2013

Managing Acquired Knowledge from Different Network Partners: The Role of Knowledge Management Systems

Bernhard Moos
University of Bamberg, Bamberg, Germany, bernhard.moos@uni-bamberg.de

Managing Acquired Knowledge from Different Network Partners: The Role of Knowledge Management Systems

Bernhard Moos

University of Bamberg, Bamberg, Germany
bernhard.moos@uni-bamberg.de

Abstract. One key asset of a firm is its knowledge stock comprising different knowledge domains (e.g., market, technological knowledge, etc.). This stock results from firm internal and/or external resources such as exchange partners (e.g. customers and R&D partners). The paper focuses on external partners and explores for which knowledge domain the usage of knowledge management systems (KMS) regarding the management of acquired knowledge from them is beneficial or detrimental to the organization. Further, the importance of each type of partner for knowledge creation is demonstrated. Using data from 154 firms, the results show that (1) each type of partner contributes to most of the knowledge domains, (2) KMS facilitate the management of the knowledge stock of a firm excluding the domain of product knowledge, and (3) the usage of KMS for managing acquired knowledge has two faces depending on the type of knowledge and on the type of exchange partner.

Keywords: knowledge management systems, exchange partners, moderation analysis, knowledge creation, networks

1 Introduction

Knowledge has become a strategic resource for firms [2]. This study focuses on external partners (e.g. customers) as sources of knowledge and explores their influence on the creation of different types of knowledge (e.g. market knowledge) by using a social capital (SC) lens. SC 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" [54]. Knowledge is one of these resources that can be acquired via networks. Thus, SC at different levels of analysis has been found to affect knowledge acquisition and exploitation [70], knowledge transfer [64], as well as knowledge creation [52]. Hence, the different exchange partners can be seen as a "pool of knowledge" and SC allows a firm to access this resource pool, thereby facilitating the exchange and combination of knowledge [52].

Merely maintaining relationships to external exchange partners is insufficient unless the acquired knowledge is internalized [34]. To employ knowledge as a differentiating factor for competitive advantage, it is necessary to keep it up to date by reconfiguring it better, faster and more efficiently than direct competitors [3]. This task is

11th International Conference on Wirtschaftsinformatik,
27th February – 01st March 2013, Leipzig, Germany

facilitated by knowledge management and especially by knowledge management systems (KMS). Hence, KMS as a ”vehicle for the creation and transfer of knowledge” [64] have become a central resource of a firm [48]. Besides managing internal knowledge, KMS are of particular importance to capture knowledge from different partners covering multiple domains [5], [48] and to manage this external knowledge effectively [34].

Focusing on knowledge, researchers have identified various types of exchange partners [e.g., 45] and analyzed their influence on innovation [19]. Other studies investigated the effect of different knowledge domains [e.g., 51] or KMS [e.g., 43] on firm performance. Nevertheless, the question of how KMS affect the management of acquired knowledge, spanning different domains from various exchange partners, has not been analyzed so far. In particular, it is unclear how different types of exchange partners contribute to different types of knowledge and what the role KMS play in this respect. Accordingly, the following research question is formulated:

What is the differential impact of using KMS for managing different types of acquired knowledge from various types of exchange partners?

This research closes this gap by using an explorative data analysis connecting both aspects “external exchange partners” and “internal KMS usage for managing acquired knowledge”. Further, answering the research question is of great practical relevance. First, knowing which type of exchange partner affects which type of knowledge is essential for effective investments into a firm’s network from a knowledge management perspective. Second, knowing for which combination of knowledge domain and type of exchange partner KMS are especially effective is of great importance for the dedicated usage of such systems. Thus, my research extends previous work by investigating the role of KMS usage for managing acquired knowledge aiming at the creation, respectively enhancement of the internal knowledge stock of a firm. Thereby, the importance of each external exchange partner is scrutinized.

The paper starts with the development of the research model. Then the methodology is introduced followed by a presentation of the results. Finally, conclusions and limitations are discussed.

2 Research Model

The research model explores the impact of KMS usage by the focal firm for managing acquired knowledge comprising different domains from various types of exchange partners. Thereby, the influence of each exchange partner in terms of SC between the focal firm and the corresponding type of partner on the knowledge stock of a firm is explored. In the following sections the set of exchange partners, the set of knowledge types, the relations between them, and the influence of the usage of KMS are introduced. I do not formulate hypotheses for the effect of the usage of KMS on each combination of exchange partner and knowledge type (5 types of exchange partners x 5 types of knowledge = 25 hypotheses) nor for the influence of each exchange partner on each knowledge domain. Rather I stick to a more general rationale by describing why different exchange partners positively influence the knowledge stock and by

illustrating the positive role of KMS usage for managing the acquired knowledge from them. Hence, the model as visualized in Fig. 1 serves as a baseline model which allows exploring the differential relationships between the different types of exchange partner and knowledge domains as well as the role of KMS usage for managing acquired knowledge for each combination of partner and domain.

