationship learning increases suppliers' understanding of their customers' needs, enhances customization through knowledge-sharing interactions between suppliers and their customers, and enables suppliers and their customers to co-create value from the suppliers' KIBS. Increased customer value improves the customer's experience in the customer-supplier relationship (Tuli et al., 2007), builds customer satisfaction and loyalty (Carlzon, 1987) and increases the supplier's revenues (Matthyssens & Vandenbempt, 2008) by providing both more and better services and product and solution sales (Heskett et al., 1997; Kastalli, Van Looy, & Neely, 2013). Thus, we hypothesize:

H_1. Relationship learning (i.e., knowledge sharing, joint sense-making, and integration to relationship-specific memory) positively moderates the relation between KIBS offerings and sales performance in the supplier–customer relationship.

3. Research method

3.1. Sample and data collection procedure

The machine and equipment manufacturing industry (SIC 28) in Finland was chosen as the context for this study because Finnish product manufacturing companies typically customize their products and involve customers in their development operations, thus offering knowledge-based business services such as R&D services (e.g., machinery development, material design), product tailoring (e.g., customization of industrial machinery or tools), problem analyses (e.g., analyses of the customer's manufacturing processes and machinery), and feasibility studies (e.g., analyses of the technical viability of the customer's manufacturing plans in the range of certain cost and profitability targets) to their customers. We chose the supplier–customer relationship as the level of analysis. For our key respondents, we used managers at supplier firms whose roles include overseeing the evaluated customer relationships. Of the key respondents, 19% were managing directors or production managers, 61% were key account/sales managers or business developers, 12% were R&D managers, and 8% were unclassified. The data were collected in early 2010.

Before sending out our web-based questionnaire, we contacted the surveyed companies by phone. During the data collection process, we sent two reminders. A total of 91 questionnaires were returned; thus, we obtained a satisfactory response rate of 23%. After accounting for refusals, the final response rate was 25%. Despite the satisfactory response rate, we analyzed the data for non-respondent bias by comparing the actual respondents to the non-respondents with respect to three variables (revenue, profit and balance sheet value) and by comparing the first one-third and the last one-third of the respondents with respect to the key study variables (Werner, Praxedes, & Kim, 2007). No significant differences were found between respondents and non-respondents.

The typical respondent firm in our sample generated an annual turnover of approximately 13.6 million EUR (median value), served 120 customers, and employed a staff of 100 while producing a return on investment of 19.4%. In the evaluated customer relationships, the suppliers rated their switching time as relatively high (6 months) because they were product manufacturers. The suppliers' factories were typically located near their customer bases, i.e., within 130 km. The data corresponded to small- and medium-sized product manufacturing business units that offered services to large industrial customers located nearby. Finally, product sales and subcontracting generated most of the suppliers' revenues (on average, 63% and 17%, respectively), whereas the service business accounted for 20% of sales on average. From the perspective of revenue generation, the suppliers have not reached the "critical mass of service sales" (Fang et al., 2008:1) and thus can be argued to be in the early stages of migrating from a product-dominant to a service-dominant business model.

3.2. Methods, construct measures, validity and reliability

A two-step approach to structural equation modeling was applied. First, the constructs were verified by applying structural equation modeling. Second, the research model was tested by using the sophisticated Stata 12.1 program, which enabled appropriate testing of the non-linear relationships. This study used measures adopted from prior studies. The items, the constructs and their theoretical roots are reported in the Appendix A. For the relationship learning and relationship performance variables, we used 7-point Likert scales ranging from "fully disagree" to "fully agree". For the KIBS offering, we asked the respondents to evaluate how actively each service was offered to customers

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using 7-point Likert scales (0 = not offered; 1 = not actively at all; 7 = very actively). This service-specific activity evaluation is similar to other evaluations used in prior studies (Homburg, Hoyer, & Fassnacht, 2002; Homburg et al., 2003; Martínez-Tur, Peiró, & Ramos, 2001). We measured the control variables using continuous variables.

