Whom to ask for what knowledge?
A comparison of exchange partners and their impact on knowledge types

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Abstract
From which sources does a firm acquire its knowledge? One of the most important key assets of a firm is its knowledge stock, which can be distinguished into different types of knowledge (e.g., market knowledge). This knowledge stock results from internal and/or from external sources such as exchange partners (e.g., customers). Our paper focuses on these external partners and investigates how the social capital residing in the relationships to these exchange partners is related to the creation of different types of knowledge. Thereby, this research generates practical guidelines for investing in a firm’s network. Using data from 161 firms, the results show that (1) customers are the most important source for market knowledge; (2) regarding process, technological and organizational knowledge the combination of R&D partners and customers contributes the most; and (3) for product knowledge no single source being the most important knowledge contributor can be identified.

1. Introduction

This study analyzes the influence of various types of exchange partners (e.g., customers and suppliers) in a network of firms on the creation of different types of knowledge (e.g., market knowledge) by using a social capital lens. Social capital, is defined “as the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit” [48, p. 243]. Social capital at different levels of analysis has been found to influence, e.g., knowledge sharing [13], knowledge transfer [34], knowledge creation [46], value creation [61], and knowledge exploitation and acquisition [62].

In fact, social capital theory hypothesizes a positive influence of social capital on the creation of new knowledge because it eases the access to resources in a network, e.g., of firms and facilitates exchanging and combining knowledge [46, 48]. Therefore, having various types of exchange partners in a network creates the opportunity for a firm to tap into the resources provided by the partners. A prominent example of these resources is knowledge that has been found a key asset of firms which has to be exchanged and combined to come up with innovations and eventually performance [56].

Research has investigated the role of networks of firms and alliances for knowledge transfer and performance [22, 47, 57] and identified various types of exchange partners [e.g., 41]. On the other hand, prior research has been engaged in the investigation of different types of knowledge such as market knowledge and technological knowledge and their effects on, e.g., performance [17, 36, 44].

However, the question of how different types of exchange partners such as customers and suppliers differentially contribute to certain types of knowledge is under-researched. This issue is of highly practical relevance because to know which type of exchange partner affects which type of knowledge is crucial for assessing the contribution to a firm’s knowledge creation and thus allows to thoroughly investing in networks from a knowledge management perspective.

Thus, our research extends previous work by investigating how social capital in relationships to different types of exchange partners in a network is related to the creation of different types of knowledge. We therefore formulate the following research question:

What is the differential impact of social capital related to different types of exchange partners on various types of knowledge?

Using social capital theory as theoretical lens and applying data from a survey among manufacturing
firms, we demonstrate, for instance, the relative importance of social capital with customers for the creation of market and technological knowledge compared to the influence of suppliers.

This paper is structured as follows. First, the research model is developed using arguments from the social capital theory. Second, the methodology used is introduced. Third, the results are presented. Finally, conclusions and limitations are discussed.

2. Research Model

Figure 1 visualizes our research model. It deals with different types of exchange partners in terms of social capital between the firm and the corresponding partner type and its influence on different types of knowledge which are characteristic for an organization. The set of partners as well as the set of types of knowledge and the relationship between them are introduced in the following sections. The model will serve as a baseline model which allows us to explore the differential relationship between certain types of exchange partners and knowledge.

2.1 Types of Knowledge

We focus on different types of knowledge as dependent variables which together form the knowledge stock, representing the level of knowledge assets of an organization [29]. The literature suggests several categories of knowledge being transferred in inter-organizational cooperation. Predominantly two categories are emphasized in literature, namely market and technological knowledge [e.g., 44]. The first one is about the external environment of an organization, i.e. about the factor and product markets, and thus is externally oriented. It comprises not only knowledge about markets a firm is actually engaged in but also about potential future markets. Furthermore, market knowledge is investigated by several studies in terms of knowledge about competitors and customers [17], suppliers [23], partners [49], industry information [59], as well as in a general way [62]. By contrast, technological knowledge refers mostly to the technological competence of an organization [38] and to the recognition of new technologies. Furthermore, IT knowledge [6, 52] and state-of-the-art technical practices [45] are prominent examples of technological knowledge.

Beside these two types of knowledge, two further types might be important. The first one comprises knowledge about managing and designing the firm’s internal processes (process knowledge) [5]. The second one is organizational knowledge that includes knowledge about the organizational form and functions as well as about strategic and sourcing topics [33].