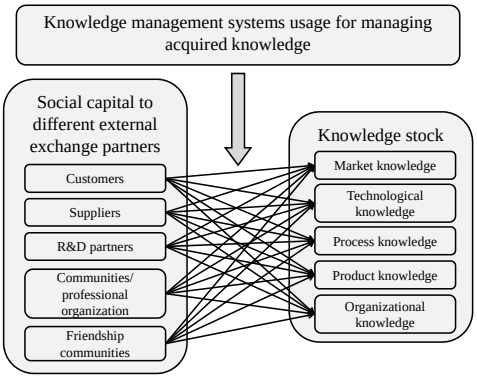

Fig. 1. Research Model

2.1 Knowledge Stock

As described in Moos et al. [53] the knowledge stock of a firm represents the level of knowledge assets of an organization [33] and comprises different domains. Literature on inter-organizational cooperation emphasizes many categories of knowledge predominantly highlighting market and technological knowledge [e.g., 51]. Market knowledge is externally oriented and comprises knowledge about an organization's external environment in terms of actual and potential future markets a firm is engaged in. It is also knowledge about industry information [67] and different partners [55]. Technological knowledge refers mostly to the technological competence of a firm [41] and to the ability to recognize new technologies [5]. Examples of this domain are IT knowledge [60] and state-of-the-art technical practices [50]. Beside these two types, knowledge about managing and designing a firm's internal processes (process knowledge) [8] as well as knowledge about the organizational form and functions or about strategic and sourcing topics (organizational knowledge) [37] might be important. Before the survey started, 18 case studies with CEOs or business unit managers of manufacturing firms ranked as very innovative in their industries according to sales volume of new products in relation to total sales were carried out. These studies demonstrated the importance of knowledge about how well the product landscape is known by a firm's employees which constitutes the last domain (product knowledge).

2.2 Exchange Partners and the Role of Social Capital (SC)

Several types of exchange partners were identified based on literature on inter-organizational cooperation and especially on knowledge transfer. The set of partners com-

prises: Customers and suppliers [e.g., 14], R&D partners, communities/professional organizations [46], and the friendship communities [e.g., 38] of the survey respondent in terms of private contacts. R&D partners cover R&D service providers (e.g., engineering companies) [e.g., 45] and public research institutions (e.g., universities) [e.g., 14]. Communities/professional organizations comprise industry associations and related working groups including firms within [19] and without the firm group.

As argued in Moos et al. [53] a firm will raise its knowledge stock by maintaining active relationships to these exchange partners and interacting with them. Thus, each exchange partner functions as an external knowledge source. Since I focus on these relationships, SC theory is applied by investigating the contribution of SC to each of the exchange partners on knowledge creation [54]. SC theory has been chosen because SC "directly affects the combine-and-exchange process and provides relatively easy access to network resources" [52] and because it "inheres in the structure of relations between actors and among actors" [18], and thus resides in relationships. According to Nahapiet and Ghoshal [54] SC consists of three dimensions. As already discussed in Moos et al. [53] each dimension influences the formation of the organizational knowledge stock for the following reasons.

The *structural dimension* focuses on ties between actors and their strength characterized by frequency of interaction. Strong ties enhance knowledge and information flow [31]. Further, for raising different domains of knowledge, strong ties to diverse types of exchange partners are important [10]. Hence, the structural dimension increases the access to knowledge [71] by providing communication channels for exchanging knowledge [51]. The *relational dimension* concentrates on the nature of ties in terms of mutual respect and trust based upon the development of relationships over time [30] and enhances the efficiency and effectiveness of knowledge exchange [47]. First, trusted relationships improve the willingness to exchange knowledge because both exchange partners engaged in the relationship trust in each other to handle the exchanged knowledge carefully [51]. Second, the relational dimension guides actions through the creation of mental maps [e.g., 9]. These maps simplify the knowledge exchange process and further foster the subsequent application of the exchanged knowledge in terms of reducing time for verification [51]. Finally, the *cognitive dimension* deals with shared vocabulary, shared narratives and interpretations [32] and increases the knowledge exchange by creating a greater understanding through common languages and symbols [25] and by a common frame of reference [56] in which knowledge can be integrated [32]. Additionally, the reach and richness of exchanged knowledge increases by establishing perspective-sharing and sense-making [62].

After all, each dimension of SC fosters the knowledge exchange between a focal firm and its various partners. Consequently, each partner positively impacts the creation of the focal firm´s knowledge stock since the firm acquires knowledge from.

2.3 The Moderating Role of KMS Usage for Managing Acquired Knowledge

Besides having different types of partners as knowledge sources it is necessary to maintain the consistency and integrity of the knowledge stock [65] to ensure that the knowledge is state-of-the-art at any time [5]. A firm "requires a well-planned system

of knowledge management that enables the firm to excel in technological, market and administrative knowledge creation" [59] Thus, the usage of KMS is of central importance. Adopting Pavlou and El Sawy's [57] understanding, KMS can be defined as an "IT-based system[s] developed to support and enhance the organizational processes of knowledge creation, storage/ retrieval, transfer, and application" [2].

A KMS facilitates the creation of knowledge directories by storing useful knowledge [57] acquired from multiple sources such as external exchange partners, and allows updating or even deleting the knowledge in an effective way [5]. KMS further offers effective mechanisms for information retrieval which makes it easier for knowledge consumers within a firm to identify and find the knowledge of interest [5]. Thereby, KMS supports the connection of different pieces of knowledge by, e.g., checking newly acquired knowledge against already existing, and hence contributes to a more comprehensive understanding of acquired knowledge. Also KMS provides a channel for collaboration and communication between knowledge producers and seekers in a firm [57] and thus support the knowledge distribution [5] of newly acquired knowledge. The application of knowledge is supported by the usage of KMS in terms of simplifying and speeding up the access to knowledge [27]. Altogether, the use of KMS has a positive effect for managing acquired knowledge by building and administering the knowledge stock, including structuring newly acquired knowledge.