The construct items were translated from English to Finnish and then back-translated by another person to ensure translation equivalence (Brislin, 1970). In addition, the modified constructs (i.e., KIBS offering and supplier sales performance) were pre-validated. In the pre-validation process, we used the content validity index (CVI) from Polit, Beck, and Owen (2007). The pre-validation process called for nine experts from the research field of strategy and service marketing to assess whether each item fit the definition of the construct that it was intended to measure. A web-based questionnaire was developed and validated by the experts, who assessed the item-construct fit on a scale ranging from one to four (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). Over three rounds of validation, the measures were found to be methodologically rigorous, as demonstrated by the value of the content validity index (average I-CVI and average I-CVI [I-CVI/AVE]) relative to the threshold value of .8 (Polit et al., 2007). Every construct exceeded the threshold. In addition, before the data were collected, three business managers from manufacturing companies evaluated and commented on the questionnaire.

This study defines KIBS offerings as services that create knowledge for the purpose of developing a customized solution to satisfy a customer's needs; it operationalizes KIBS offerings to include such items as product-tailoring services (Homburg et al., 2003; Samli, Jacobs, & Wills, 1992), feasibility studies (Homburg et al., 2003), research services (Gebauer, Edvardsson, & Bjurko, 2010) and problem analyses (Homburg et al., 2003; Oliva & Kallenberg, 2003). The questionnaire items were adopted from multiple studies (see Appendix A) (Gebauer et al., 2010; Homburg et al., 2003; Samli et al., 1992) and were also pre-validated by experts. A factor analysis that was employed with principal axis factoring with maximum likelihood rotation demonstrated a one-dimensional structure. In the factor analysis, all of the items loaded above .40 onto the main factor. Moreover, the SEM model exhibited a good model fit, which suggests that the construct validity is high ($\chi2 = 1.16$, degree of freedom [df] = 2, p = .56, $\chi2/df = 0.58$, RMSEA = .000, CFI = 1.00, TLI = 1.02) (Bollen, 1989; Hu & Bentler, 1999). The item loadings were statistically significant, and both Composite Reliability (.97) and Average Variance Extracted (.88) showed satisfactory values.

Relationship learning was operationalized as a multi-dimensional construct composed of three sub-dimensions: knowledge sharing, joint sense-making and integration into relationship-specific memory. All of these items were adopted from Selnes and Sallis (2003). The items used to measure the theoretical dimensions were constructed and averaged into three parcels based on the results of principal axis factoring (Little, Cunningham, Shahar, & Widaman, 2002) with maximum likelihood rotation, which validated the three-dimensional factor structure. In the factor analysis, all of the items were loaded above .40 onto their main factors without significant side loadings (<.40). All of the factors exhibited satisfactory Cronbach's alpha values above .7 (Nunnally, 1978). Furthermore, the SEM analysis indicated a good model fit, which suggested high construct validity ($\chi2 = 43.93$, df = 39, p = .27, $\chi2/df = 1.126$, RMSEA = .037, CFI = .99, TLI = .99) (Bollen, 1989; Hu & Bentler, 1999). The item loadings were statistically significant ($p \le 0.001$). Composite Reliability (0.997) and Average Variance Extracted (.92) demonstrated values above the suggested thresholds. We also tested the behavior of the construct using PLS modeling, which allows researchers to apply constructs of a formative nature. The results obtained using the formative measurement model were consistent with the results obtained using the reflective measurement model. The different dimensions had nearly equally important effects on the latent construct (with path coefficients of .392 to .395). We used a reflective measurement model because relationship learning requires the existence of all of the dimensions of knowledge sharing, joint sense-making and integration into relationship-specific memory (the reflective construct) (Borsboom, Mellenbergh, & van Heerden, 2004; Law, Wong, & Mobley, 1998).