In addition, case studies which have been carried out among both innovation managers and CEOs of business unit managers, respectively, of 18 manufacturing firms before doing the survey, have shown the importance of product knowledge which refers to the extent of knowledge about the product landscape among a firm’s employees.

2.2. Exchange Partners

According to the literature focused on inter-organizational cooperation and especially on knowledge transfer we identified the following types of exchange partners which are typical for a firm’s network:

- Customers [10, 16, 19, 41]
- Suppliers [10, 16, 19, 41]
- R&D partners: R&D service providers (privately owned companies, e.g., engineering companies) [41] and public research institutions (e.g., universities) [10, 16, 19, 41]
- Communities/professional organizations [42] (including firms within the firm group [16] and without the group): industry associations and related working groups
- Friendship communities [35, 43]: private contacts of the survey respondent

By interacting with these different types of exchange partners the firm will basically raise its knowledge stock. Thereby each exchange partner functions as an external knowledge sources. Thus we center on the relationships between the focal firm and its partners and we apply the concept of social capital
to each of these external knowledge sources to investigate their contribution to knowledge creation [48] and transfer. First, because social capital “inheres in the structure of relations between actors and among actors” [15, p. 98] and thus resides in relationships and second, “because social capital directly affects the combine-and-exchange process and provides relatively easy access to network resources” [46, p. 735].

According to Nahapiet and Ghoshal [48] social capital comprises three dimensions. Accordingly social capital affects the formation of the organizational knowledge stock for the following three reasons.

First, the structural dimension focuses on the linkages between actors. Hence the concept of tie and its strength has become an important part of the structural dimension. Strong ties are characterized by frequent and direct interaction between actors and thus enhance the knowledge and information flow [26]. Furthermore for the effectiveness of an organization it is beneficially to maintain strong ties to diverse types of knowledge partners [8] in terms of different types of knowledge. Thus by providing relationships in terms of communication channels for transferring knowledge [30] the structural dimension of social capital increases the access to knowledge [63].

The second dimension of social capital is called relational dimension and refers to mutual respect and trust based upon the development of relationships over time [27]. Trust is an important aspect because trust enhances the efficiency and effectiveness of knowledge transfer [1, 43]. On the one side trust improves the willingness to exchange and on the other side trust guides further actions through the creation of mental maps [7, 20, 30, 48].

Finally, the cognitive dimension deals with shared vocabulary, shared narratives and interpretations [28, 40]. Similar to the argumentation before, this dimension improves the knowledge transfer by developing a greater understanding through common languages and symbols [20] between the actors which arise in the relationship over time and by creating a common frame of reference [50] in which knowledge can be integrated [28]. Furthermore by establishing a perspective-sharing and sense-making the reach and richness of transferred knowledge increases [54].

3. Methodology

3.1. Data Collection

We have collected survey data among the 2,500 largest firms of the German manufacturing industry according to the SIC codes 3011-3999 and to the revenue of 2007. The main reason for choosing this industry is that it comprises a large number of high-tech firms which are characterized by a high stock of knowledge and thus are especially adequate for detecting knowledge transfer from their environment.

We only focused on the most important product division of the firms since firms often exhibit multiple divisions. Thereby, we avoided aggregation problems on the firm level. Our case studies indicated that the “most important” product division is commonly associated with “largest” product division but not with “most successful”. Furthermore, these case studies showed that the person in charge of this division is appropriate for answering the question. On the one side s/he is familiar with the innovation process and on the other side s/he has the necessary knowledge to evaluate the relationship to different exchange partners because s/he is responsible for the daily business and therefore stays in contact with the partner of the division.

Each firm was called by phone in advance in order to identify this person in charge of the most important product division. In 2,160 cases we found the respective person. After this initial contact, the questionnaires were mailed out according to the channel preferences of the recipient (mostly postal mail but also by fax (4 times) and email (581 times)). If the person had not answered within a couple of weeks, a reminder was sent out 4 weeks after the initial dispatch and this person was called another 2 weeks later.

This process resulted in 229 completed questionnaires, whereof 161 could be used for analyzing the model because they showed no missing data regarding all measurement items. This high amount of missing data stems from the fact that not every participating product division has a relationship to all exchange partners included in the analysis. For example, most of the respondents stated to have no friendship community with which they share business related topics and therefore have skipped this section of the questionnaire. Survey fatigue of the respondent can be excluded for explaining the proportion of missing values because the questionnaire was sent out in three different versions with different item orders. Comparing the scores calculated by confirmatory factor analyses of the dependent knowledge variables using the Mann-Whitney test showed no differences between the three groups.