3 Methodology

3.1 Data Collection

The data stems from a survey among the 2,500 largest firms of the German manufacturing industry (Standard-Industrial-Classification codes 3011-3999 and revenues of 2007). This industry was chosen because it consists of a large degree of high-tech firms which are characterized by a huge stock of knowledge and by using KMS. Thus, this industry is appropriate for detecting knowledge acquisition from their environment and for effects through the usage of KMS. To avoid aggregation problems on a firm level I focused on the most important product division. The previously mentioned case studies have shown that "most important" is commonly understood as "largest" rather than "most successful" division. These studies indicated that the manager in charge of this division is totally familiar with the relationship to each exchange partner because s/he is responsible for the daily business and therefore stays in contact with the partners of the division. Further, this person has the necessary overview to evaluate the level of existing knowledge for each domain. According to the preference of the identified person the questionnaires were sent by mail (1575 times), fax (4 times), or email (581 times), respectively. Four weeks after the initial dispatch a reminder was delivered if the person had not answered. After another two weeks the person has been called a second time and a second reminder was sent out.

154 of 229 received questionnaires could be used for analysis because they showed no missing data regarding the measurement items. If a participant did not maintain a relationship to a specific type of partner s/he skipped this section of the survey, e.g.,

most of the respondents stated to have no friendship community with which they share business related topics. So not every participant has a relationship to all types of partners which explains the difference between used and received questionnaires.

Non-response bias was examined in two ways. First, early and late respondents were compared. Early respondent corresponds to respondents which answered after the initial dispatch, whereas late respondents are respondents which replied after having received the reminder questionnaire and/or call. The assumption of this method is that the latter ones share similarities with those organizations which have not participated in the survey [4]. Second, I compared the demographic data at organizational level in terms of revenue and number of employees of the respondents with those who were in the original sample but had not answered. In both cases the Mann-Whitney test as a non-parametric test for group comparisons was applied, showing no differences between the corresponding groups, indicating the absence of non-response bias.

3.2 Measurement

After reviewing literature on both SC theory and knowledge transfer a project team of four researchers developed the questionnaire by extracting measurement instruments from 97 journal articles. This resulted in a reflective measurement model consisting of 3 to 4 items for each construct. Each dimension of SC was measured by three items which together indicates the overall SC related to each exchange partner. Table 1 lists all the items and gives the references. The questionnaire was pre-tested independently with eight firms to ensure the understandability of the items and the comprehensiveness of the constructs. Furthermore, we applied the card sorting approach with a couple of managers and research colleagues for the five knowledge domains to gain a higher convergent validity. Based on the feedback, two items were modified regarding the wording and one item was deleted. Finally, six more pre-tests have been conducted resulting in no further changes.

As control variables I included firm size (log of number of employees). Further, environmental turbulence was measured by three items from De Luca and Atuahene-Gima [20] and Jaworski and Kohli [39] regarding the rapidness and predictability of technological changes and customer needs. Finally, the strategy type of the organization was captured by using an item from Droge et al. [22], with a scale ranging from “focusing on the optimization of processes” to “focusing on innovation leadership”.

3.3 Analysis

For analyzing the data and exploring the influence of the usage of KMS for managing acquired knowledge for each combination of knowledge type and type of exchange partner, the product-term-approach was used by running hierarchical multiple linear regressions which is the most preferred method for examining moderation effects [24]. Social capital to an exchange partner represents the independent, respectively the predictor variable, the usage of KMS represents the moderator and the product of these two represents the interaction term indicating the moderation effect whereas a type of knowledge denotes the dependent variable (cf. equation 1).

As five different types of knowledge and exchange partners are distinguished, 25 multiple linear regressions were executed. In a first step all items according to a latent variable were aggregated by calculating the mean. Regarding the social capital dimensions the mean was calculated over all items of the three dimensions to each exchange partner, which results in one value indicating the quality of the corresponding relationship. Since the independent and the moderator variable are measured on the same scale these two variables were standardized [15] to avoid computational errors because the correlation between these variables and the interaction term decreases and thus the problem of multicollinearity among them is reduced [24]. Furthermore, it allows an easier interpretation of the results [15] especially for the effect of the independent and moderator variable [24]. Finally, the interaction term was calculated as the product of the standardized independent and moderator variable [24].

In the first step of the hierarchical regression analyses only the control variables are included (x_1 = log of numbers of employees, x_2 = environmental turbulence, x_3 = strategy type). Then the predictor x_4 (standardized social capital to an exchange partner), the moderator x_5 (standardized usage of KMS) and the interaction term x_6 (x_4*x_5) are included stepwise. The corresponding regression coefficients are represented by b to g. To ensure maximum comparability of the coefficients over the 25 regressions each was calculated on the same sample of 154 questionnaires.

$$\text{Type of knowledge} = a + b * x1 + c * x2 + d * x3 + e * x4 + f * x5 + g * x6 \quad (1)$$

4 Results

4.1 Validating the Measurement Model

For each latent variable the items were aggregated to a single score by calculating the mean. To underline the quality of the measurement model, indicator reliability was checked by applying confirmatory factor analysis (CFA) (principal component analysis). Since the items were derived from literature CFA was applied instead of an explanatory factor analysis for each dimension of social capital to each exchange partner, the types of knowledge, and for the usage of KMS. This is done because low reliability of the independent and/or the moderator variable decreases the reliability of the interaction term and thereby the power of the moderation test [24]. 63 of the 67 items showed loadings higher than .7 [36]. Four missed this threshold but have loadings above .6 [7] indicating sufficient indicator reliability (cf. Table 1).