Sales performance was measured using items adapted from Covin, Prescott, and Slevin (1990) and Gupta and Govindarajan (1984). Following prior studies (Medlin, Aurifeille, & Quester, 2005), we transformed the items to measure the sales performance of the supplier in a particular customer relationship. Moreover, we asked the respondents to evaluate the importance of a specific measure (on a scale from 1 to 7) and to rate their satisfaction with their firms' performance in customer relationships using a particular measure (on a scale from 1 to 7). For the final measure, we multiplied the importance and satisfaction ratings to determine the weighted average performance score for each case. Two items were used to measure supplier sales performance: the supplier's level of sales and sales growth in the customer relationship. Clearly, because the items were highly correlated, the construct was one-dimensional (i.e., the items loaded significantly above .4 onto the main dimension in the factor analysis). In addition, the items loaded significantly on the latent construct when we tested the full measurement model. When testing the full measurement model, this construct showed satisfactory Composite Reliability (.82) and Average Variance Extracted (.71). Finally, we should note that subjective and objective performance measures are strongly correlated (Murphy & Callaway, 2004) and that the level of sales performance in a customer relationship would be difficult to measure reliably using any method other than the supplier's subjective evaluation.

To evaluate discriminant validity, we tested the measurement model with all of the main constructs. The full measurement model exhibited an acceptable fit: $\chi2 = 132.76$, df = 111, p = .078, $\chi2/df = 1.196$, RMSEA = .046, CFI = .97, TLI = .96 (Bollen, 1989; Hu & Bentler, 1999). All of the items loaded above .05 onto their main constructs, and the item loadings were statistically significant. In summary, the analyses demonstrated that all of the constructs and items were satisfactory in terms of reliability and validity.

In addition, we controlled for several variables, such as the geographic distance between a supplier's factory and its customer, because we suspected that greater supplier proximity could result in an improved relationship with respect to physical interactions (Grönroos & Voima, 2012), knowledge sharing (Audretsch & Feldman, 1996), greater customer value and, therefore, higher sales performance. We also controlled for customers' dependence on their suppliers, which is reflected by suppliers' switching time for customers, because we expected greater customer dependence on a supplier's resources to potentially generate better sales growth opportunities for the supplier (Palmatier, Dant, Grewal, & Evans, 2006). In addition, we controlled for the mediating effect of relationship learning and the direct effect of KIBS offerings on supplier sales performance. Finally, we controlled for the effect of social capital and the proximity of the KIBS offering unit to the customer, but we removed these controls from the final models due to noise that decreased the model fit. We report the effects of these tests together with the results of robustness checks at the end of the results section.

To test and control for common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), we compared the single-factor model with the original research model (McFarlin & Sweeney, 1992; Podsakoff et al., 2003) and found that the research model exhibited a significantly better model fit ($\chi2 = 153.12$, df = 112, p = .01, $\chi2/df = 1.37$, RMSEA = .064, CFI = .945, TLI = .933) than the single-factor model ($\chi2 = 370.14$, df = 119, p = .000, $\chi2/df = 3.11$, RMSEA = .152, CFI = .664, TLI = .616), which suggested low common method variance. Moreover, the model fit of the main measurement model was significantly better without two of the control variables, but removing those two control variables did not significantly affect the path coefficients or statistical significance results in the research

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model. However, for improved control over the results, we decided to retain those two variables in the research model. In addition, we tested our research model using a method factor approach (the marker variable approach) (Podsakoff et al., 2003; Rönkkö & Ylitalo, 2011). For the marker variables, we used customer seminars (service share from relationship revenue), warranties (service share from relationship revenue), and insurance services (service share from relationship revenue) because these variables provided a good proxy for the method variance in our data and research model. Adding the method factor did not significantly improve the model fit ($\chi 2 = 217.47$, df = 146, p = .000, $\chi 2/df = 1.490$, RMSEA = .073, CFI = .915, TLI = .890) and did not significantly change the path coefficients or statistical significance results, which suggests that there is no significant method variance in the data (Podsakoff et al., 2003; Rönkkö & Ylitalo, 2011).

