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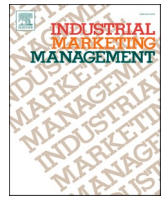
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# Unleash the power of the installed base: Identifying cross-selling opportunities from solution offerings

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## ABSTRACT

Cross-selling for solution offerings in the post-deployment phase is under-researched. This study posits that although providers of solution offerings have more opportunities to expand their business through enhanced cross-selling opportunities, three mechanisms determine to what extent cross-selling opportunities materialize: solution modularity, sales-service cooperation, and value assessment tooling. Using data collected from 220 US firms, we test our conceptual model while correcting for potential endogeneity. The findings confirm that two of these mechanisms help firms leverage their solutions in the post-deployment by contributing to customer satisfaction and financial performance. Sales-service cooperation has a strong positive moderating effect, whereas value assessment tooling shows a substitution effect together with solution offering, in driving cross-selling opportunities. We also find diminishing returns of cross-selling opportunities on customer satisfaction, implying that an optimum level of cross-selling opportunities exists.

Over the past decade, many business-to-business (B2B) manufacturers have transitioned from a goods-dominant business model to offering solutions that integrate products and value-added services (Suppatvech, Godsell, & Day, 2019). For instance, IBM moved away from hardware production to offer business solutions. Dutch material handling systems manufacturer Vanderlande Industries (now owned by Toyota Industries) decided to provide turnkey baggage handling solutions for airports and complete retail and wholesale inventory systems (Antioco, Moenaert, Lindgreen, & Wetzels, 2008). Past research shows that these companies enjoy a competitive advantage due to idiosyncratic resources and organizational capabilities (Macdonald, Kleinaltenkamp, & Wilson, 2016; Tuli, Kohli, & Bharadwaj, 2007; Ulaga & Reinartz, 2011). However, many manufacturers making the transition have reported disconcerting results, including lower profits and even bankruptcy (Neely, 2008; Ulaga & Reinartz, 2011). Explanations include a need for organizational learning and increased development and operational costs, which must be recovered first (Tuli et al., 2007; Wang, Lee, Fang, & Ma, 2017). Therefore, it is vital to understand the mechanisms and contingencies that can help make selling solution offerings profitable.

Consistent with the extant literature (e.g., Panagopoulos, Rapp, & Ogilvie, 2017; Worm, Bharadwaj, Ulaga, & Reinartz, 2017), we define a

solution offering as an integrated and customized combination of products and services that aim to achieve predefined outcomes for a customer by facilitating or taking over particular customer business processes. A more advanced and complete solution offering – covering all stages from requirement definition to post-deployment (Tuli et al., 2007) – will have more features, consumables, and potential updates, increasing the chance of further customization over time and thus generating cross-sales. Cross-selling concerns the sale of products or services offered by the same firm beyond the initial, main deal (Homburg, Boehler, & Hohenberg, 2020; Schmitz, 2013); it will help the solution provider gain a larger share of its customers' wallets (Schmitz, Lee, & Lilien, 2014). However, several factors may prevent identifying and seizing such lucrative cross-selling opportunities in post-deployment. First, the sale of a complete solution may decrease the chance of selling add-ons (Guiltinan, 1987; Stremersch & Tellis, 2002). Customers with an idiosyncratic solution may be satisfied with the customization of their system and thus not need extras. Second, the sales force may be complacent and fail to pursue cross-selling opportunities in favor of selling complete, integrated systems and, thus big deals (Xu, Van der Borgh, Nijssen, & Lam, 2021).

To date, research has failed to examine which capabilities solution providers need to overcome these hurdles and capitalize on cross-selling

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opportunities. Against this backdrop, this research aims to uncover the contingencies that affect how solution providers can seize cross-selling opportunities and thus fuel their customer satisfaction and firm financial performance. We consider cross-selling as a further customization of a customer's solution in post-deployment. Following Wang et al., 2017, p.137) we regard the identification and seizing of such cross-selling opportunities as “a coordination problem between a buyer and its supplier that aims to implement adaptations to meet the specific needs of individual customers.” Coordination refers to the deliberate and orderly alignment or adjustment of partners' actions to customize further the customer's solution in post-deployment (Gulati & Singh, 1998; Wang et al., 2017). By further crafting this perspective, this study makes two significant contributions.

First, we bridge the gap between cross-selling studies and extant servitization and solution-selling research. Fig. 1 illustrates with a Venn diagram these two domains, focusing on key articles for illustrative purposes. Although the solution and value selling literature stress the importance of transitioning from product to solution selling, only a few studies have focused on the sales process and, more specifically, the post-deployment phase. Most do not even mention the word “cross-selling”. The current study extends prior work by filling this gap.

Second, we identify three important coordination mechanisms: solution modularity, sales-service collaboration, and value assessment tooling capabilities. Consistent with Wang et al. (2017) we consider that solution modularity is a unilateral coordination mechanism, whereas sales-service collaboration and value assessment tooling represent bilateral coordination mechanisms. Solution modularity (e.g., Sanchez, 1999; Wang et al., 2017) refers to the solution's modular architecture that reduces complexity and facilitates low-cost replicability of a solution for different customers of the target segment. Sales-service collaboration is defined as the ability of the sales and service departments to exchange information and develop knowledge effectively to facilitate product-service-system, and thus solution offering, selling. Finally, value assessment tooling concerns the programs and/or means to help sales configure the best idiosyncratic solution for a customer (Hinterhuber, 2017; Terho, Eggert, Ulaga, Haas, & Böhm, 2017).

By studying cross-selling efforts of solution providers in the post-deployment stage, we extend prior servitization literature in general (Tuli et al., 2007; Ulaga & Reinartz, 2011) and solution-selling research in particular (Salonen, Terho, Böhm, Virtanen, & Rajala, 2021; Terho et al., 2017; Panagopoulos et al., 2017). By focusing on the relevant coordination mechanisms, we add to prior work that has examined the necessary contingencies of solution strategy success (Terho et al., 2017;

Worm et al., 2017).

In the following sections, we first provide the theoretical background of our work. We then outline our conceptual framework and develop our hypotheses. After the methodology, we present our results. We end with a discussion that includes implications for scholars and managers and identifies some limitations of our research.

## 1. Theoretical background

### 1.1. Solutions offering and sales cycle

The marketing field has paid considerable attention to new, integrated service solutions but has generally used limited conceptualizations. For instance, service orientation is “defined in terms of three dimensions: (1) the number of services offered, (2) how many customers these services are offered to (broadness), and (3) how strongly these services are emphasized” (Homburg, Hoyer, & Fassnacht, 2002, p. 88). Other researchers have used metrics such as service ratio (i.e., service segment revenue / total revenue; Fang, Palmatier, & Steenkamp, 2008; Josephson, Johnson, Mariadoss, & Cullen, 2016; Suarez, Cusumano, & Kahl, 2012). Although insightful, these measures primarily concentrate on the service-focus of manufacturers, not the integrated solution they try to sell.