To ensure that non-response bias was not present in our data set, we first compared the data from respondents who answered after the reminder call or after repeatedly sent questionnaires vs. those who answered directly [2]. Second, at an organizational level of analysis, we compared the demographic data in terms of revenue and number of employees of the respondent firms with those who had not answered but were in the sample. Third, at an individual level, we...
compared the professional experience of the respondents with those who participated in the survey but were not in the sample used for this analysis. Professional experience was measured twofold: number of years carrying out the current job and variety of business functions (e.g. sales, production) covered during one’s working life. For all tests we used the Mann-Whitney test which showed no significant differences between the compared groups.

3.2. Measurement

The questionnaire was developed by four researchers after reviewing the broad literature on social capital theory and knowledge transfer. We extracted measurement instruments from 97 journal articles including comparable works and developed on this basis a reflective measurement model consisting of 3 to 4 items for each construct predominantly based on one resource.

Table 3 lists all the items and gives the references to the finally selected resources.

Data about social capital related with each type of exchange partner was captured as a secondary construct formed by the three dimensions of social capital (structural, relational, and cognitive) measured by 3 items each (cf. Figure 1). Thus the overall construct of social capital is reflected by 9 items for each type of partner.

We pre-tested the questionnaires in a first step independently with 8 firms. Based on these feedbacks, we slightly modified the questionnaire in terms of the wording of the items to ensure their understandability and the comprehensiveness of the constructs. In a second step, for the five types of knowledge (not for the social capital measure), we applied a card sorting approach with a couple of innovation managers to gain higher content validity. The feedbacks were used to adjust the measurement model of the knowledge constructs by re-formulating two items and deleting one item. Finally, 6 more pre–tests have been conducted resulting in no further changes.

3.3. Analysis

For analyzing our data and exploring those combinations of types of exchange partners and knowledge types being existent, we use a two-step procedure (Figure 2). First, we applied the Partial Least Squares (PLS) approach using the software package SmartPLS2.0.M.3 [53] for calculating our research model with each type of exchange partner separately. This results in five examined models where the types of knowledge have been kept constant but the type of exchange partner has been iterated. Every model was evaluated with the same sample of 161 questionnaires to assure the comparability across the models.

In a second step, we compared the path coefficients between the construct representing one type of partner and a specific type of knowledge to scrutinize which partner can differentiate from other partners regarding the importance for this specific type of knowledge. Figure 2 illustrates the comparison of two exchange partner regarding their influence on product knowledge. Therefore we applied the parametric test for group comparison suggested by Keil et al. [37] as well as the non-parametric group comparison test by Henseler et al. [31]. We decided to use both tests to underline and to strengthen our results, well knowing that Chin and Dibbern [12] as well as Henseler et al. [31] mentioned that the non-parametric test is more appropriate for comparing PLS path coefficients.

This approach has the advantage that we can detect the effect of each partner type on a specific type of knowledge not only by the path coefficient but also by the $R^2$ of the knowledge type. We are also able to analyze the reverse model which consists of all types of exchange partners and only one type of knowledge for comparing the partners. However, this approach has the disadvantage that we will only get a $R^2$ for this one type of knowledge cumulated for all partners. Thus we cannot compare the effect of each partner type on the knowledge type by the $R^2$.

![Figure 2. Research approach](image)

4. Results

4.1. Validating the measurement model

Before estimating the structural model, the measurement model has to be analyzed regarding reliability and validity. For ensuring indicator
reliability, the loading of each item should be above .7 as recommended by Hulland [32]. 61 of the 64 loadings are higher than this threshold and all are highly significant. Two of the three remaining items missed the threshold but have loadings larger than .6 as it is suggested by Bogazzi and Yi [4]. Unfortunately one item (.555), measuring the strength of the structural linkage to communities/professional organizations, is below .6 and thus does not meet any threshold. However, to guarantee the comparability of the measurement of the structural dimension over all types of exchange partners we decide to leave this one item in the measurement model.

Table 3 shows the minimum loading of each item that has occurred in one of the five analyzed models.

For examining convergent validity, we used the composite reliability (CR) and the Average Variance Extracted (AVE). As recommended by Nunnally [51] the CR should be above .7 and the AVE above .5 [11]. Both requirements are fulfilled by all constructs. Table 1 shows the lowest CR and AVE for each construct in any one of the five models examined.