4. Results

This section presents the correlation matrix for the constructs, reports the structural model and interprets the plotted results. Given that the highest correlation between the independent variables (suppliers' KIBS offerings and relationship learning) was .44 (Table 1), and the variance inflation factor (VIF) analysis showed values for all of the constructs lower than 1.5 (mean VIF 1.26, threshold < 10), it is safe to conclude that the research model is satisfactorily free of multicollinearity (Tabachnick & Fidell, 2007).

The analysis with the control variables demonstrated a significant effect from the proximity between the supplier service site and the customer (in kilometers) on the dependent variable ($\beta = .29$; $p \leq .05$) (Table 2). The effects of the other four controlled variables—proximity between the supplier factory and the customer ($\beta = -.16$; n.s.), customer potential ($\beta = .09$; n.s.), customer dependence ($\beta = .01$; n.s.) and supplier dependence—remained small and non-significant ($\beta = .19$; n.s.). Model 1 explains 11% of the variation in sales performance.

Moreover, we controlled for the direct effects on the main constructs, suppliers' KIBS offerings, relationship learning and sales performance. The model demonstrated that a supplier's KIBS offerings had no direct effect on its sales performance ($\beta = .15$; n.s.), which was also true of relationship learning ($\beta = .03$; n.s.). Model 2 explains 14% of the variation in sales performance, thus improving Model 1 significantly ($\Delta R^2 = 0.03$, F = 1.91, d.f. = 7, 83, $p < 0.05$).

Third, in our main research model, we tested the moderating effect of relationship learning on the relationship between a manufacturer's KIBS offerings and sales performance in the customer relationship. Our results provide clear evidence of the positive moderating role of relationship learning ($\beta = .27$; $p \leq .05$). In the model, the constructs explain 20% of supplier sales performance in the customer relationship. We plotted the interactions, as suggested in prior studies (Brambor, Clark, & Golder, 2006). For the interaction, we applied the product term approach and created a product term from mean-centered and averaged service offerings and mean-centered and averaged relationship learning. Finally, we plotted the interactions using standardized path coefficients (Fig. 2). The plotted marginal effects (.2 intervals in Fig. 2) suggest a positive moderating impact of relationship learning on the linear relationship between a supplier's KIBS and sales performance in the customer relationship. The moderating effect of relationship learning becomes significant from the KIBS offering levels 1.83 to 2.23 and remains significant until the level of 4.43, which suggests that relationship learning is required at the highest levels of KIBS, as demonstrated in Fig. 2. Model 3 explains 20% of the variation in sales performance, thus improving Model 2 significantly ($\Delta R^2 = 0.06$, F = 2.55, d.f. = 8, 82, $p < 0.05$). Fig. 2 confirms our hypothesis. Based on these results, it appears that relationship learning positively moderates the effect of supplier KIBS offerings on supplier sales performance. (See Fig. 1.)

As a robustness check, we tested the research model with the main research constructs by applying AMOS structural equation modeling. In this test, the research model demonstrated an acceptable fit ($\chi 2 = 154.03$, df = 126, p = .045, $\chi 2/df = 1.22$, RMSEA = .050, GFI = .85, CFI = .96, IFI = .96). In addition, we controlled for the potential non-linearity of the effects by applying Stata 12.1, but we found only weak signs of those effects between service offerings and a supplier's sales

Table 2
Results of the hierarchical regression analyses.[a]