Some studies, however, have used a more detailed perspective and aimed to capture the *integration* of the solution offering by emphasizing the requirement for seamlessly combining products and services. For instance, Shankar, Berry, and Dotzel (2007) define a hybrid offering as a combination of “one or more goods and one of more services, creating more customer benefits than if the good and service were available separately”. Similarly, Ulaga and Reinartz (2011) argue that hybrid offerings require distinctive organizational capabilities to combine unique resources into innovative and customized combinations of products and services.

Tuli et al. (2007) show that although manufacturers may see a hybrid offering as a “customer solution”, customers have a more encompassing view. Therefore, they define a solution as “a set of customer-supplier relational processes comprising (1) customer requirements definition, (2) customization and integration of goods and/or services and (3) their deployment, and (4) post-deployment customer support, all of which are aimed at meeting customers' business needs” (p. 5). It has led to the development of measurement scales tapping the extent to which goods and services are integrated across these four relational processes (e.g., Worm et al., 2017). A matching solution selling scale has also been

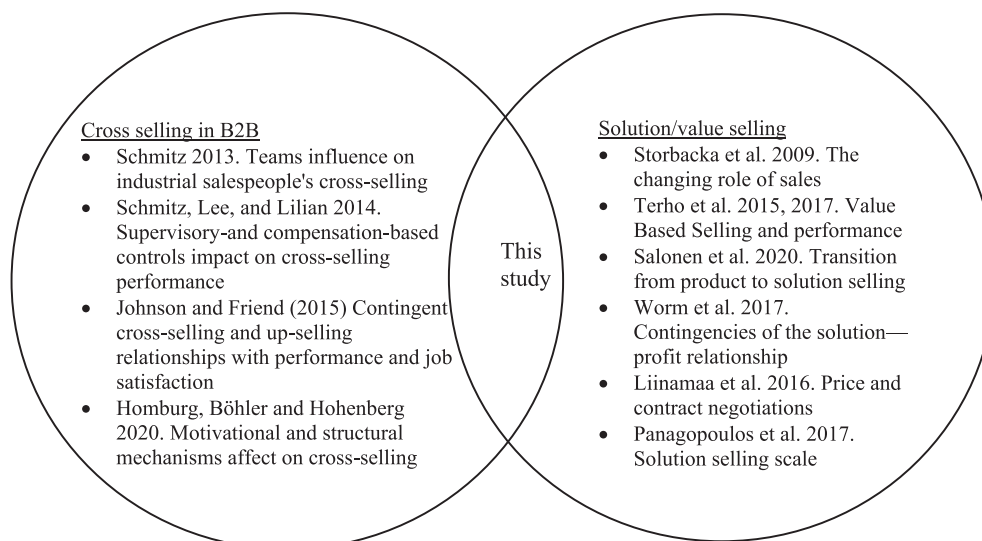


Fig. 1. Positioning of this research in the literature.

developed (Panagopoulos et al., 2017). Interestingly, a more long-term view of post-deployment is lacking.

### 1.2. Postdeployment and cross-selling

Cross-selling represents a relationship building strategy for a solution provider and a significant opportunity to increase and prolong a customer's lifetime value. Cross-selling provides an effective means to continue or maintain a B2B relationship and improve relationship satisfaction in post-deployment (Uлага & Reinartz, 2011; Verstrepen, Deschoolmeester, & Berg, 1999). To be successful though, prior research has shown that cross-selling requires the supplier to possess cross-selling capabilities, which might stem from solution characteristics, close relationships with customers, or effective learning processes (Uлага & Loveland, 2014). Although these findings indicate the potential of cross-selling for solution providers, prior research has paid scant attention to the conditions under which this potential materializes. Also, research into customization and selling has focused on offering additional implementation services in post-deployment but not cross-selling per se (e.g., Tuli et al., 2007). In fact, the cross-selling opportunities to adjust or upgrade a solution to help customers develop over time remain unexplored.

### 1.3. Coordination mechanisms

In our solution context, cross-selling concerns further customization in the post-deployment stage of a solution offering for a current customer by selling a hard- or software extension or selling extra support or service. The nature of the solution offering will determine the opportunities for cross-selling. The conversion or seizing depends on the firm's coordination mechanisms. Cross-selling, achieved through coordination with the customer, will increase the customer's solution value and fuel the provider's revenue stream.

As Fig. 2 illustrates, we develop a contingency model to predict boundary conditions that affect the firm's ability to capture the outlined extra opportunities to deepen the customer relationship according to the coordination mechanisms. The solution offering's attributes and technological capability might increase or reduce the coordination problem associated with cross-selling in the post-deployment stage. These attributes and capabilities may reside in the unilateral efforts of the individual firm and bilaterally in the properties of the relationship between the two firms (Wang et al., 2017).

First, *solution modularity* reflects the degree to which functional components of a solution interact in standardized, specified ways, allowing for the substitution of parts without requiring changes to the design of other components (Sanchez, 1999). Since the coordination is

arranged through the architectural design of the solution, it concerns a unilateral coordination mechanism (Wang et al., 2017). Modular solution design reduces complexity, facilitates low-cost replicability of a solution for different target segment customers, allows for a flexible solution configuration, and minimizes the need for information exchange between the provider and its customers. The structuring of options also allows for easy identification of cross-selling opportunities and prompt customer systems augmentation in post-deployment. So, this solution attribute should ease the coordination problem during customization (Srikanth & Puranam, 2014).

Second, poorly defined customer demands create a significant hurdle to coordinated efforts for effective customization (Franke, Keinz, & Steger, 2009). Customers often lack an accurate assessment of their own product attribute needs (Franke et al., 2009; Kramer, 2007). In such situations, *sales-service cooperation*, indicating strong relationships and rich interactions between the sales and service departments of a solution provider, is important (de Ruyter, Keeling, & Yu, 2020). Service staff spends much time with customers and knows what is going well and what can be improved. Service can help sales identify and understand customer problems and thus resolve any ambiguities. Sales-service cooperation helps leverage a service department's local knowledge of the customer and make salespeople better understand the latent cross-selling opportunities in the served market. Next, sales can interact with the customer in a focused way to identify the best solution and thus cross-sell. Because sales-service coordination relies on both departments' involvement with the customer the mechanism is bilateral.

Third, *value assessment tooling* allow firms to use data generated by their installed base to analyze and optimize machine settings and, for instance, to engage in predictive maintenance tuned to the needs of each individual customer (Opresnik & Taisch, 2015). These tools help estimate the potential monetary impact of the provider's solution for a potential customer, given the performance of their installed solutions at statistically comparable customers (Keränen & Jalkala, 2013; Terho, Haas, Eggert, & Uлага, 2012). Using value tools in intensive bilateral interactions, salespeople and their customers can quickly identify plug-ins or add-ons and demonstrate the monetary value of extensions.

We focus on these three core mechanisms in a first attempt to understand cross-selling in servitization context. We develop our hypotheses next.