4.2 Role of KMS Usage and Importance of Exchange Partner

Table 2 presents the results of the final step of the linear regressions by listing the unstandardized regression coefficients [24] of the relationships between the type of exchange partner and the knowledge domains (e), between the usage of KMS and the knowledge domains (f), and the coefficients of the moderating effect (g) in terms of the usage of KMS for managing acquired knowledge (compare equation 1). The re-

gression coefficients of the control variables (not reported) indicates a positive impact of firm size on organizational and technological knowledge. All other control variables do not show a clear pattern regarding the different knowledge domains.

Table 1. Construct Specifications and Item Loadings in Brackets

Market Knowledge (source: [6, 20])
Our product division's knowledge of competitor strategies is very thorough. (.804)
Our product division's knowledge of our customer is broad and complete. (.805)
Our product division has thorough knowledge about emerging customers and their needs. (.781)
Our knowledge of potential competitors' strengths and weaknesses is very thorough. (.878)
Technological Knowledge (source: [26, 41, 50])
Our product division has very high knowledge about state-of-the-art technologies practices relevant for us. (.820)
Our product division has very high knowledge about implementing new technologies. (.924)
Our product division has the necessary skills to implement new acquired technological knowledge. (.897)
Our product division has considerable competences in utilizing new technologies. (.877)
Process Knowledge (source: [8, 29])
Our product division has very high knowledge about the organization of efficient production process. (.852)
Our product division has very high competences in managing business processes. (.837)
Our product division is very competent in the optimization of manufacture operations. (.872)
All relevant employees know the manufacture process in such a way, that they can effective contribute to their optimization. (.825)
Product Knowledge (sources: own development)
The coworkers of the product division know the product landscape of the company well. (.861)
The coworkers of the product division know all relevant characteristic of all of our products. (.886)
The coworkers of the product division know exactly for which operational areas the products are appropriate. (.873)
Organizational Knowledge (sources:[12, 20, 37, 66])
We have a great deal of knowledge about the optimization of the innovation process. (.877)
We know always exactly, whom we must ask and involve (externally, as internal), in order to exploit new technologies. (.836)
We know exactly how to engage our coworkers active in the innovation process. (.898)
Usual methods for the management of innovation projects are comprehensively well known. (.876)
KMS usage (sources: [11, 42, 57])
Our firm uses a knowledge management system for archiving and reusing of knowledge. (.734)
All product divisions use a common knowledge managements system. (.896)
Our IT infrastructure supports an effective information exchange significantly. (.833)
Social capital #exchange partner# (structural) (sources: [16, 23, 28])
The exchange with our most important #exchange partners# is very intensive. (>.870)
We exchange a lot of information with our most important #exchange partners#. (>.847)
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") [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")] (>.739[1)])
Social capital #exchange partner# (relational) (sources: [63, 68])
The chemistry between us and our most important #exchange partner# is right. (>.874)
Our most important #exchange partner# is absolutely trustworthy. (>.877)
The relationship to our most important #exchange partner# is characterized by mutual respect. (>.874)
Social capital #exchange partner# (cognitive) (source: [41])
We and our most important #exchange partner# always agree concerning innovative topics. (>.745)
The communication with our most important #exchange partner# about content wise topics is outstandingly. (>.811)
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.) (>.726[2)])
#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"). Items were originally in German and have been measured by a 7-Point-Likert-Scale (totally agree to totally disagree) [1)] In case of customers, the loading was only 681. In case suppliers, the loading was only .666. In case of communities/professional organizations, the loading was only .603 [2)] In case of communities/professional organizations, the loading was only .649.

According to Carte and Russel [13] the delta of R2 in terms of the effect size (f2) is applied for interpreting the moderation's effect size instead of the regression coefficients (g). For interpreting the regression coefficients (e) and (f) it has to be considered that these two represent "conditional" rather than "main" effects [24]. Since these two variables are standardized, the effect of the independent variable indicates the effect of this variable at the average level of the predictor variable and vice versa [24]. Because the focus of this study is on exploring the effect of KMS usage for managing

acquired knowledge, only the direction, the ratio between as well as the level of significance are interpreted for these two coefficients but not their absolute amount [13].

In order to check for the degree of multicollinearity among the latent variables, the variance inflation factor (VIF) was calculated. For each regression analysis the VIF of each latent variable is below 3.33 [21] indicating the absence of multicollinearity.