<table>
<thead>
<tr>
<th>Construct</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social capital (structural)</td>
<td>≥.848</td>
<td>≥.626</td>
</tr>
<tr>
<td>Social capital (relational)</td>
<td>≥.904</td>
<td>≥.758</td>
</tr>
<tr>
<td>Social capital (cognitive)</td>
<td>≥.812</td>
<td>≥.601</td>
</tr>
<tr>
<td>Market knowledge</td>
<td>≥.887</td>
<td>≥.664</td>
</tr>
<tr>
<td>Technological knowledge</td>
<td>≥.924</td>
<td>≥.753</td>
</tr>
<tr>
<td>Process knowledge</td>
<td>≥.828</td>
<td>≥.708</td>
</tr>
<tr>
<td>Product knowledge</td>
<td>≥.905</td>
<td>≥.756</td>
</tr>
<tr>
<td>Organizational knowledge</td>
<td>≥.827</td>
<td>≥.751</td>
</tr>
</tbody>
</table>

Furthermore, we tested for discriminant validity by comparing whether the square root of the AVE of each construct is greater than the inter-correlations with the other constructs. Additionally, we looked at the loadings of the items which should be higher than their correlation with any other construct. Both requirements are met by each construct in all examined models. Due to space restriction these results are not reported but can be provided from the authors upon request.

4.2. Analyzing the structural model

Figure 3 shows the results of the group comparisons of the different types of exchange partners regarding their importance for each type of knowledge which indicates that:

- All types of partners contribute to most of the different knowledge types and thus help to enhance the knowledge stock of a firm; the only exceptions are: friendship communities regarding organizational and technological knowledge as well as communities/professional organizations regarding product knowledge (weak or rather no significant path).
- Regarding market knowledge the customers are the most important partners (highest path coefficient .516***) and thus can add significantly more market knowledge than other exchange partners (all group comparisons are significant).
- In terms of product knowledge customers also contribute the most (highest path coefficient .309***) but they cannot set themself apart from other exchange partners (only weak significantly differentiation to communities/professional organizations). Furthermore, the range of the path coefficients is smaller compared to other knowledge types (.309*** to .205***; excluding communities/professional because of the marginal significance) so that we can conclude that all exchange partners are equally important for this type of knowledge.
- For organizational knowledge the most important exchange partner are R&D partners (path coefficient .439***) and customers (path coefficient .371***). Both contribute more to organizational knowledge than the other exchange partners (strongly significant different in terms of R&D partners and weakly significant different in terms of customers).
- Concerning process and technological knowledge the results show the same pattern, namely that customers play the most important role for both types of knowledge (highest path coefficient .516*** and .532***) followed by the R&D partner (path coefficient .357*** and .388***). Furthermore these two types of exchange partners are significantly different from other exchange partners (comparisons are strongly significant regarding customers and weak significant regarding R&D partners).

As mentioned in the previous section, this approach (model comprising one type of exchange partner and five knowledge types) has the advantage that we also can compare the effect of each exchange partner on each type of knowledge by comparing the R² of the knowledge type. Table 2 shows the importance of each partner ranked by the R². We find that the rank order of the partners is the same if ordered by path coefficients (compare Figure 3), thus, it perfectly supports the results above.

Furthermore, we estimated each of the five models (iterating the exchange partners while keeping the five knowledge types constant) based on the maximal sample size for each partner type in order to analyze whether the data containing missing values influences
the results (customer N=222, supplier N=213, friendship communities N=188, R&D partners N=210, and communities/professional organizations N=203). In this case, we are only able to detect the importance of exchange partners for each knowledge domain but we cannot compare partners among each other by group comparison since the sample sizes differ.

The only mentionable change regarding the priority of exchange partners is that suppliers become less important regarding every type of knowledge but organizational knowledge. In terms of market and process knowledge they even become the least important exchange partners whereas regarding product and technological knowledge they lose only one “ranking position”.