## 2. Hypotheses development

### 2.1. Effect of solution offering on cross-selling and firm performance

The performance contracts generally accompanying solutions imply an inherent promise of the provider to keep helping its customers

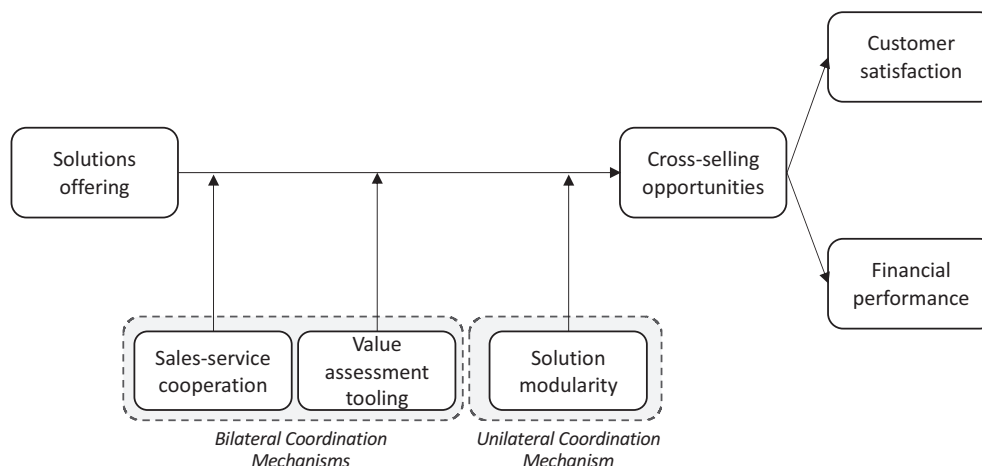


Fig. 2. Conceptual Model.

enhance their value by offering updates and extensions to their original solution (Liinamaa et al., 2016). Both basic and full-fledged solutions are sold, differentiating between customers with primary and those with elaborate needs. More off-the-shelf extensions, e.g., product and service modules, can be sold to the first group. As a customer's business evolves and trust in the provider's contribution grows, a customer may decide to involve this provider more and thus buy its add-ons or upgrades.

A solution provider with a strong, extensive solution offering is in an excellent position to identify and exploit different cross-selling opportunities (Johnson & Friend, 2015). Characterized by a more elaborate architecture, more opportunities for extension and, thus cross-selling will exist. Providers offering complex solutions will have thought more about product life cycle management and future extensions (Sanchez, 1999). In contrast, providers with less elaborate offers and less intricate solution architectures will have fewer options to extend the installed product-service system. As a result, their cross-selling opportunities will be slimmer. Hence, we hypothesize:

**H<sub>1</sub>.** A provider's degree of solutions offering relates positively to cross-selling opportunities.

Cross-selling opportunities carry the potential to increase customers' current solution value and, thus their satisfaction (Homburg et al., 2020; Johnson & Friend, 2015). In contrast to transactional deals, providers engaged in solution selling employ a relational perspective and understand the importance of post-deployment (Tuli et al., 2007). This perspective entails that they identify, develop, and insert additional value-added products and services to keep the relationship healthy (Uлага & Loveland, 2014). The provider's flexible extendibility of a customer's solution provides extra customer benefits and satisfaction.

Exploratory research suggests that cross-selling opportunities positively correlate with customer satisfaction and firm profitability (Tuli et al., 2007). Because costs for selling add-ons to existing customers are lower than those for selling a new system to an unfamiliar prospect, sales returns will be higher. In addition, the price for add-ons generally compares favorably to parts sold as part of a complete, new system. Customers buying complete systems generally benefit from price bundling and discounts. In contrast, solution owners with a partial or incomplete system tend to be locked in and cannot easily switch to the competition, which warrants a markup (Kamakura, 2007; Kamakura, Wedel, de Rosa, & Mazzon, 2003) that benefits the provider's profit margin and, thus financial performance. Although the lock-in may muffle satisfaction levels, we anticipate the extra value from the add to still be considered by the customer as beneficial and positive. Therefore, we hypothesize,

**H<sub>2a-b</sub>.** Cross-selling opportunities relate positively to a) customer satisfaction and b) financial firm performance.

## 2.2. Moderating role of solution modularity

We anticipate the identified coordination mechanisms to moderate the direct relationship between solutions offering and cross-selling opportunities. Manufacturers adopt modular architectures to control solutions' inherent complexity and costs of customization (Bask, Lipponen, Rajahonka, & Tinnilä, 2011; Wang et al., 2017). The structural capability to design subsystems or modules that operate independently yet seamlessly allows a firm to efficiently create and deliver highly customized solutions (Schaarschmidt, Walsh, & Evanschitzky, 2018). A high level of modularity means fine-grained functionality and, therefore, plenty of cross-selling opportunities; it makes it easier for salespeople to discuss and suggest potential upgrades and extensions (Brusoni & Prencipe, 2001; Schaarschmidt et al., 2018). It avoids discussing unstructured needs and requirements and immediately focuses customer attention on the specific problem the module solves, which stimulates customer buying (Homburg, Müller, & Klarmann, 2011).

Solutions offerings can only be extended easily when the architecture

allows for upgrades and extensions (Chai, Wang, Song, Halman, & Brombacher, 2012). Modules represent customer functions that can help develop an advanced solution offering flexibly. Simple solution offerings can also be augmented with services and other products, particularly if more components exist that operate relatively independently. So, also, in this situation, this unilateral (solution design) coordination mechanism is effective. Hence, we propose:

**H<sub>3a</sub>.** Solution modularity strengthens the positive relationship between the degree of solutions offering and cross-selling opportunities.

## 2.3. Moderating role of sales-service cooperation and value assessment tooling

Solutions typically are characterized by a broad network of stakeholders to talk to (Uлага & Loveland, 2014), allowing the solution provider to explore the customer business processes extensively during and after the sale of the original solution, i.e., the initial deal (Antico et al., 2008). Service and sales employees play a vital role in ensuring correct fulfillment and spotting opportunities for growth (de Ruyter et al., 2020; Rapp et al., 2017). Several reasons explain why sales-service cooperation can enhance spotting cross-selling opportunities. First, by frequently visiting or even by being permanently on-site at customer facilities, service employees are uniquely positioned to identify avenues for improvement and, thus cross-selling opportunities (Uлага & Reinartz, 2011; van der Heijden, Schepers, Nijssen, & Ordanini, 2013). Stronger sales-service cooperation, as a coordination mechanism, can help create a better commitment of both sales and service employees to share information and use their knowledge to move the business forward (Homburg & Jensen, 2007; Üstüner & Godes, 2006). Second, its rich customer data (log files) related to complaint handling, troubleshooting, training, education, and maintenance services (Neely, 2008; Rapp et al., 2017) make the service department a valuable information source for cross-selling prospecting. It can help identify ways to better cater to customer needs and provide extra value. By sharing this information, service departments can help salespeople become more efficient in identifying and converting sales opportunities with existing customers for growth (Rouziès & Hulland, 2014).

We expect that sales-service cooperation strengthens the relationship between the degree of solution selling and identifying cross-selling opportunities. Advanced solution offerings are more interwoven with customers' business processes and thus more idiosyncratic than simple solutions. Local knowledge about the functioning of these solutions at the customer then is more critical and, therefore, the value of the information of the service department more prominent. Excellent sales-service cooperation will allow for sales to identify better and more cross-selling opportunities under these conditions, which then can be discussed with the customer. Indirect support comes from the solution and value selling literature that stresses the importance of internal collaboration for challenging solutions (Panagopoulos et al., 2017; Terho et al., 2017; Tuli et al., 2007). Hence,

**H<sub>3b</sub>.** Sales-service cooperation strengthens the positive relationship between the degree of solutions offering and cross-selling opportunities.