Table 2. Results of the Linear Regressions: (e)/(f)/(g) = Coefficient of the Exchange Partner / Usage of KMS / Interaction Term (compare equation 1); (f^2) = Effect Size of the Interaction Term (>.35=strong, >.15=medium, >.02=weak) [17] (^{x}: p<=.01; $^+$: p<=.05; *: p<=.1)

Type of know.	Customer				Supplier				R&D Partner			
	e	f	g	f^2	e	f	g	f^2	e	f	g	f^2
Market	.412^x	.159$^+$	.027	.001	.245^x	.254^x	.011	.000	.229^x	.253^x	.008	.000
Organizational	.320^x	.311^x	.018	.000	.280^x	.387^x	-.064	.005	.483^x	.385^x	-.124	.017
Product	.297^x	.048	.026	.001	.302^x	.116	-.004	.000	.256^x	.113	.033	.001
Process	.507^x	.135*	.009	.000	.268^x	.249^x	.010	.000	.368^x	.258^x	-.206^x	.050
Technological	.457^x	.119*	-.146$^+$	.038	.229^x	.206^x	-.010	.000	.371^x	.207^x	-.112*	.018

	Communities				Friendship Com.			
	e	f	g	f^2	e	f	G	f^2
Market	.216$^+$	.227^x	.119	.013	.200$^+$	.246^x	.009	.000
Organizational	.275^x	.347^x	.130	.013	.128	.381^x	.137	.016
Product	.132	.098	.012	.000	.256^x	.105	.060	.003
Process	.189$^+$	.229^x	.162*	.023	.206$^+$	.242^x	.128	.016
Technological	.223^x	.174$^+$	.070	.005	.168$^+$	.200^x	.124*	.019

Looking at the influence of exchange partners on the knowledge stock of a firm, I can conclude that all types of partners enhance the knowledge stock regarding all types of knowledge, excluding communities/professional organizations regarding product and friendship communities regarding organizational knowledge. Communities sometimes comprise competitors which hinders the exchange about products. Since organizational knowledge focuses on the innovation process which is quite unique for each firm it is difficult to share knowledge within the private environment.

The usage of a KMS is significantly positively related to the management of the knowledge stock of a firm, excluding the domain of product knowledge. Product knowledge comprises mostly knowledge about products of the competitors as well as about problems regarding the handling. Further, this kind of knowledge is predominantly not documented by using "classical" KMS rather it is documented by running CRM databases or by ERP systems in terms of the complaint management.

For managing acquired process knowledge from R&D partners as well as for technological knowledge from customers, the usage of a KMS shows a significant negative effect (f^2 are above .02). Further, for managing organizational and technological knowledge from R&D partners the usage of KMS seems to be obstructive (f^2 are nearby .02). In contrast the usage of KMS is beneficial for managing acquired market, organizational, and process knowledge from communities as well as for the management of organizational, process, and technological knowledge from friendship communities (f^2 are above or nearby .02). Regarding process knowledge acquired from communities the positive effect is even significant. In most of the other cases the usage of a KMS supports the management of acquired knowledge from external partners whereas this effect is not significant (f^2 are below .02) (e.g., customer and product knowledge) or the usage of KMS does not seem to matter for the management of acquired knowledge (f^2 is zero) (e.g., suppliers regarding market knowledge).

4.3 Validity of the Results

Capturing the dependent, independent, and the moderator variable from only a single respondent raises common method issues. For testing the presence of common method bias (CMB) two different approaches by Podsakoff et al. [58] and Lindell and Whitney [49] were applied. *First*, the dataset was analyzed regarding the existence of a single component which accounts for the major proportion of the variance by conducting the Harman single-factor test [58]. The largest identified component within the model accounts for 37.5% of the variance indicating that a single factor accounting for the majority of the variables' variance does not exist. *Second*, theoretical unrelated marker variables [49] were included in the questionnaire. By calculating the mean of these variables a marker construct was built which was added in a further step to the hierarchical regression analyses. Running the 25 regressions again including the marker construct it can be scrutinized in detail whether CMB is a problem in the data [61]. The regression coefficients of the marker construct (not reported) demonstrated that only the domain of product knowledge is affected. Comparing the results of the regressions including the marker construct with the results given in Table 2 no fundamental structural differences in terms of regression coefficient's strength and significance were identified underlining the validity of the results.

5 Discussion and Conclusion

The objective of the paper was to explore the differential effect of the usage of KMS at the firm level for managing acquired knowledge comprising different domains from various exchange partners for knowledge creation, respectively enhancement.

Before discussing results, limitations of this study should be forwarded to allow interpretation of results while considering these limitations. First, the data stems only from a single industry limiting the generalizability. It would be interesting to verify the results within another setting, especially within the service sector. Second, knowledge acquisition from external partner was only scrutinized form the perspective of SC. Further research should consider demographic differences within a firm's network or the similarity between the exchanging organizations, e.g., in terms of their structures [44]. Also other organizational aspects that foster knowledge acquisition like the amount of absorptive capacity [71] should be taken into account. Third, for the management of acquired knowledge, only the usage of KMS is included as a moderator. Further research should also explore other knowledge management influence factors [see e.g. 35] and knowledge-processing activities within an organization as moderators for the management of acquired knowledge like, e.g., systems, coordination, and socialization capabilities as they are distinguished by van den Bosch et al. [69]. Additionally, other IT systems like project and resource management as well as cooperative work systems [57] should be considered beside KMS.

Results show that for managing acquired knowledge from external partners the usage of KMS has two faces. On the one hand, in most cases the usage of KMS indicates a positive effect which is not significant. At this point it has to be mentioned that it is difficult to detect moderation effects when using continuous moderator and inde-

pendent variables since the power of moderation analysis is particularly low [24]. Even if the requirement of reliability, as illustrated before, is fulfilled, effect sizes for moderations are generally small [24]. Furthermore, the median effect size (f^2) for categorical moderators is .002 [1]. On this basis, Kenny [40] postulates values of .005, .01, and .025 for small, medium, and large moderation effects instead of 02, .15, .35 as by Cohen [17]. Taking both aspects into account the latter thresholds have to be relativized. Under these circumstances the usage of KMS seems to be quite relevant for managing acquired knowledge from communities regarding market, organizational, and process knowledge as well as for the management of acquired organizational, process, and technological knowledge from friendship communities. Beside competitors as mentioned before, communities comprise mostly organizations which are very similar regarding their processes and organizational routines executed and which are often operating in the same markets. Hence, the management of acquired knowledge from them is simplified. The same accounts for managing acquired knowledge from friendship communities because of the overlapping interests among the members.