Dependent variable: Sales performance	Model 1	Model 2	Model 3
Controlled effects			
Proximity between the supplier factory and the customer (kilometers)	−.16	−.14	−.14
Proximity between the supplier service site and the customer (kilometers)	.29*	.25*	.20
Customer potential (size of the customer measured by number of personnel)	.09	.07	.08
Customer dependence (supplier switching time for the customer measured in months)	−.01	−.03	−.05
Percentage of the turnover of this relationship (customer-supplier) from the turnover of your organization	.19	.20	.16
Main effects			
Supplier's KIBS offering		.15	.07
Relationship learning		.03	.01
Moderation effects			
Supplier's KIBS offering * Relationship learning			.27*
ΔR2	.11	.03	.06
R^2	.11	.14	.20
Adjusted R^2	.06	.07	.12
F	2.14	1.91	2.55

[a] Standardized coefficients are reported.
* Indicates that $p < 0.05$ (in two-tailed tests).

Table 1
Correlations among the constructs and control variables.

	1.	2.	3.	4.	5.	6.	7.	8.
1. Sales performance	1.00							
2. Knowledge-intensive business service offering	0.18	1.00						
3. Relationship learning	0.20	0.44*	1.00					
4. Proximity between the supplier factory and the customer (kilometers)	−0.04	0.00	−0.08	1.00				
5. Proximity between the supplier service site and the customer (kilometers)	0.21*	0.15	0.14	0.43*	1.00			
6. Customer potential (size of the customer measured by number of personnel)	0.04	0.07	0.15	0.16	−0.05	1.00		
7. Customer dependence (supplier switching time for the customer measured in months)	−0.04	0.13	−0.00	−0.02	−0.08	0.01	1.00	
8. Percentage of the turnover of this relationship (customer–supplier) from the turnover of your organization?	0.20	−0.10	0.21*	−0.09	0.01	−0.06	−0.05	1.00

* $p \leq 0.05$ (two-tailed).

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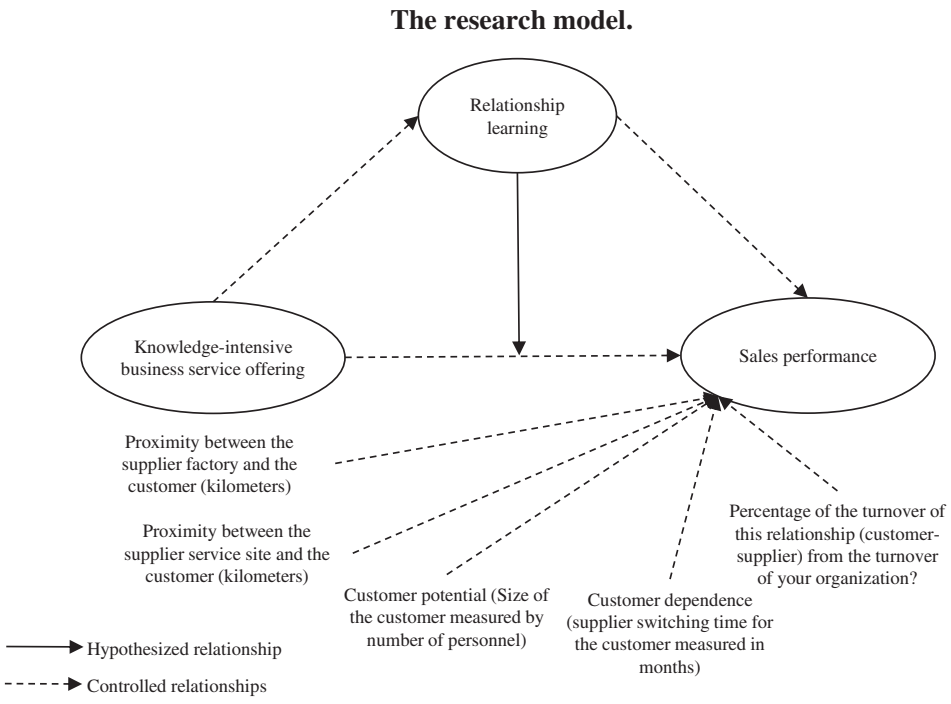

Fig. 1. The research model.

performance. We also tested the moderating effect of relationship learning on the weakly non-linear relationship between KIBS offerings and a supplier's sales performance. The moderating effect was similar to that of the linear effect, and the non-linearity remained weak. When testing the model without control variables, we found that removing the controls added to the non-linearity of the direct relationship from the service offering to the sales performance, which demonstrated the potential for non-linearity and is an interesting topic that should be considered in future research.