Solution providers with sophisticated customer value assessment tools also have a higher ability to identify cross-selling opportunities. Using such tools to compare an installed solution at a customer to the optimal configuration suggested by the value tool (based on the performance of many statistical twins), customers can be advised and more easily convinced of an update's or add-on's value. We expect this coordination mechanism's impact to be more important for identifying cross-selling opportunities for firms with less – rather than more – advanced solutions offerings. In other words, value-added tooling is expected to weaken the relationship between the degree of solutions offering and cross-selling opportunities. First, value tools are expected to have less value for more idiosyncratic, customized solution offerings.



Value tools can be used across customers (economies of scale) only when some degree of standardization of solutions offerings is present – which is more likely for less sophisticated solution offerings. So, there likely is a trade-off between complexity of the offering and utility of value tools. Thus, we expect a substitution effect between solutions offering and value assessment tool regarding the chance of identifying cross-selling opportunities. Second, providers with strong solution offerings are more likely to sell a complete and optimal system at the start. They generally work hard to help the customer determine the correct configuration and show its monetary impact on the customer's business process in situ at the initial sale. Formally:

**H<sub>3c</sub>.** Value-added tooling attenuates the positive relationship between solutions offering and cross-selling opportunities.

### 3. Method

#### 3.1. Research context and data collection

We gathered data from US firms across various industries. The US has the highest percentage (58%) of firms combining manufacturing and service (Neely, 2008) and thus represents an excellent research setting. Instead of relying on service ratio as an inclusion criterion, we focused on sales from solution offerings. We included firms with 10% or more share of solution sales to increase the potential sample. Firms also needed to have >15 employees, ensuring that respondents could answer all questions referring to different business functions and departments.

We collected data from two sources. First, we collected data from the panel of a professional data collection agency using sales, marketing, and service managers as key informants. These employees were considered most qualified to answer the questions regarding solutions offerings of the firm and sales-service-related matters. If the firm offered more than one solution, the respondent was asked to focus on the most important one.

A quota sample and online survey resulted in 250 responses (i.e., 250/471 = 53.1% gross response rate). However, thirty responses had extensive missing values and thus were deleted before analyzing the data. We checked respondent versus non-respondent firms and found no significant difference in revenue and percentage sales of performance contracts in total turnover ( $F = 1.26, p = .27$  and  $F = 1.36, p = .25$ ). It suggests that non-response bias is not influencing our results.

Second, we obtained industry-level secondary data from COMPU-STAT. We used the Fama-French 30 Industrial Classification and focused on indicators of the year before the collection of our survey data. For 14 industries, the data could be matched with the survey data, with the number of observations per industry ranging between 5 and 72 firms.

#### 3.2. Measurement

We developed our questionnaire in line with general procedures recommended by Churchill Jr (1979) and Gerbing and Anderson (1988). Because common method bias is a concern when using a survey instrument to measure independent and dependent variables, we also followed the procedural steps of Podsakoff, MacKenzie, Lee, and Podsakoff (2003). Specifically, we assured complete confidentiality and varied scale formats and separated predictor and criterion variables in our survey instrument.

Before data collection, we conducted field interviews with sales and service managers to ensure a deep understanding of their business context. After developing the questionnaire, it was administered to four sales and service managers of firms selling solutions offerings to verify its wording, response formats, and clarity of instructions. Based on their feedback, we made appropriate changes. Next, we pretested the questionnaire with a sample of 30 respondents before the final rollout.

#### 3.3. Measurements

The measures we used were drawn from the extant literature. Appendix A provides an overview of study constructs and their measures. We operationalized solutions offering with the solution offering-scale developed by Worm et al. (2017). The continuous measure consists of nine items that assess the nature of the solution offering and covers all four stages identified by Tuli et al. (2007). It focuses on solution offers with an output-based value proposition and focus on a customer's business process. A five-points Likert scale was used, and one item was dropped due to a poor factor score ( $< 0.5$ ). The final composite reliability coefficient was 0.88.

For cross-selling opportunities, we developed a new scale consisting of five items focusing on the extent to which the current offerings allowed the firm to sell additional products and services to its existing customers. The items were based on Schmitz (2013) share of customers' cross-buying potential scale and measured using a five-points Likert scale with anchors "strongly disagree" (1) and "strongly agree" (5). As a pre-test, we conducted interviews with three sales managers to establish face validity and proper coverage of the definition. Post-hoc, we dropped one item due to poor fit. The composite reliability coefficient was 0.72.

The measures for both ultimate dependent variables, i.e., customer satisfaction and financial firm performance, were adopted from Vorhies and Morgan (2005). They used four and three items respectively and used a seven-points Likert scale with the anchors "much worse than competitors" (1) and "much better than competitors" (7). The firm's competitors in the industry functioned as the benchmark. The composite reliability coefficient was 0.89 and 0.84, respectively.

For sales-service cooperation, we adapted the sales-R&D cooperation scale from Ernst, Hoyer, and Rübsaamen (2010), contextualizing it to the solution setting. We included seven items and used a seven-points Likert scale. The composite reliability coefficient was 0.88.

Solution modularity was operationalized using Wang et al. (2017) product modularity scale. It focuses on how the firm's solution can be decomposed into separate modules. We expanded the original scale to six items to account for both product and service components. It was measured using a five-points Likert scale, again with anchors "strongly disagree" (1); "strongly agree" (5). The composite reliability coefficient of this construct was 0.87.

Finally, value assessment tooling was operationalized using a scale of Terho et al. (2017). Its original 4 items were contextualized and then extended with two additional items. These extra items captured the presence and use of a configurator to help sales propose the best, most valuable product-service compositions to customers. The composite reliability coefficient of this construct was 0.88.

#### 3.4. Control variables

We added several control variables that could affect cross-selling opportunities, financial performance, and customer satisfaction to ensure proper model estimation. Both firm and industry-level controls were used (Worm et al., 2017). At the firm level, we included firm size (fte's and revenues) and R&D expenditures (% of revenue in the past 12 months) to capture a firm's resources and capabilities to create and push new offerings to the market. Higher investments may give way to better-designed solutions. We also included several industry indicators: number of firms (competition), median sales to working capital ratio, and median gross profit margin. The measures capture the maturity and effectiveness of a firm's industry, which may affect a firm's strategy and performance (e.g., Luthans & Stewart, 1977). Finally, we included the squares of solution offering and cross-selling opportunities in our model to check and control for nonlinear effects.

### 3.5. Assessment of measurement models

We estimated a seven-factor confirmatory factor analysis with the survey data. The fit indices we obtained suggest the model fits the data well:  $\chi^2 = 954.885$ ; d.f. = 642; comparative fit index (CFI) = 0.93; Tucker-Lewis fit index = 0.92; root mean error of approximation = 0.042; standardized root mean square residual = 0.048. Moreover, all factor loadings were positive and significant ( $p < .01$ ), and the composite reliabilities were  $>0.70$  (as mentioned above). The average variance extracted (AVE) by each construct was greater than the square of the latent correlation between it and all other constructs in the measurement model (Fornell & Larcker, 1981). It supports the discriminant validity of the constructs. Finally, the maximum variance inflation factor (VIF) is below the threshold value of 10 for all predictors (Hair, Black, Anderson, & Babin, 2010), indicating that multicollinearity should not be an issue. We report the descriptive statistics and correlations in Table 1.