![Diagram showing the importance of each type of exchange partner for different types of knowledge ordered from left to right by path coefficient (in brackets) and significance of differences determined by using the non-parametric test by Henseler et al. [31]/ by using the parametric test by Keil et al. [37] (illustrated by arrows (***: p<.01, **: p<.05, *: p<.1) (Com. = communities, Prof. Org. = professional organization))

Figure 3. Importance of each type of exchange partner for different types of knowledge ordered from left to right by path coefficient (in brackets) and significance of differences determined by using the non-parametric test by Henseler et al. [31]/ by using the parametric test by Keil et al. [37] (illustrated by arrows (***: p<.01, **: p<.05, *: p<.1) (Com. = communities, Prof. Org. = professional organization))
Table 2. Importance of each type of exchange partner for different knowledge types ordered by $R^2$ (in brackets)

<table>
<thead>
<tr>
<th>Partner</th>
<th>Market (MK)</th>
<th>SU</th>
<th>FC</th>
<th>R&amp;D</th>
<th>CPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CU</td>
<td>1 (.20)</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>SU</td>
<td>1 (.10)</td>
<td></td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>FC</td>
<td>1 (.27)</td>
<td>3</td>
<td></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>1 (.28)</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>CPO</td>
<td>1 (.20)</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

CU /SU/ FC/ R&D/ CPO = Customer; Supplier; Friendship community; R&D partner; Communities/professional organizations

MK /PDK /OK /PCK /TK = Market /Product/ Organizational/ Process / Technological knowledge

5. Discussion and Conclusion

The objective of the study was to analyze the differential effects of various exchange partners which are typical for a firm’s network on the knowledge stock of a focal firm. According to literature on inter-organizational research and on knowledge transfer we distinguished not only between customers and suppliers but also include partners like communities/professional organizations and R&D partners as well as friendship communities. Furthermore we differentiate five types of knowledge which are characteristic for an organization namely market, product, organizational, process and technological knowledge and assume a positive but differential effect of each type of exchange partner on each knowledge type.

Before discussing the results of the study, we first specify the main limitation which should be considered when interpreting the results. We used a single person to capture both the dependent and independent variables which raises common method issues. For addressing this issue we developed the questionnaire appropriately and designed three different versions with varying order of questions. Furthermore, we used post-hoc statistical analyses. Additionally we applied the group comparisons approach because this approach is rather robust against common method bias. Another limitation is that we only include the exchange partners as knowledge sources and the resulting knowledge stock. Further research should consider organizational aspects as moderators that foster knowledge transfer like the usage of knowledge management systems or the amount of absorptive capacity of an organization. Also, including demographic differences within a firm’s network could be an aspect for explaining knowledge transfer.

Our analysis shows that customers are the most important external knowledge source of an organization for creating knowledge except for organizational knowledge. For market knowledge the positive effect of customers is most significant. Regarding the knowledge types of organizational, process, and technological knowledge not only customer matter but also R&D partners. Both types of exchange partners can contribute significantly more to these knowledge types than other partners.

Additionally, regarding product knowledge each exchange partner has a positive effect but no one is different from other types of partners. This implies that for creating or enhancing product knowledge each partner type is of same importance. One possible explanation could be that product knowledge focuses on knowledge about products of the focal firm. These products are known to external partners and interpreted under different perspectives such as use cases by customers and manner of application of material by suppliers. Thus knowledge about a firm’s product, interpreted under specific perspectives of exchange partners is fed back to the firm and increases its knowledge about its own products. However due to the different perspectives of various exchange partners this feedback of knowledge is complementary but might be of equal importance.

As an overall conclusion we can summarize that each type of exchange partner of a firm’s network is important for the knowledge stock of an organization. But partners differ in their impact on various types of knowledge. Thus, we contribute to prior research by demonstrating the hitherto unknown differential impact of various exchange partners on different types of knowledge. Accordingly, our results provide guidelines for organizations to invest systematically into its network of exchange partners depending on the knowledge type.