When testing the moderating effect of individual learning dimensions on the relationship between KIBS offerings and sales performance, we found that no single dimension had a statistically significant effect on the KIBS—sales performance link; the model is only valid when the relationship learning construct is applied. Thus, in light of the existing

Moderating effect of relationshiplearning on the relationship between knowledge-intensive business service offerings and supplier sales performance.

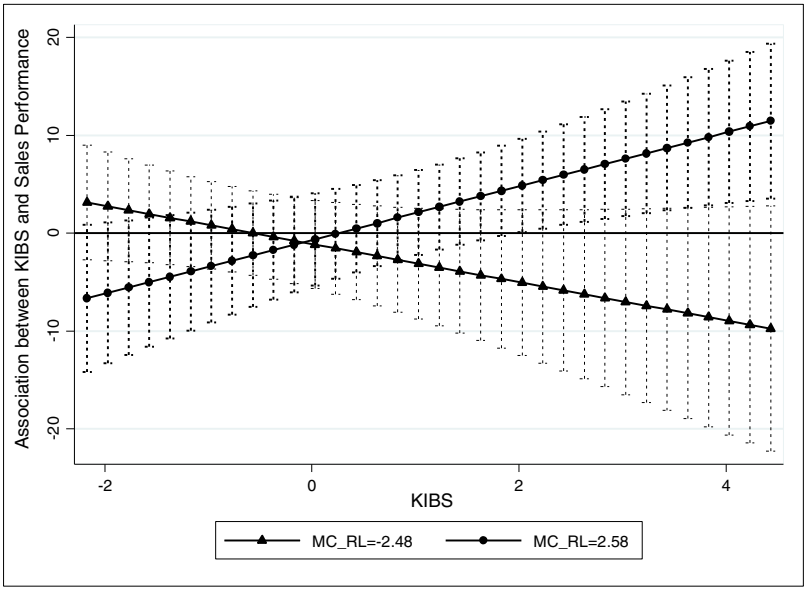

Fig. 2. Moderating effect of relationship learning on the relationship between knowledge-intensive business service offerings and supplier sales performance.

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data, constructs and measures and despite the relatively weak potential for the non-linearity of the direct effect and the interaction, we conclude that there is a positive linear interaction between KIBS offerings and relationship learning.

5. Discussion and implications

5.1. Theoretical contributions

This study makes three distinct contributions to the literature on industrial marketing and service business. First, this study is one of the few empirical attempts to provide evidence with regard to the moderating activities that enable value creation from manufacturing firms' service offerings. By demonstrating the importance of relationship learning in the relationship between a supplier's KIBS offerings and sales performance, we extend the literature on the financial impact of industrial service businesses. This study argues that manufacturing firms can avoid the service paradox with regard to KIBS by utilizing relationship learning in their supplier–customer relationships. Hence, we complement the work of Kindström et al. (2013: 1070), who argue that "a new [service-oriented] mental model [for product-oriented firms] implies not only learning but also the willingness and ability to unlearn and reject obsolete routines" by providing evidence on the role of relationship learning in the context of KIBS exchanges in manufacturer-customer relationships.