### 3.6. Endogeneity considerations

The effect of solution offering on cross-selling opportunities may be spurious as common unobserved factors (e.g., organizational factors, common method bias) may exist. For example, salespeople may sell more solution offerings via cross-selling through the implemented company policy or incentive structure. Reversed causality might also play a role; cross-selling opportunities could influence how companies offer integrated solutions. We adopted Garen (1984) control function procedure to correct possible endogeneity in our analyses (Sande & Ghosh, 2018).

For the front-end of our model, we proceeded as follows. First, we regressed solution offering (SOL) on a set of predictors to obtain the structural residual term ( $\hat{\varepsilon}$ ). We used customer privacy concerns as the primary antecedent and measured this concept with a four-item scale (alpha coefficient 0.794), adapted from Martin, Borah, and Palmatier (2017). The extra predictors included relative solution offering quality in industry compared to other sectors (standard deviation) and the industry's median sales to working capital ratio. These predictors served to (i) prevent misspecification due to a possible weak instrument, (ii) reduce endogeneity due to common method bias, and (iii) allow to conduct the overidentification test (Antonakis, Bendahan, Jacquart, & Lalive, 2010; Sande & Ghosh, 2018). Second, we calculated the interaction term ( $\hat{\varepsilon} \times \text{SOL}$ ) and ( $\text{SOL} \times \text{SOL}$ ) and used these together with SOL to re-estimate the model accounting for unobserved heterogeneity. First, the extended model was found significant (F-value = 27.433,  $df_1 = 3$ ;  $df_2 = 246$ ;  $p < .01$ ). Second, the Sargan test showed the exclusion criterion was satisfied ( $\chi^2 = 4.060$ ,  $df = 2$ ,  $p > .10$ ), which means the instruments are exogenous. Finally, the Wu-Hausman test showed the assumption of no systematic differences in coefficients between model with and without endogeneity correction was rejected ( $\chi^2 = 13.984$ ,  $df = 1$ ,  $p < .01$ ), indicating the presence of endogeneity and thus confirming the importance of our corrective actions.

For the back end of our model, we adopted the same approach. Here, we regressed cross-selling (CRO) on a set of predictors using solution offering quality in the industry of the focal firm as our primary predictor to obtain the structural residual term ( $\hat{\varepsilon}$ ). As other predictors, we included customer privacy concerns and again the median sales to working capital ratio in the focal firm's industry. Next, we calculate the interaction term ( $\hat{\varepsilon} \times \text{CRO}$ ) and ( $\text{CRO} \times \text{CRO}$ ) and added it with CRO to our model. The results suggested that our instruments were valid. The results for customer satisfaction are as follows: F-value of 22.002 ( $df_1 = 3$ ;  $df_2 = 246$ ;  $p < .01$ ), the Sargan test results in a  $\chi^2$  of 1.091,  $df = 1$ ,  $p > .10$ , and the Wu-Hausman test shows a F-value of 2.467 ( $df_1 = 2$ ;  $df_2 = 245$ ;  $p = .085$ ). The results for financial performance are as follows: F-value of 22.002 ( $df_1 = 3$ ;  $df_2 = 246$ ;  $p < .01$ ), the Sargan test results in a  $\chi^2$  of 0.601,  $df = 1$ ,  $p > .10$ , and the Wu-Hausman test has a F-value of

**Table 1**  
Descriptives and Intercorrelation Matrix of Constructs.

	Mean	Std. Dev.	AVE	CR	1	2	3	4	5	6	7	8	9	10	11	12
1 Customer satisfaction	5.63	1.19	0.67	0.89	—											
2 Financial firm performance	5.44	1.10	0.64	0.84	0.61	**										
3 Cross-selling opport.	3.97	0.72	0.57	0.76	0.46	0.47	**									
4 Solution offerings	3.88	0.77	0.53	0.88	0.37	0.39	**	—								
5 Solution modularity	3.70	0.78	0.54	0.87	0.38	0.38	**	0.48	**							
6 Sales-service cooperation	5.38	1.03	0.52	0.88	0.47	0.46	**	0.46	**	0.50						
7 Value added tooling	3.75	0.80	0.55	0.88	0.39	0.46	**	0.45	**	0.36	**					
8 Firm size (revenues)	3.94	2.47	—	—	0.15	0.17	**	0.08	**	0.43	**	—				
9 Firm size (fte's)	4.76	2.16	—	—	0.04	0.06	0.02	0.04	0.04	0.08	0.14	**	—			
10 Firm R&D expenditures	27.58	13.35	—	—	0.15	0.24	**	0.12	**	0.02	0.04	0.06	0.02	—		
11 Industry size <sup>a</sup>	278.6	231.7	—	—	0.02	0.06	0.05	0.06	0.04	0.14	0.05	0.02	0.07	0.01	—	
12 Sales to work. Cap. ratio <sup>a,b</sup>	5.51	2.89	—	—	−0.05	−0.14	**	−0.09	*	−0.07	−0.04	−0.08	−0.03	−0.01	−0.56	**
13 Gross profit margin <sup>a,b</sup>	0.48	0.17	—	—	0.08	0.14	**	0.13	*	0.14	0.05	0.10	0.04	0.01	0.61	−0.573

Notes

<sup>a</sup> Correlation coefficients refer to industry-level correlations.

<sup>b</sup> Median.

\* $p < .05$ , \*\* $p < .01$ .

6.585 ( $df_1 = 2$ ;  $df_2 = 245$ ;  $p = .037$ ).

In accord with these results, we correct and control for the endogeneity bias by including both the residual and the interaction term of the residual term and the scores of solution offerings as well as cross-selling opportunities as covariates while estimating the model.

### 3.7. Model specification

We employ linear modeling with cluster-robust estimation in Stata 15.0 to account for the nested structure of data (i.e., companies nested within industries). The following three equations capture the full model:

$$CRO_i = b_0 + b_1 SOL_i + b_2 COOP_i + b_3 MOD_i + b_4 VAT_i + b_5 (SOL_i \times MOD_i)_i + b_6 (SOL_i \times COOP_i)_i + b_7 (SOL_i \times VAT_i)_i + \text{Control Variables} + \varepsilon_i, \quad (1)$$

$$CSAT_i = b_0 + b_1 SOL_i + b_2 COOP_i + b_3 MOD_i + b_4 VAT_i + \text{Control Variables} + \varepsilon_i, \quad (2)$$

$$FPER_i = b_0 + b_1 SOL_i + b_2 COOP_i + b_3 MOD_i + b_4 VAT_i + \text{Control Variables} + \varepsilon_i, \quad (3)$$

where CRO = cross-selling opportunities, CSAT = customer satisfaction, FPER = financial performance, SOL = solutions offering, COOP = sales-service cooperation, MOD = solution modularity, and VAT = value assessment tooling.