On the other hand, the usage of KMS for managing acquired organizational and process knowledge from R&D partners is not appropriate. Further, for acquired technological knowledge from customers and R&D partners the usage of KMS for management shows a negative effect. One possible explanation is that the acquired knowledge from R&D partners is highly specific and as the case may be tacit. This type of partner is predominantly contacted by an organization to solve specific problems of individual production process. Therefore, the documentation of this knowledge is very difficult. Organizational knowledge focuses on the unique and complex innovation process of a firm. Hence, R&D partners can contribute a lot whereas the usage of KMS for documenting the acquired knowledge is problematic due to the complexity and specificity of this knowledge. In this case a commonly used KMS of a firm does not possess the necessary function as it would be the case by using customized KMS for the R&D unit of an organization since R&D partners predominantly stay in contact only with this unit. Furthermore, joint development projects with R&D partners are often practiced, especially for experimental learning. Thus, a lot of knowledge can be transferred including technological knowledge which is tacit to a great extent. The negative effect of the usage of KMS for managing acquired technological knowledge from customers could be explained as follows. Customers are occasionally contacted for idea generation and pilot-testing. Hence, the acquired knowledge including technological aspects deals predominantly with issues regarding the products. Hence, as mentioned before, commonly used KMS seem to be inappropriate as this knowledge remains predominantly within the R&D unit. At this point further research is required to analyze the role of KMS for knowledge acquisition from R&D partners and customers in depth.

As an overall conclusion it can be summarized that a firm's partner network is an important contributor for building or enhancing the knowledge stock. Additionally, for the management of this knowledge stock the usage of KMS plays a significant role whereas the application of such systems for managing acquired knowledge shows some limitations. From a research perspective this study extends previous works by differentiating various exchange partners regarding their effect on different

knowledge domains and the influence of KMS usage. From a practical perspective the results provide guidelines for organizations to invest systematically into their network of exchange partners and into the usage of KMS. Table 3 summarizes the guidelines by building a priority queue over the different external partners according to their impact on the corresponding knowledge domain. Additionally, it is indicated for which combination of external partner and knowledge domain the usage of KMS for managing acquired knowledge is beneficially or detrimentally.

Table 3. Practical Implications

Type of know.	**Priority queue over external partners regarding their effect (bold=significant) on each knowledge domain ([] = partner are of same importance) including the effect of the usage of KMS for each combination in round brackets (o/+/- = no/positive/negative)**
Market	**Customers**(o) >> [**Suppliers**(o); **R&D Partners**(o); **Com**.(+); **Friendship Com**. (o)]
Organiz.	**R&D Partners**(-) >> **Customers**(o) >> [**Com**.(+); **Suppliers**(+)] >> Friendship Com.(+)
Product	[**Customers**(o); **Suppliers**(o)] >> [**R&D Partners**(o); **Friendship Com**.(o)] >> Com. (+)
Process	**Customer**(o) >> **R&D Partners(-)** >> **Suppliers**(o) >> [**Friendship Com**.(+); **Com**.(+)]
Technol.	**Customers(-)** >> **R&D Partners**(-) >> [**Suppliers**(o); **Com**.(+)] >> **Friendship Com**.(+)

References

1. Aguinis, H., Beaty, J.C., Boik, R.J., Pierce, C.A.: Effect Size and Power in Assessing Moderating Effects of Categorical Variables Using Multiple Regression: A 30-Year Review. Journal of Applied Psychology 90, 94-107 (2005)
2. Alavi, M., Leidner, D.E.: Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. MIS Quarterly 25, 107-136 (2001)
3. Almahamid, S., Awwad, A., McAdams, A.C.: Effects of Organizational Agility and Knowledge Sharing on Competitive Advantage: An Empirical Study in Jordan. International Journal of Management 27, 387-404 (2010)
4. Armstrong, J.S., Overton, T.S.: Estimating Nonresponse Bias in Mail Surveys. Journal of Marketing Research 14, 396-402 (1977)
5. Ashrafi, N., Xu, P., Kuilboer, J.P., Koehler, W.: Boosting Enterprise Agility via IT Knowledge Management Capabilities. In: 39th Hawaii International Conference on System Sciences (HICSS), pp. 1-9. IEEE (2006)
6. Atuahene-Gima, K.: Resolving the Capability - Rigidity Paradox in New Product Innovation. Journal of Marketing 69, 61-83 (2005)
7. Bagozzi, R.P., Yi, Y.: On the evaluation of structural equation models. Journal of the Academy of Marketing Science 16, 74-94 (1988)
8. Bassellier, G., Benbasat, I.: Business competence of information technology professionals: conceptual development and influence on IT-business partnerships. MIS Quarterly 28, 6733-6694 (2004)
9. Bhatt, G.D., Grover, V.: Types of Information Technology Capabilities and Their Role in Competitive Advantage: An Empirical Study. Journal of Management Information Systems 22, 253-277 (2005)
10. Burt, R.S.: Structural Holes: The Social Structure of Competition. Harvard University Press, Cambridge (Mass.), London (1992)