In particular, our findings suggest that the relationship between KIBS offerings and sales performance is linear, with a moderating role of relationship learning. This finding challenges recent studies on the financial impact of servitization that stipulate that the relationship between service provision and performance is U-shaped (Fang et al., 2008; Kohtamäki, Partanen, Parida, & Wincent, 2013; Suarez et al., 2013). This contradiction may be explained by our study's context (KIBS) and the characteristics of its sample (i.e., manufacturing firms initiating their service business toward large industrial clients). KIBS are labor-intensive and require intense face-to-face interaction between a supplier and its customer (Hu et al., 2013). Thus, such services are not easy to scale up and offer to a wide range of clients without substantial organizational investments in areas such as recruiting professional service personnel (Gebauer & Fleisch, 2007). However, KIBS may be exclusively offered to and/or demanded by a few key customers, which resonates well with Kastalli et al. (2013), who find that manufacturing firms may also be profitable in the initial stage of their service operations if they offer just a few services to a handful of high-paying customers. Following this line of thought, we propose that exclusive and well-paying customers may represent "low hanging fruit" that are relatively easy to harvest in the context of suppliers offering KIBS (Kastalli et al., 2013: 177).

Second, our study contributes to the literature on value co-creation in the context of knowledge-intensive business services, which has been dominated by conceptual articles (Gebauer et al., 2012; Grönroos & Helle, 2010; Payne et al., 2008) and in-depth case studies (Bettencourt et al., 2002; Ordanini & Pasini, 2008). Indeed, the existing studies have emphasized the vital roles of communication (Bettencourt et al., 2002; Van der Valk & Wynstra, 2012) and joint problem solving (Aarikka-Stenroos & Jaakkola, 2012) in co-creating value from knowledge-intensive business services. This study confirms the main assumptions of prior studies with quantitative evidence but more importantly extends them further by suggesting that the co-creation of value from KIBS requires relationship learning—i.e., knowledge sharing, joint sense-making and integration into relationship-specific memory. Therefore, we extend the view of Payne et al. (2008: 89), who suggest that value co-creation should incorporate "a deep understanding of customer experiences and processes" and argue that relationship learning can serve as one of the core "encountering processes" of value co-creation (Payne et al., 2008: 85).

Finally, our study extends the long and ongoing discussion regarding supplier–customer relationships (Bastl, Johnson, Lightfoot, & Evans, 2012; Gadde & Snehota, 2000; Jap, 1999; Johnston, McCutcheon, Stuart, & Kerwood, 2004; Narayandas & Rangan, 2004; Perry, Cavaye, & Coote, 2002; Sheth & Sharma, 1997). This rich stream of research has generated valuable knowledge on the key variables in successful buyer–seller relationships; however, it has remained relatively scant on the role of learning within buyer–seller relationships and more importantly how such learning influences the performance of the supplier. Our study taps into this opportunity by adopting the suppliers' perspective, as "there is a need to examine the exchange relationship from the supplier's perspective as well" (Paulraj, Lado, & Chen, 2008: 59), and informs the theory by demonstrating that relationship learning improves suppliers' performance in the context of knowledge-intensive business services.

5.2. Managerial implications

This study has important practical implications for strategic managers of manufacturing firms who aim to create and appropriate value by offering KIBS. First, we find that relationship learning capabilities (i.e., knowledge sharing, joint sense-making, and relation-specific knowledge integration) must be in place to create value for customers by offering KIBS and, more importantly, to earn the corresponding returns from such services. Thus, key account managers require sufficient resources and adequate tools to develop and support those mechanisms and to integrate customers into the customization process. Moreover, our study presents a new challenge to relationship managers on both sides (i.e., suppliers and customers) by asking them to implement shared learning processes and mechanisms between partners. Such learning skills are particularly important to individuals operating as boundary persons (i.e., those who interact with a firm's clientele or supplier base).

Second, these results indicate that KIBS and exclusive, well-paying customers may offer lucrative opportunities for manufacturing firms that are in the initial stage of their service operations. Thus, by offering KIBS, manufacturing firms can provide their service operations with a promising start, which may, for instance, speed up organizational learning, encourage personnel to adopt a service orientation, and, as a consequence, decrease the overall upfront investments of industrial service businesses.