## 4. Results

Table 2 shows the results of our empirical analysis. Model 1 shows the results for the front part of the model and indicates a positive influence of solutions offering on cross-selling opportunities ( $b = 0.25$ ,  $p < .01$ ). It lends support for H1.

For the impact of the three contingency variables, we also turn to Model 1. In contrast to our hypothesis, the modular design does not affect the relationship between the solutions offering—cross-selling opportunities ( $b = -0.04$ , *n.s.*). However, as anticipated, the moderating effect of sales-service cooperation is significant and positive ( $b = 0.15$ ,  $p < .01$ ). So, there is support for H3<sub>b</sub> but not H3<sub>a</sub>. We also find a significant negative effect of value assessment tooling ( $b = -0.08$ ,  $p < .05$ ), supporting H3<sub>c</sub>. Fig. 3 helps to interpret the two significant moderating effects; it plots the marginal effect patterns for the group of firms one standard deviation below and above the mean of the moderator. Panel A confirms that sales-service cooperation enhances the solution offerings—cross-selling opportunities relationship; companies with high sales-service cooperation enjoy a stronger relationship than counterparts with low sales-service cooperation. Panel B shows a substitution effect for value assessment tooling as anticipated; there is a weaker relationship between solution offerings—cross-selling opportunities for high than low value assessment tooling.

Models 2 and 3 involve the results for the back-end of our model. These indicate that cross-selling opportunities enhance customer satisfaction ( $b = 0.51$ ,  $p < .01$ ) and financial firm performance ( $b = 0.33$ ,  $p < .05$ ). So, there is support for H2<sub>a</sub>, and H2<sub>b</sub>, respectively. We also note a significant negative quadratic term of cross-selling opportunities on customer satisfaction ( $b = -0.24$ ,  $p < .05$ ). With the strong positive main effect of cross-selling opportunities, this quadratic effect suggests the direct linear effect levels off. So, there are decreasing returns of cross-selling efforts. Finally, sales-service cooperation has a strong direct effect on customer satisfaction ( $b = 0.39$ ,  $p < .001$ ) and financial firm performance ( $b = 0.34$ ,  $p < .001$ ). Of the controls, only a firm's R&D expenditures has a positive impact on firm financial performance ( $b = 0.01$ ,  $p < .001$ ).

## 5. Discussion

Although attention for B2B manufacturers' transition from goods-dominant business models to offering solutions has mushroomed, research attention for the post-deployment phase and cross-selling has remained limited. However, leveraging cross-selling opportunities is vital because it can increase customer retention and help a provider grow its business organically. In response, this study focused on if and how companies can benefit from cross-selling activities in a solution offering context.

The findings suggest that although there generally is a positive relationship between solution offering and cross-selling opportunities, a firm's organizational bilateral coordination mechanisms determine the ultimate strength of this relationship and, hence, the downstream effects on customer satisfaction and financial firm performance. The findings have both theoretical and managerial implications.

## 6. Theoretical implications

Our empirical study extends previous sales and solution strategy research by focusing on the post-deployment stage. For firms offering solutions, fostering continuous relationships with customers and leveraging cross-selling opportunities are essential for sustainable customer satisfaction and profit growth (Tuli et al., 2007). The direct positive effects of cross-selling opportunities on customer satisfaction and financial firm performance confirm this. However, the significant negative quadratic term of cross-selling opportunities on satisfaction suggests diminishing returns. It implies an end to how many extra options a provider can sell to a customer for a particular solution offer. Future research may explore this more in depth.

The degree to which firms have converted from goods to solution selling, and the scope of the solution, determine the size of a firm's cross-selling opportunities. However, as anticipated, firms have different mechanisms for leveraging these cross-selling opportunities. First, sales-service cooperation plays a vital role. High cross-functional collaboration between the two departments facilitates the transfer of customer need knowledge of the service to the sales department, resulting in a substantial increase in cross-selling opportunities. This collaboration is key in the post-deployment stage, or as Panagopoulos et al. (2017, p. 148) note: "Because emergent situations may require refinement of the offering's value (Haas, Snehota, & Corsaro, 2012), the salesperson also performs activities to diagnose new needs and propose new solutions and, thus, further cement the quality of interactions with the customer...". It confirms the need for sales to pay attention to all stages of solution selling and invest in personal relationships with the service department. Input may be based on big data, but the service staff's tacit, local knowledge enhances its value. The learning from the bilateral coordination of service with current customers is leveraged and helps the sales department seize cross-selling opportunities with these customers in post-deployment.

Second, value assessment tooling is an essential coordination mechanism between a provider and buyer, too. A provider that invests in the development of value assessment tools generates insights that can help sales identify options and convince customers better. However, this knowledge will also find its way into the solution's design. Specifically, it will be used to enhance or extend the underlying product-service system's modular architecture to increase the solution's value for all customers. Yet, it will also help customize the original or initial solution more effectively. As a result, the firm's value assessment tooling potency for identifying cross-selling opportunities will decrease. Therefore, the two mechanisms act as substitutes. It extends prior work by, for instance, Hinterhuber (2017), who focused on drivers of value quantification capabilities and how sales and account managers use them to translate a solution's competitive advantages into quantified customer benefits.

Third, modular design, as a unilateral coordination mechanism, did not moderate the solution offering—cross-selling opportunity



**Table 2**  
Regression Results.

		Model 1: Cross-selling opportunities			Model 2: Customer satisfaction			Model 3: Financial firm performance		
		b	t		b	t		b	t	
Intercept		3.98	22.55	***	5.49	17.34	***	4.96	17.72	***
<i>Independent variables</i>										
Solutions offering	H1	0.25	2.58	**	−0.07	−0.46		0.06	0.77	
Cross-selling opportunities	H2a/b	–	–		0.51	2.36	**	0.33	1.71	*
<i>Moderators</i>										
Solution modularity		0.20	2.26	*	0.26	1.91	*	0.03	0.28	
Sales-service cooperation		0.25	4.01	***	0.39	3.72	***	0.34	6.11	***
Value assessment tooling		0.08	2.31	*	0.22	1.94	*	0.25	3.12	***
<i>Interactions</i>										
Solution modularity × Solutions offering	H3a	−0.04	−0.86							
Sales-service cooperation × Solutions offering	H3b	0.15	2.51	**						
Value assessment tooling × Solutions offering	H3c	−0.08	−2.12	*						
<i>Control variables and paths</i>										
Solutions offering squared		0.06	0.66							
Cross-selling opportunities squared					−0.24	−2.90	**	0.02	0.26	
Firm size (revenues)		0.00	0.08		0.01	0.28		0.04	1.63	
Firm size (fte's)		−0.01	−0.34		0.01	0.19		0.00	0.02	
Firm R&D expenditures		−0.00	−0.41		0.00	0.61		0.01	3.35	***
Industry size		−0.00	−1.28		0.00	1.20		0.00	0.93	
Median gross profit margin		0.37	1.54		−0.57	−1.17		−0.16	−0.43	
Median sales to working capital ratio		−0.02	−1.44		0.03	0.90		−0.00	−0.03	
$\hat{\epsilon}_{\text{endogenous}}$		−0.07	−0.84		−0.31	−2.17	*	−0.14	−0.94	
$\hat{\epsilon}_{\text{endogenous}} \times \text{endogenous}$		0.04	0.38		0.10	0.94		−0.03	−0.28	
R <sup>2</sup>		55.5%			55.5%			54.5%		
$\Delta R^2$		3.1%								