11. Byrd, T.A., Turner, D.E.: An exploratory examination of the relationship between flexible IT infrastructure and competitive advantage. Information & Management 39, 41-52 (2001)
12. Carmeli, A., Tishler, A.: The Relationships between Intangible Organizational Elements and Organizational Performance. Strategic Management Journal 25, 1257-1278 (2004)
13. Carte, T.A., Russell, C.J.: In Pursuit of Moderation: Nine Common Errors and Their Solutions. MIS Quarterly 27, 479-501 (2003)
14. Chen, Y.-S., Lin, M.-J.J., Chang, C.-H.: The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. Industrial Marketing Management 38, 152-158 (2009)
15. Chin, W.W., Marcolin, B.L., Newstead, P.R.: A Partial Least Squares Latent Variable Modeling for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study. Inf. Sys. Research 14, 189-217 (2003)
16. 16. Chung, S.H., Rainer, R.K., Lewis, B.R.: The impact of information technology infrastructure flexibility on strategic alignment and applications implementation. Communications of the AIS 11, 191-206 (2003)
17. Cohen, J.: Statistical power analysis for the behavioral sciences. Erlbaum, Hillsdale (1988)
18. Coleman, J.S.: Social Capital in the Creation of Human Capital. American Journal of Sociology 94, S95-S120 (1988)
19. de Faria, P., Lima, F., Santos, R.: Cooperation in innovation activities: The importance of partners. Research Policy 39, 1082-1092 (2010)
20. De Luca, L.M., Atuahene-Gima, K.: Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance. Journal of Marketing 71, 95-112 (2007)
21. Diamantopoulos, A., Siguaw, J.A.: Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. British Journal of Management 17, 263-282 (2006)
22. Droge, C., Calantone, R.J., Harmancioglu, N.: New Product Success: Is It Really Controllable by Managers in Highly Turbulent Environments? Journal of Product Innovation Management 25, 272-286 (2008)
23. 23. Fang, E.: Customer Participation and the Trade-Off between New Product Innovativeness and Speed to Market. Journal of Marketing 72, 90-104 (2008)
24. Frazier, P.A., Tix, A.P., Barron, K.E.: Testing Moderator and Mediator Effects in Counseling Psychology Research. Journal of Counseling Psychology 51, 115-134 (2004)
25. Galunic, D.C., Rodan, S.: Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation. Str. Man. Journal 19, 1193-1201 (1998)
26. Garcia-Morales, V.J., Ruiz-Moreno, A., Llorens-Montes, F.J.: Effects of Technology Absorptive Capacity and Technology Proactivity on Organizational Learning, Innovation and Performance: An Empirical Examination. Tech. Ana. & Str. Man. 19, 527-558 (2007)
27. Gold, A.H., Malhotra, A., Segars, A.H.: Knowledge Management: An Organizational Capabilities Perspective. Journal of Management Information Systems 18, 185-214 (2001)
28. Goles, T., Chin, W.W.: Information systems outsourcing relationship factors: detailed conceptualization and initial evidence. The DATA BASE for Advances in Information Systems 36, 47-67 (2005)
29. Gosain, S., Malhotra, A., El Sawy, O.A.: Coordinating for flexibility in e-business supply chains. Journal of Management Information Systems 21, 7-45 (2004)
30. Granovetter, M.: Economic Action and Social Structure: The Problem of Embeddedness. The American Journal of Sociology 91, 481-510 (1985)
31. Granovetter, M.: The Strength of Weak Ties. The American Journal of Sociology 78, 1360-1380 (1973)