5.3. Limitations and suggestions for further research

With regard to limitations, the present study considers only the moderating effect of relationship learning on the relationship between KIBS offerings and sales performance. Thus, future studies on the moderating effects of other relational capabilities on the service-performance relationship are needed. Second, because survey studies tend to suffer from common method variance, and despite the fact that the data used in this study seemed to be mostly free of this problem, researchers are encouraged to use multiple respondents when conducting surveys. Third, because quantitative methods are incapable of fully capturing the complexity and variety of the learning mechanisms embedded in supplier–customer relationships, especially in the context of industrial service businesses, we encourage in-depth case studies that concentrate on the role of relationship learning in service exchanges.

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Appendix A. Means, standard deviations (SD), parcel/item loadings

Constructs and items	Mean	SD	Loadings	Parcel
Main variables				
Knowledge-intensive business service offering in the customer relationship (0 = not offered; 1 = not actively at all; 7 = very actively) (Bettencourt et al., 2002; Gebauer et al., 2010; Homburg et al., 2003; Samli et al., 1992)				
Product tailoring services (Homburg et al., 2003; Samli et al., 1992)	4.81	2.37	.51	
Feasibility studies (Homburg et al., 2003)	1.25	2.22	.77	
Research services (Gebauer et al., 2010; Homburg et al., 2003)	1.89	2.38	.85	
Problem analysis (Homburg et al., 2003; Oliva & Kallenberg, 2003)	2.26	2.45	.69	
Relationship learning (1 = "fully disagree"; 7 = "fully agree") (Selnes & Sallis, 2003)				
Information sharing			.89	Parcel 1
Our companies exchange information related to changes in end-user needs, preferences and behavior.	5.11	1.49	.61	
Our companies exchange information related to changes in market structure, such as mergers, acquisitions or partnering.	4.13	1.69	.74	
Our companies exchange information related to changes in the technology of the focal products.	4.89	1.40	.77	
In the relationship, we frequently adjust our common understanding of end-user needs, preferences, and behavior.	4.73	1.76	.62	
In the relationship, we frequently adjust our common understanding of trends in technology related to our business.	3.89	1.73	.88	
Joint sense-making			.80	Parcel 2
It is common to establish joint teams to solve operational problems in the relationship.	3.21	1.83	.86	
It is common to establish joint teams to analyze and discuss strategic issues.	2.67	1.62	.87	
The atmosphere in the relationship stimulates productive discussion encompassing a variety of opinions.	4.43	1.61	.63	
Integration into a relationship-specific memory			.78	Parcel 3
In the relationship, we frequently evaluate and, if needed, adjust our routines in order delivery processes.	3.79	1.69	.91	
We frequently evaluate and, if needed, update the formal contracts in our relationship.	3.69	1.81	.81	
We frequently evaluate and, if needed, update information about the relationship stored in our electronic databases.	3.54	1.67	.87	
Supplier sales performance in the customer relationship (Importance of the measure, 1 = "not important at all"; 7 = "very important"; Satisfaction in terms of the measure, 1 = "very dissatisfied"; 7 = "very satisfied") (Covin et al., 1990; Gupta & Govindarajan, 1984; Medlin et al., 2005)				
Sales level in the relationship (importance of the measure * satisfaction in terms of the measure)	28.63	10.02	.65	
Sales growth in the relationship (importance of the measure * satisfaction in terms of the measure)	24.70	10.07	.75	
Control variables				
V88 Proximity between the supplier factory and the customer (kilometers)	495.29	1130.37	–	
V89 Proximity between the supplier service site and the customer (kilometers)	561.51	1871.97	–	
V87 Customer potential (Size of the customer measured by number of personnel)	3078.33	11,873.52	–	
V90 Customer dependence (supplier switching time for the customer measured in months)	9.74	10.34	–	
V91 Percentage of the turnover of this relationship (customer-supplier) from the turnover of your organization?	18.29	21.51	–	

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