Notes: \*p < .05, \*\*p < .01, \*\*\*p < .001 (one-tailed). n = 220.  $\Delta R^2$  refers to change compared to direct effects only model.

relationship but directly impacts cross-selling opportunities (b = 0.20, p < .05). A possible explanation is that a solution's modular architecture is equally beneficial for identifying cross-selling opportunities for companies with advanced and more basic solutions. Companies that use modular platforms generally restructure their product-service design and modularize their internal processes and knowledge architectures, enabling them to sense and seize opportunities quicker (Sanchez, 1999). It explains the direct impact on cross-selling opportunities that we found. A related and alternative explanation is that we did not contextualize our solution modularity measure. Borrowing directly from extant literature, the measure probably did not capture the number of components to allow for efficient life cycle management, i.e., components that would enable the solution to grow with a customer's increased maturity and changing needs.

Fourth, several previous studies (e.g., Fang et al., 2008) have shown that solutions offered directly affect financial firm outcomes. In contrast, our results suggest that cross-selling is a potential mediating mechanism for firms to achieve customer satisfaction and financial firm performance. Post-hoc mediation tests show that cross-selling is a significant mediator (p < .001) accounting for about 61% of the relationship between solutions offering and financial performance and about 55% of the relationship between solutions offering and customer satisfaction. Thus, organic growth achieved with existing customers partially mediates the direct relationship. Because solution providers aim to become long-term partners, extending our view of the solution sales cycle is critical as Tuli et al. (2007) advocated. The post-deployment stage and its related cross- and upselling should be accounted for. Selling updates and upgrades is a critical element of these firms' business model (Suppatvech et al., 2019). "Opportunities for add-on and solution-oriented business models are higher, as IoT technology is integrated further with the value offering. [...] The creation of more diverse and unique services, and subsequent capture of generated value for add-on business model cases, as well moving down the supply chain for solution-oriented business models, are the ultimate goals." (p.81).

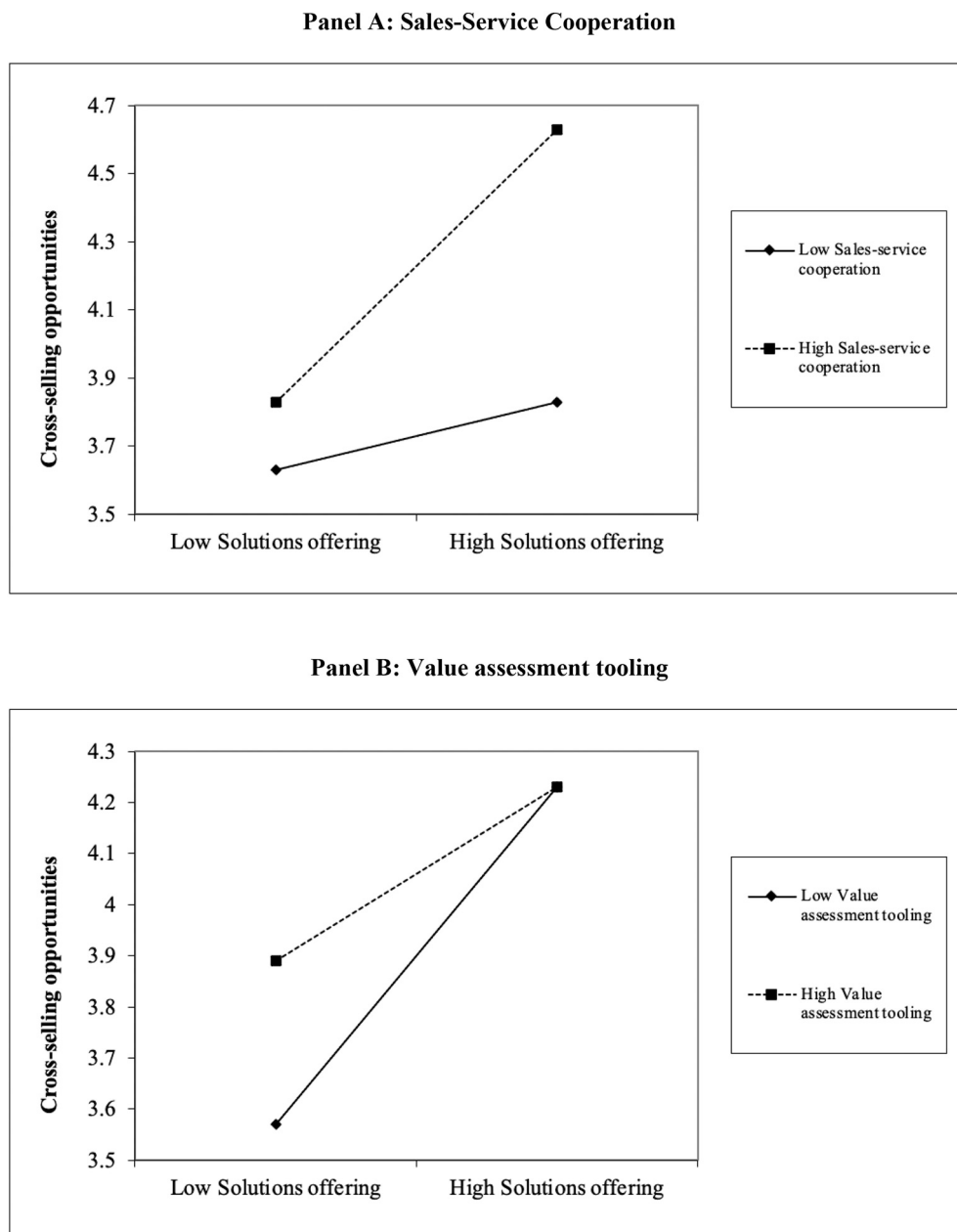
The direct effects observed for several of our levers on our ultimate dependent variables deserve further discussion too. Sales-service cooperation and value-added tooling moderate the front-end of our model and directly contribute to customer satisfaction and financial firm performance. Close sales-service collaboration can help accomplish better contract performance, which results in better customer ratings and thus also higher profit margins for these contracts. The positive direct impact of value assessment tooling on firm performance is consistent with findings of prior work on value-based selling and solution offerings (e.g., Terho et al., 2012).

In conclusion, we contribute to the literature on cross-selling and servitization by regarding cross-selling as a coordination problem and identifying factors to relieve it. It extends prior research that has examined cross-selling but not in a business-to-business servitization context. Our study advances the understanding of coordination in a cross-selling situation. It thereby sheds light on specific attributes related to the provider (product modularity), and the customer-provider relationship (sales-service cooperation and value assessment tooling) as mechanisms for relieving or worsening the coordination difficulty associated with cross-selling.

## 7. Managerial implications

Our study provides important guidelines to managers for maximizing the cross-selling opportunities of solution providers to grow their firms' customer satisfaction and financial firm performance. Managers must foster the creation of different coordination mechanisms at the organizational level that enable sellers to identify profitable cross-selling opportunities and enhance customer satisfaction.