32. Grant, R.M.: Prospering in Dynamically-competitive Environments: Organizational Capability as Knowledge Integration. Organization Science 7, 375-387 (1996)
33. Haas, M.R., Hansen, M.T.: When Using Knowledge can hurt Performance: The Value of Organizational Capabilities in a Management Consulting Company. Strategic Management Journal 26, 1-24 (2005)
34. Hao, J.-X., Yan Yu, A., Dong, X.-Y.: Bridging the role of Absorptive Capacity on Knowledge Management Systems Success. In: Pacific Asia Conf. on Inf. Sys. (2011)
35. Holsapple, C.W., Joshi, K.D.: An investigation of factors that influence the management of knowledge in organizations. The Journal of Stra. Inf. Sys. 9, 235-261 (2000)
36. Hulland, J.: Use of Partial Least Squares (PLS) in strategic management research. A review of four recent studies. Strategic Management Journal 20, 195-204 (1999)
37. Hult, G.T.M., Ketchen, D.J., Arrfelt, M.: Strategic supply chain management: Improving performance through a culture of competitiveness and knowledge development. Strategic Management Journal 28, 1035-1052 (2007)
38. Jansen, J.J.P., Van Den Bosch, F.A.J., Volberda, H.W.: Managing Potential And Realized Absorptive Capacity: How Do Organizational Antecedents Matter? Academy of Management Journal 48, 999-1015 (2005)
39. Jaworski, B.J., Kohli, A.K.: Market orientation: Antecedents and consequences. Journal of Marketing 57, 53 (1993)
40. Kenny, D.A., http://www.davidakenny.net/cm/moderation.htm
41. Ko, D.-G., Kirsch, L.J., King, W.R.: Antecedents of Knowledge Transfer from Consultants to Clients in Enterprise System Implementations. MIS Quarterly 29, 59-85 (2005)
42. Kulkarni, U.R., Ravindran, S., Freeze, R.: A Knowledge Management Success Model: Theoretical Development and Empirical Validation. Journal of Management Information Systems 23, 309-347 (2006)
43. Kuoching, F., Chen, E.T., Wenching, L.: Implementation of Knowledge Management Systems and Firm Performance: An Empirical Investigation. Journal of Computer Information Systems 45, 92-104 (2004)
44. Lane, P.J., Lubatkin, M.: Relative Absorptive Capacity and Interorganizational Learning. Strategic Management Journal 19, 461-477 (1998)
45. Laursen, K., Salter, A.: Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. Str. Man. Journal 27, 809-825 (2006)
46. Lesser, E.L., Fontaine, M.A., Slusher, J.A.: Knowledge and Communities. Butterworth-Heinemann, Oxford (2000)
47. Levin, D.Z., Cross, R.: The Strenght of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer. Management Science 50, 1477-1490 (2004)
48. Liao, S.-h., Wu, C.-c., Hu, D.-c., Tsui, K.-a.: Relationships between knowledge acquisition, absorptive capacity and innovation capability: an empirical study on Taiwan's financial and manufacturing industries. Journal of Information Science 36, 19-35 (2010)
49. Lindell, M.K., Whitney, D.J.: Accounting for Common Method Variance in Cross-Sectional Research Designs. Journal of Applied Psychology 86, 114-121 (2001)
50. Matusik, S.F., Heeley, M.B.: Absorptive Capacity in the Software Industry: Identifying Dimensions That Affect Knowledge and Knowledge Creation Activities. Journal of Management 31, 549-572 (2005)
51. Maurer, I., Bartsch, V., Ebers, M.: The Value of Intra-organizational Social Capital: How it Fosters Knowledge Transfer, Innovation Performance, and Growth. Organization Studies 32, 157-185 (2011)

52. McFadyen, M.A., Cannella, A.A.: Social Capital and Knowledge Creation: Diminishing Returns of the Number and Strength of Exchange Relationships. Academy of Management Journal 47, 735-746 (2004)
53. Moos, B., Wagner, H.-T., Beimborn, D., Weitzel, T.: Whom to ask for what knowledge? A comparison of exchange partners and their impact on knowledge types. In: 45th Hawaii International Conference on System Sciences (HICSS) (2012)
54. Nahapiet, J., Ghoshal, S.: Social Capital, Intellectual Capital, and the Organizational Advantage. Academy of Management Review 23, 242-266 (1998)
55. Nakayama, M.: An assessment of EDI use and other channel communications on trading behavior and trading partner knowledge. Information & Management 41, 563-580 (2003)
56. Nelson, K.M., Cooprider, J.G.: The Contribution of Shared Knowledge to IS Group Performance. MIS Quarterly 20, 409-432 (1996)
57. Pavlou, P.A., El Sawy, O.A.: From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development. Information Systems Research 17, 198-227 (2006)
58. Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P.: Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. Journal of Applied Psychology 88, 879-903 (2003)
59. Popadiuk, S., Choo, C.W.: Innovation and knowledge creation: How are these concepts related? International Journal of Information Management 26, 302-312 (2006)
60. Reich, B.H., Kaarst-Brown, M.L.: Creating social and intellectual capital through IT career transitions. Journal of Strategic Information Systems 12, 91-109 (2003)
61. Richardson, H.A., Simmering, M.J., Sturman, M.C.: A Tale of Three Perspectives: Examining Post Hoc Statistical Techniques for Detection and Correction of Common Method Variance. Organizational Research Methods 12, 762-800 (2009)
62. Sambamurthy, V., Bharadwaj, A., Grover, V.: Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. MIS Quarterly 27, 237-263 (2003)
63. Sarkar, M., Echambadi, R., Cavusgil, S.T., Aulakh, P.S.: The Influence of Complementarity, Compatibility, and Relationship Capital on Alliance Performance. Journal of the Academy of Marketing Science 29, 358-373 (2001)
64. Sherif, K., Hoffman, J., Thomas, B.: Can technology build organizational social capital? The case of a global IT consulting firm. Information & Management 43, 795-804 (2006)
65. Stein, E.W., Zwass, V.: Actualizing Organizational Memory with Information Systems. Information Systems Research 6, 85-117 (1995)
66. Szulanski, G.: Exploring Internal Stickiness: Impediments to the Transfer of Best Practice within the Firm. Strategic Management Journal 17, 27-43 (1996)
67. Tippins, M.J., Sohi, R.S.: It Competency and Firm Performance: Is Organizational Learning a Missing Link? Strategic Management Journal 24, 745-761 (2003)
68. Tiwana, A., McLean, E.R.: Expertise Integration and Creativity in Infomations Systems Develeopment. Journal of Management Information Systems 22, 13-43 (2005)
69. Van Den Bosch, F.A.J., Volberda, H.W., De Boer, M.: Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities. Organization Science 10, 551-568 (1999)
70. Yli-Renko, H., Autio, E., Sapienza, H.J.: Social Capital, Knowledge Acquisition, and Knowledge Exploitation in Young Technology-Based Firms. Str. Man. J. 22, 587 (2001)
71. Zahra, S.A., George, G.: Absorptive Capacity: A Review, Reconceptualization, and Extension. Academy of Management Review 27, 185-203 (2002)