Table 3. Construct specifications and item loadings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicator</th>
<th>Loading</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Knowledge</td>
<td>Our product division’s knowledge of competitor strategies is very thorough.</td>
<td>&gt;.761</td>
<td>[3, 17]</td>
</tr>
<tr>
<td></td>
<td>Our product division’s knowledge of our customer is broad and complete.</td>
<td>&gt;.787</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our product division has thorough knowledge about emerging customers and their needs.</td>
<td>&gt;.743</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our knowledge of potential competitors’ strengths and weaknesses is very thorough.</td>
<td>&gt;.843</td>
<td></td>
</tr>
<tr>
<td>Knowledge Type</td>
<td>Description</td>
<td>Loading</td>
<td>References</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>Technological Knowledge</td>
<td>Our product division has very high knowledge about state-of-the-art technologies practices relevant for us.</td>
<td>&gt;.824</td>
<td>[21, 39, 45]</td>
</tr>
<tr>
<td></td>
<td>Our product division has very high knowledge about implementing new technologies.</td>
<td>&gt;.888</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our product division has the necessary skills to implement new acquired technological knowledge.</td>
<td>&gt;.869</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our product division has considerable competences in utilizing new technologies.</td>
<td>&gt;.784</td>
<td></td>
</tr>
<tr>
<td>Process Knowledge</td>
<td>Our product division has very high knowledge about the organization of efficient production process.</td>
<td>&gt;.837</td>
<td>[5, 25]</td>
</tr>
<tr>
<td></td>
<td>Our product division has very high competences in managing business processes.</td>
<td>&gt;.847</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our product division is very competent in the optimization of manufacture operations.</td>
<td>&gt;.814</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All relevant employees know the manufacture process in such a way, that they can effective contribute to their optimization.</td>
<td>&gt;.815</td>
<td></td>
</tr>
<tr>
<td>Product Knowledge</td>
<td>The coworkers of the product division know the product landscape of the company well.</td>
<td>&gt;.812</td>
<td>Own development</td>
</tr>
<tr>
<td></td>
<td>The coworkers of the product division know all relevant characteristic of all of our products.</td>
<td>&gt;.880</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The coworkers of the product division know exactly for which operational areas the products are appropriate.</td>
<td>&gt;.858</td>
<td></td>
</tr>
<tr>
<td>Organizational Knowledge</td>
<td>We have a great deal of knowledge about the optimization of the innovation process.</td>
<td>&gt;.852</td>
<td>[9, 17, 33, 58]</td>
</tr>
<tr>
<td></td>
<td>We know always exactly, whom we must ask and involve (externally, as internal), in order to exploit new technologies.</td>
<td>&gt;.838</td>
<td></td>
</tr>
<tr>
<td></td>
<td>We know exactly how to engage our coworkers active in the innovation process.</td>
<td>&gt;.891</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Usual methods for the management of innovation projects are comprehensively well known.</td>
<td>&gt;.820</td>
<td></td>
</tr>
<tr>
<td>Social capital #exchange partner# (structural)</td>
<td>The exchange with our most important #exchange partners# is very intensive.</td>
<td>&gt;.861</td>
<td>[14, 18, 24]</td>
</tr>
<tr>
<td></td>
<td>We exchange a lot of information with our most important #exchange partners#.</td>
<td>&gt;.845</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compared to the industry average we interact … frequently with our most important #exchange partner#. (Scale: “Considerably less”, “less”, “rather less”, “just as much”, “rather more”, “more”, “considerably more”)</td>
<td>&gt;.707</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[I and my most important private contacts have interacted … regarding business-related topics within the last three years. (Scale: “weekly”, “monthly”, “quarterly”, “biannually”, “annually”, “less frequently, “never”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social capital #exchange partner# (relational)</td>
<td>The chemistry between us and our most important #exchange partner# is right.</td>
<td>&gt;.848</td>
<td>[55, 60]</td>
</tr>
<tr>
<td></td>
<td>Our most important #exchange partner# is absolutely trustworthy.</td>
<td>&gt;.860</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The relationship to our most important #exchange partner# is characterized by mutual respect.</td>
<td>&gt;.874</td>
<td></td>
</tr>
<tr>
<td>Social capital #exchange partner# (cognitive)</td>
<td>We and our most important #exchange partner# always agree concerning innovative topics.</td>
<td>&gt;.727</td>
<td>[38]</td>
</tr>
<tr>
<td></td>
<td>The communication with our most important #exchange partner# about content wise topics is outstandingly.</td>
<td>&gt;.829</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our most important #exchange partner# and we always have a common language to deal with technical issues. (I and my most important private contacts tell similar anecdotes from daily business.)</td>
<td>&gt;.738</td>
<td></td>
</tr>
</tbody>
</table>

#exchange partner#: “customers”, “suppliers”, “R&D partners”, “communities/professional organizations”, “friendship communities”.

In case of “friendship communities” all statements were formulated in Singular instead of Plural (“I” instead of “We”). All items were originally in German and have been measured by a 7-Point-Likert-Scale, ranging from 1 (totally agree) to 7 (totally disagree) and were adopted and adapted to our research domain.

1) Items were developed based on concepts from Gosain et al. [25].

2) Items were developed based on concepts from Carmeli and Tishler [9] as well as from De Luca and Atuahene-Gima [17].

3) In case of suppliers, the loading was only .627. In case of communities/professional organizations, the loading was only .555 and did not meet the usual thresholds. Nevertheless, we left it to ensure maximally comparable measures across the different exchange partners.

4) In case of communities/professional organizations, the loading was only .608.
7. References