First, managers should proactively create an organizational environment that fosters sales-service cooperation. It requires a change in culture and benefits from different control-, cooperation- and development-oriented integrative activities (Momeni & Martinsuo, 2019). A stepwise approach can help. For example, one may begin by



**Fig. 3.** Contingency Effects on Solution offering—Cross-Selling Opportunities.  
 Panel A: Sales-Service Cooperation.  
 Panel B: Value assessment tooling.

installing a project team in which people for both functions work together, exploring the use of service data to enhance customer value in solution implementation and post-deployment stages. In addition, traditional interventions like joint training sessions, creating shared responsibility (e.g., installing group goals), and developing a mutual information system could be considered. Having service or customer care staff accompany salespeople to visit clients may also help sell service contracts and spur cross-selling. It fosters bilateral coordination between the provider and its customers. Finally, product and service portfolios or menu cards can help jointly developed for different customer groups.

Second, managers can provide structure. Without structure, salespeople may be reluctant to sell add-ons because these options are unfamiliar to them, sales agents fail to see the added value of these components, or employees miss the ‘bigger picture’ recognizing the importance of the post-deployment for the success of the firm’s solution

strategy. The structure can come from the solution offers’ design or from the use of excellent value assessment tools. The two instruments are cross-selling coordination substitutes. Since the design is hard to change, attention can better focus on the value assessment tools in the short term. For the long-term, managers can help by educating salespeople to participate in modular solution design and development. In this regard, more cross-selling options, i.e., modules, can be designed into the system (Sanchez, 1999).

Finally, managers can use incentives to stimulate cross-selling in post-deployment, identify best practices, and offer cross-selling training. Although not part of our results, these instruments can help complement the above-mentioned suggestions.

## 8. Limitations and future research

This research has several limitations, which represent opportunities

for future research. First, although augmented with secondary data, we primarily used perceptual data from key informants. Still, future research could rely on richer multisource data. Second, we used a cross-sectional perspective and focused on US firms. The cross-sectional approach limits our ability to conclude causal relations. Future research using longitudinal data could help explore the proposed causal relationships further. Because US industries are leading in servitization and our sample existed of US firms selling solution offerings, our results may not be fully generalizable. Future work comparing industries and studying servitization in multiple countries thus would be helpful. Third, additional coordination mechanisms and levers could be identified and studied. Scholars could pay more attention to and control for firms' solution life cycle management and its impact on cross-selling opportunities over time. A contextualized measure of solution modularity could be developed. It should capture the solution modularity's ability to cater to customers' evolving needs. Fourth, scholars could

adopt a customer perspective.<sup>1</sup> Cross-selling opportunities may exist but need to be converted. When the customer is told that an add-on or software update is not included in the solution but could be acquired separately, the provider might risk the downgrading of the initial solution for being less integrative than initially believed, which may hurt satisfaction and ultimately firm financial performance. The question is how can a provider prevent adverse and stimulate positive emotions? This would require exploring moderators at the back end of the model.

In conclusion, cross-selling seems a particularly relevant and fertile avenue for future research. We hope our research provides some impetus for future work.

#### Data availability

The authors do not have permission to share data.

## Appendix A. Constructs and Items

Solutions offering (Tuli et al., 2007; 5-points Likert scale, strongly disagree-strongly agree)	Factor Loading
The product-service system (PSS) offerings...	
• Require understanding of each customer's requirements.	0.670
• Integrate products and services into customers' environment.	0.751
• Are customized to each customer's specific needs.	0.713
• Require customer involvement in development and/or implementation.	0.714
• Require detailed specifications of mutual contractual obligations. *	–
• Involve taking over the customer's activities / process.	0.702
• Promise an outcome specified by customer-specific metrics.	0.755
• Include implementation of the service/solution (over time).	0.791
• Include post-deployment support.	0.700
<b>Solution modularity</b> (Wang et al., 2017; 5-points Likert scale, strongly disagree-strongly agree)	
Our product-service systems...	
• ...are composed of standardized product modules.	0.739
• ...are composed of standardized service modules.	0.748
• ...allow for changes in key components of the product without redesigning others.	0.703
• ...allow for changes in key components of the service without redesigning others.	0.708
• ...have product modules that fit together with little adjustment.	0.769
• ...have service modules that fit together with little adjustment.	0.726
<b>Sales-service cooperation</b> (Ernst et al., 2010; 7-points Likert scale, very little-very much)	
Please indicate the level of cooperation between sales and service when selling product-service systems for the following activities (during the past 12 months):	
• Analysis of customer needs.	0.705
• Configuration of products and services that can work together as a PSS.	0.728
• The delivery and installment of PSSs.	0.697
• After-sales service and post deployment support.	0.701
• Identifying improvements based on complaints, customer reports, etc.	0.734
• Streamlining and enhancing operational processes.	0.721
• Specification of new products and services for the PSS.	0.750
<b>Value added tooling</b> (based on Terho et al., 2017; 5-points Likert scale; strongly disagree-strongly agree)	
To what extent do you agree or disagree with the following statements. Our firm has...	
• ...developed tools to quantify the impact of our firm's product-service system on customers' business.	0.739
• ...tools in place to estimate the financial implications for customers when using our firm's product-service system.	0.749
• ...a method to assess the financial value that our firm's product-service system delivers to customers.	0.786
• ...has a procedure to integrate customer evidence to build proof for the value of our firm's solution offering.	0.773
• ... developed a configurator to facilitate solution offering composition choices.	0.712
• ...a product-service system configurator to compose the right solution for customers.	0.704
<b>Cross-selling opportunities</b> (based on Schmitz, 2013; 5-points Likert scale, strongly disagree-strongly agree)	
Deploying product-service systems to our customers...	
• provides opportunities to sell additional products and/or services.	0.842
• helps to increase customer share of wallet over time. *	–
• leads to insights on how to provide additional offerings to customers.	0.763
• aids the further exploitation of customers' potential with regard to additional products/ services.	0.682
• facilitates the sale of upgrades or other add-ons.	0.735
<b>Customer satisfaction</b> (Vorhies & Morgan, 2005; seven-points Likert scale, much worse than competitors-much better than competitors)	
Please evaluate your firm's performance relative to your major competitors on the following items (during the past 12 months):	

(continued on next page)

<sup>1</sup> We thank one of the reviewers for pointing us to this opportunity for further research.

(continued)

Solutions offering (Tuli et al., 2007; 5-points Likert scale, strongly disagree-strongly agree)	Factor Loading
• Customer satisfaction.	0.823
• Delivering value to customers.	0.815
• Delivering what customers want.	0.842
• Retaining valued customers.	0.804
<b>Financial firm performance</b> (Vorhies & Morgan, 2005; seven-points Likert scale, much worse than competitors-much better than competitors)	
• Please evaluate your firm's performance relative to your major competitors on the following items (during the past 12 months):	
• Return on investment (ROI).	0.812
• Return on sales (ROS).	0.819
• Reaching financial goals.	0.766
<b>Industry R&amp;D spend</b>	
• What percentage of revenue did your company invest in R&D in the last 12 months?	
(Averaged to industry-level)	
* Item dropped.	

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